1987 DEVELOPMENT PROGRAMS
FIREARMS

ITEM	BUDGET($000)
APPLIED RESEARCH	250
SLUG BARREL DEVELOPMENT	100
MODEL 870 FUNCTIONAL IMPROVEMENTS	50
NCS	700
NBAR	200
MODELS 870 AND 1100 SMALL GAGE RESTYLE	50
SYNTHETIC STOCKS	150
SINGLE SHOT SHOTGUN	250
LAW ENFORCEMENT/MILITARY	100
10 GAGE MAGNUM	200
LIGHTWEIGHT SHOTGUN RECEIVER	100
MODEL 700 MOUNTAIN RIFLE CALIBER ADDITIONS	100
SHOTGUN PRODUCT IMPROVEMENTS	100
RIFLE PRODUCT IMPROVEMENTS	50
TOTAL NEW PRODUCT DEVELOPMENT	2,400
SHOTGUN BARREL PROCESS DEVELOPMENT	200
TOTAL NEW PROCESS DEVELOPMENT	200

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

To JWB
From RSM

Subject: 1987 Program Concept Statements

A NBAR

To complete the development and support the processing (and production efforts) as well as develop future calibers and improvements in a way that recognizes and meets the needs of our customers so that Company goals are met.

b. Mountain Rifle Short Action

To expand the Mountain Rifle line in a way that satisfies the needs of production and Marketing so that program timing makes sense and we are ahead of schedule for once.

B Low Cost Rimfire Rifle

To develop a low cost replacement for the Nylon 66 in a way that recognizes the budget and priority constraints in Research and Production so that Remingtons product line and profits are enhanced.

B. Weatherby

To support the manufacture of Weatherby bolt action rifles in a way is compatible with Remingtons legal and moral obligations so that profits are enhanced

B. Porter

To coordinate a program to accomplish the outsourced manufacture and assembly, and in-house test pack and shipment of this shotgun in a way that identifies and capitalizes on the vendors' and Remington's strengths so that Dick Heckert can have this expensive toy. (so that Remingtons reputation of quality and craftsmanship will be enhanced

C. 3200 Improvement

To coordinate the outsourced development of a 3200 based competition shotgun family in a way that minimizes development and production expenditures so that a profit can be made recognizing that we are targeting a limited market.

RD-69-B

REMINGTON ARMS COMPANY, INC.

INTER-DEPARTMENTAL CORRESPONDENCE

Remington DUPONT PETERS DUPONT

"CONFINE YOUR LETTER TO ONE SUBJECT ONLY"

xc: T. C. Douglas
R. S. Murphy
K. C. Rowlands
J. R. Snedeker
File-Monthly Reports

Ilion, New York
January 5, 1987

TO: W. H. COLEMAN, II

FROM: T. C. DOUGLAS

NEW PRODUCTS DEVELOPMENT QUARTERLY REPORT - DECEMBER

MODEL 11-87 AUTOLOADING SHOTGUN

Production is experiencing a very high gallery reject rate due to "Doesn't Blow Back" malfunctions. Research testing indicates that the terminal bolt velocity of passed guns is 30-40 inches/sec too slow. One hundred guns built with parts that "meet the process gages" were tested on December 23rd with no improvement. All testing to date indicates that the problem is in the gas cylinder on the barrel. Efforts are continuing to determine the root cause of the problem. Production is increasing all orifice hole sizes by approximately .016 inches to increase the bolt velocity and the gallery pass rate. Research will test 200 guns from the warehouse with the drilled out orifices to determine the effectiveness of this "fix".

SYNTHETIC LONG STOCK - MODEL 700 RS

Choate Machine and Tool Company has been selected to be our vendor for 1987 and tooling development is progressing at a slow rate. The latest prototype stock samples are expected Dec. 22, and if they are acceptable, the mold can be textured. Bruce Rau will be here Jan. 5th to help make a decision. The turnaround time to texture the mold is approximately one week. Choate is planning a prototype run of grip caps, stock inserts, and butt pads the first week in January.

The probability of Choate having 100 stocks by mid-January for our Field Force and writers is high. The probability of having grip caps, inserts, and butt pads is lower since they have not been sampled yet. As a fallback position, Mountain Rifle butt pads and grip caps can be used with an interim insert.

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

SNIPER WEAPON SYSTEM

Remington completed submission of a new sniper rifle system for the Army on November 14th. Eight complete systems and the bid packages were hand delivered. Fred Martin gave an orientation course at Aberdeen, Maryland on Nov. 18th and is scheduled to give a second course at Fort Benning, Georgia on Jan. 6th. A Pre-Award Survey of the Ilion site will be conducted on January 7th. Steyr from Austria is the only other bidder for this contract. The award of the initial contract for 500 systems is to be given by April 1987.

NBAR

Research efforts are being directed at resolving bedding, bolt lock, and magazine system questions. Schedules have been developed for these programs, however, delays in prototype fabrication and vendor negotiations have adversely affected them to the point where they must be altered. Rynite to Rynite and Rynite to wood bonding questions still remain unanswered.

NBAR Program Status

Bedding

- Have tried 3M 2214 one part epoxy, did not cure properly, suspect adhesive at fault.
- Tested Devcon glued-in insert, failed.
- Have 3M 2216 two part epoxy to try, need inletting sample from N/C.
- Loctite is sending sample of "Depend" adhesive to try.
- Round bottom receivers are in N/C.
- Inserts for round bottom receivers are in Model Shop.
- Stocks in N/C to be inletted.

Bolt Lock

- CV group design failed to unlock after firing. Fred Martin is investigating.
- Nyloc set screw from bottom of bolt plug positively overrides bolt lock.
- Fred Martin has been assigned bolt lock development.

Magazine System

- Negotiations with Trexler were not fruitful; he will be asked to quote on prototype boxes.
- Kwik Klip variation must be designed.
- Jim Ronkainen design works, sample of two, design needs to be finalized.

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

NEW CONCEPT SHOTGUN

A concept for a recoil operated spring-drive action system has been proposed. A computer model will be developed to determine its effectiveness. Testing of the pressure vent gas systems has been delayed while NCS personnel work on Model 11-87 problems.

An improved continuous bolt velocity measuring device that utilizes a slide wire transducer has been developed.

A summary report of the terminated REFAS project has been written. All PDS developed electronic firing devices and technical information have been stored for future reference.

M/870 synthetic stock mold tooling has been textured and is back at the molding vendor. Prototype stocks should be available for testing by Jan. 5th. PPD is investigating scratch resistant coatings for Rynite stocks.

A M/870 stock and fore end with a Color-Dec camouflage finish that matches Remington's clothing line have been assembled on a gun for marketing's approval.

Technical information indicates that aluminum receivers will be stronger if manufactured from extruded bar stock rather than rolled material. This might eliminate the problem of receiver fragmentation experienced during a recent blow-up test. The effect of grain direction is also being investigated.

SLUG GUN DEVELOPMENT

Testing of a new rifled choke tube to enhance slug accuracy has been slowed due to interference from the SWS testing coupled with the loss of the engineer working on the project due of a ROF. The program is currently being reassigned. The phase of testing involved shooting rifled Remington choke tubes of various constrictions and twist. This data is currently being reviewed to determine where we are and to get the program back on track.

MODEL 700 GUN KIT

This rifle has been transmitted to production with the first production run expected 1Q87. Research is working on the Owners Manual with completion expected in mid-January.

PARKER

According to Don Mainland, the quotations for drawings, tooling, prototypes and production shotguns are in the mail. Pending their receipt we will issue a Purchase Requisition to fabricate 6 prototypes. A meeting to review program status is planned for Jan. 6th in Ilion.

3200 Improvement

A contract has been placed with Kolar Arms to design and build three "concept guns" based on the 3200 design. In light of the Parker progress as well as our meetings with Gamba, it is recommended to cancel our contract with Kolar in favor of the Gamba venture.

ASSIGNMENTS 1987

	PROGRAM	ASSIGNED	COMPLETION
1.	PARKER	*MURPHY	
2.	NBAR	*MURPHY, MARTIN, OWENS	
3.	MAG 10	*ROWLANDS, BAUMAN, POWERS	
4.	NCS	*POWERS, FRANZ	
5.	SLUG GUN 12 GAGE	*FINDLAY, DOUGLAS	
6.	7400 FUNCTIONAL	*WARREN	
7.	700 MTN RIFLE SA	*SMITH	
8.	7400 CARBINE 30-06	*MARTIN	
9.	RYNITE LONG STOCKS	*SMITH	
10.	SWS	*DOUGLAS, MARTIN, OWENS,SMITHSON	
11.	TC TRAP GUN & TUBES	*FINDLAY, *MURPHY, POWERS	
12.	M/11 BUFFER	*WARREN	
13.	1100 STEEL CONVERSION	*FRANZ, DOUGLAS	
14.	11-87 SANDSTROM	*OWENS	
15.	700 CLASSIC 35 WHELAN	*MARTIN	
16.	1100 20,28,& 410 RES	*FINDLAY, DOUGLAS	
17.	20 GA TUBE SPECS	*POWERS	
18.	ALUMINUM RECEIVER	*ROWLANDS	
19.	700 .338 STK PROBLEM	*MARTIN	
20.	RYNITE SHORT STOCKS	*ROWLANDS	
21.	GRAPHITE BARRELS	*ROWLANDS,*MURPHY	
22.	CERAMIC BBL LINING	*SMITH	
23.	BIATHALON RIFLE	*MURPHY	
24.	GAMBA O/U	*COLEMAN, MURPHY	
25.	870 POLICE SANDSTROM	*OWENS	
26.	870 FUNC TRANSMITTAL	*SMITHSON	
27.	MICHAELS TRANSMITTAL	*OWENS	
28.	BLACK SPCR TRANSMITTAL	*SMITHSON	
29.	700 GUN KIT MANUAL	*SMITHSON	
30.	SINGLE SHOT SHOTGUN	*BAUMAN, WARREN	

* DENOTES TEAM LEADER
1/27/87
TCD

To: TCD

Jan. 28, 87

From: RSM

Subject: January Monthly Report

Synthetic Long Stock

After the fourth sample run of the stock mold a letter was written to Choate outlining several changes to the stock mold. Approval was given to texture the stock (after the changes were made.) Choate sampled the stock again after modifying the mold with disappointing results. The modifications were not acceptable. Choate is again working on the mold and will sample it again before texturing. With our commitment to the field force in mind I have asked for 75 stocks from the next prototype run if they are acceptable. The run is planned for next week and a Remington representative should be there.

The butt pad insert has been prototyped and is heavy and oversize. Choate will try to lighten this part. The total weight of the stock is a concern.

The field force guns (75) will be all camoflaged since the mold won't be textured. Because of Choate's recent delays we will continue with the contingency plan.

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

Kit Gun

I just want to remind you that the manual sits squarely in Smithsons lap. There is some lead time involved in proofing and printing and if we don't get moving I think this one will bite us in the ass.

Parker

The contract for the balance of the drawings, for tooling and for 8 prototypes is in place and Kolar has started work. Our Jan 6 meeting was very constructive in that several questions were addressed. Task forces have been set up to resolve engraving, barrel contour, and stock issues and in addition several assignments were made regarding a case, an option list and the catalog.

Kolar has been sent two 870 barrels, (20 and 28 gage) for approval. A larger sample for prototypes must be sent.

The new ejector system has been debugged and returned to Kolar.

I will be in Wilmington, Monday Feb 2 to talk with Huntley on the patent application and with Rick Straitman of MCD on the catalog.

NBAR.

The NBAR is behind schedule and we are trying to get back on track. Ed Owens has taken over the magazine development which should help quite a bit Recent meetings with Research management and legal personnel have again changed the direction on the bolt lock and Fred Martin is investigating.

I will be contacting Dupont people to look into teflon coating (Ruger's is coating firecontrols and Mossberg is coating shotgun bores) and Kynite adhesives.

G-4A REV 1-77 ENGINEERING DUPONT COMPUTATION SHEET SHEET NO

TITLE OF PROJ OR STUDY PROJ OR STUDY NO

SUBJECT N BAR WORKS

COMPUTER ERO DATE 1/29 19 87

ESTIMATED TIME TO COMPLETE DEVELOPMENT OF THE MAGAZINE SYSTEM FOR NBAR:

	HOURS
○ TRIGGER GUARD WITH INTEGRAL MAG. BOX WELL.	
DESIGN PROTOTYPE - SIMILAR TO KWIK KLIP -----	120
- VENDOR FOR PROTOTYPE (BARDANE?) - (4-5 WEEKS)	160
- REDESIGN & REVISE MODELS - (PROTOTYPE)	200
- * + TESTING	60
• MAGAZINE BOX - (COMMON - LATCH DESIGN TO FOLLOW)	
DESIGN PROTOTYPE -	120
- VENDOR - PROTOTYPE (TREKLER) (3-4 WEEKS)	160
- REDESIGN & REVISE MODELS - (PROTOTYPE)	160
- * + TESTING	60
* ASS'Y. DESIGN - LATCHING SYSTEM.	
DESIGN LATCHING SYSTEM FOR MAG. & GUARD ASS'Y.	80
- INCORPORATE DESIGN INTO GUARD & MAG BOX	60
- FINALIZE DESIGN -	80
- TESTING -	60
- PRODUCTION PARTS - (5-6 WKS.)	220

TRANSMIT —

USE STANDARDS FOR MINIMUM ESSENTIAL INSTALLATIONS

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

REMINGTON ARMS COMPANY, INC.

INTER-DEPARTMENTAL CORRESPONDENCE

Remington PETERS

"CONFINE YOUR LETTER TO ONE SUBJECT ONLY"

cc: R. A. Darby
R. F. Ulak
T. C. Douglas
R. S. Murphy
K. C. Rowlands
J. R. Snedeker
File

Ilion, New York
January 30, 1987

TO: W. H. COLEMAN, II

FROM: T. C. DOUGLAS

NEW PRODUCTS DEVELOPMENT MONTHLY REPORT - JANUARY

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

NEW BOLT ACTION RIFLE

Testing of several different design variations of the rocker-type bolt lock has yielded negative results for all versions. A meeting was held January 16th to review the problems. It was decided to pursue a button-type bolt lock and stop work on the rocker-type bolt lock. The proposed design was reviewed with Jim Hutton and approval was given to pursue the proposed design.

Ed Owens has been assigned to the NBAR team to take over work on the detachable magazine box. There are currently three designs under consideration. Ed is currently reviewing all three designs with the intent to select the best two for final development, primary and back-up.

RD-41-B

REMINGTON ARMS COMPANY, INC.

INTER-DEPARTMENTAL CORRESPONDENCE

Remington DUPONT PETERS DUPONT

"CONFINE YOUR LETTER TO ONE SUBJECT ONLY"

xc: R. A. Darby
R. F. Ulak
T. C. Douglas
R. S. Murphy
K. C. Rowlands
J. R. Snedeker
File

Ilion, New York
January 30, 1987

TO: W. H. COLEMAN, II

FROM: T. C. DOUGLAS

NEW PRODUCTS DEVELOPMENT MONTHLY REPORT - JANUARY

MODEL 11-87 AUTOLOADING SHOTGUN

A Research and Production task force analysis indicated that a new machine for M/11-87 gas cylinder processing, the Agnew, was a potential source of problems due to an inconsistent radius for the barrel/gas cylinder braze joint. An additional 100 guns were built using gas cylinders with the suspect cut run off-line of the Agnew, in addition to minor changes in gas piston processing. The second 100 guns averaged 25 inches/sec faster in terminal bolt velocity, and the bolt velocity spread between the guns was narrowed significantly. The first 100 guns tested had a bolt velocity spread of 98 inches/sec, and the second 100 guns tested had a bolt velocity spread of 40 inches/ sec. Additional orifice testing indicated further improvement with larger orifices. Production is currently manufacturing barrels with the off-line Agnew gas cylinders, larger orifices, and are applying a light coat of oil on the magazine tube to facilitate gun break-in. The January gallery reject rate is approximately 5% versus the December rate of approximately 15% for all malfunctions.

There are approximately 4000 guns in the warehouse with smaller orifices. Research is currently conducting testing on 240 warehouse guns that have had their orifice holes enlarged and their magazine tubes oiled. This testing is designed to determine the suitability for shipment of these guns and our possible exposure to customer complaints. Additional cold weather field testing is also scheduled.

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

SYNTHETIC LONG STOCK - MODEL 700 RS

Prototype stocks were received in late December. They were unacceptable, and a letter outlining the necessary changes was sent to Choate. Additional modifications to the dies did not produce the desired results, and further modifications are underway. The next scheduled run will be the first week of February. Skip Smith will be on site during the next trial run. If the run looks good, Choate will run 75 stocks for us to be processed as camouflaged stocks for use by the Field Force. Approval will be given by Skip to texture the dies, and delivery of production textured stocks could occur by February 20th.

Choate's protype stock insert is oversize and heavier than anticipated. Modifications are underway on the insert. Butt pad dies are currently being fabricated. Delivery of production textured stocks is contingent upon successful completion of the inserts and butt pads.

SNIPER WEAPON SYSTEM

A Pre-Award Survey of the Ilion site was conducted on January 7th. The first Contract Negotiation meeting is tentatively scheduled for the week of February 16th. If the negotiations lead to mutual agreements, Remington will be invited to submit our "Best and Final" offer.

NEW BOLT ACTION RIFLE

Testing of several different design variations of the rocker-type bolt lock has yielded negative results for all versions. A meeting was held January 16th to review the problems. It was decided to pursue a button-type bolt lock and stop work on the rocker-type bolt lock. The proposed design was reviewed with Jim Hutton and approval was given to pursue the proposed design.

Ed Owens has been assigned to the NBAR team to take over work on the detachable magazine box. There are currently three designs under consideration. Ed is currently reviewing all three designs with the intent to select the best two for final development, primary and back-up.

NEW CONCEPT SHOTGUN

Initial testing of the cross-hole pressure vent gas system generated average terminal bolt velocities of 110 inches/sec for 1oz target loads, and 270 inches/sec for 2oz magnum loads. Design modifications will be made to increase the light load bolt velocities.

Marketing has approved a style of texturing for the M/870 Rynite stock and fore end. The texturing will cover all exposed surfaces of both parts, and will replace the existing checkering patterns.

Prototype M/870 Rynite fore ends have been molded on temporary tooling. After modifications to correct some minor imperfections, the fore end and stock molds will be sent to the texturing vendor.

Marketing has approved the Color-Dec camouflage finish for the M/870 Rynite stock and fore end for 1988 introduction on waterfowl guns.

PARKER

The contract for the balance of the drawings, tooling, and eight prototypes is in place and Kolar has started work. Task forces have been set up to resolve engraving, barrel contour, and stock issues. In addition, assignments were made to address a case, an option list, and the catalog.

Kolar has been sent two 870 barrels(20 and 28 guage) for approval. A larger sample for prototypes will follow upon approval.

The new ejector system has been debugged and returned to Kolar.

Randy Murphy will be in Wilmington on February 2nd to meet with Don Huntley on the patent application and with Rick Straitman of MCD on the catalog.

3-19-87

M. 7400 Carbine (.30-06)
Testing And Optics Development Has Been Completed - Information For Transmittal Has Been Given To R. Smithson

M. 700 .338 (Stock Breakage)
Production Has Solved The Problem By The Addition Of A Second Reinforcement Screw - Legal Sees No Problem - No Drawing Change Made

M. 700 .35 Whelen (Classic)
Four Samples Have Been Fabricated And Proof Tested. No Problems Encountered One Sample To Be Sent To Lonoak For Ammo Test

New Bolt Action Rifle
10 Round ~~Button~~ Receivers Have Been Completed By N.C. Receivers Have Been Sent To Model Shop For Completion - ~~As Soon As Available~~ End Of April
~~Some~~ Work Must Be Done On Production Machines

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

New Bolt Act Rifle (Cont.)
A New Bolt Lock System Has Been Developed And Sent To Legal (Patent) For Review - Additional Parts To Fabricated Are Bolt Plugs - Safety Levers & Bolt Locks - New Bolts And Extractors Are To Be Made

New Rifling Concept
A Marked Print And Instructions Have Been Given To The Tool Room/Cutter Grind For The Alteration Of An Existing Mandrel - No Date For Completion Available

SWS
Accuracy Device (sp) Has Been Completed And Is Ready For Testing - Master Stock Is Being Discussed With Custom Shop And Is To Be Completed

RD 6614C

RESEARCH - N/C & MODEL SHOP

ESTIMATED & ACTUAL COST SHEET

Date Issued 3/27/87 Date Required 4/17/87

Part Name Mag. Follower Spring Part Number ———

Model NBAR Drawing Number B-EXP-1700

Designer, Engineer or Dept. E.R. Owens Work Number C-5003-

Work Description: Please Provide 13 - Prototype Mag. Follower Springs Per Attached Print - Use .018 Thick C-1095 Material -

Personnel Required - Wage Roll ——— From ——— To ———

NE Salary ——— From ——— To ———

Exempt Salary ——— From ——— To ——— Qty. ———

		Model Shop	Cost Estimated	Cost Actual
I	—	Tooling (Tool cost, grind, etc.)		
R		Material (Cost per part)		
		Labor (Cost per part)		
		N/C Shop		
I		Program Time (Est., Proc., Prog., and Deb.)		
		Tooling (Tool Cost, grind, and setting)		
		Fixture (Design and Fabrication)		
R		Material (Cost per part)		
		Machining Cost (Cost per part)		
		Total Cost		
		Per Part Cost		

I - Process Preparation Cost
R - Machining Cost/Part
n - Number of Parts
X - Per Part Cost

$$X = \frac{I}{n} + R$$

Completion Date ——— Prepared by ———

Approval ———

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

ID 6640

RESEARCH - N/C & MODEL SHOP

ESTIMATED & ACTUAL COST SHEET

Date Issued 3/27/87 — Date Required 4/17/87

Part Name MAGAZINE FOLLOWER — Part Number ———

Model NBAR — Drawing Number C-EXP-1699

Designer, Engineer or Dept. E. R. OWENS — Work Number C-5003-

Work Description: PLEASE PROVIDE 3 PROTOTYPE FOLLOWERS PER ATTACHED PRINT- CAN BE MADE FROM CURRENT MIM MADE 700 FOLLOWER- BLANKS WILL BE PROVIDED BY ERD WHEN YOU ARE READY-

Personnel Required - Wage Roll ——— From ——— To ———

NE Salary ——— From ——— To ———

Exempt Salary ——— From ——— To ——— Qty. ———

			Cost Estimated	Cost Actual
		Model Shop		
I	—	Tooling (Tool cost, grind, etc.)		
R	Material	(Cost per part)		
R	Labor	(Cost per part)		
		N/C Shop		
I	Program Time	(Est., Proc., Prog., and Deb.)		
I	Tooling	(Tool Cost, grind, and setting)		
I	Fixture	(Design and Fabrication)		
R	Material	(Cost per part)		
R	Machining Cost	(Cost per part)		
		Total Cost		
		Per Part Cost		

I - Process Preparation Cost
R - Machining Cost/Part
n - Number of Parts
X - Per Part Cost

$$X = \frac{I}{n} + R$$

Completion Date ——— Prepared by ———

Approval ———

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

RD 6644

RESEARCH - N/C & MODEL SHOP

ESTIMATED & ACTUAL COST SHEET

Date Issued 3/27/87 Date Required 4/17/87

Part Name MAGAZINE BOX, DETACHABLE Part Number

Model N BAR Drawing Number D-EXP-1697
D-EXP-1698 BLK.

Designer, Engineer or Dept. E.R. OWENS X-307 Work Number C-5003-

Work Description: PLEASE PROVIDE 3 PROTOTYPE MAG. BOXES PER THE ATTACHED PRINTS - PASSIVE ATTACHING MEANS OF THE FOLDED ENDS CAN BE A SPOT WELD - LOCATION AND SIZE TO BE DETERMINED.

Personnel Required - Wage Roll _____ From _____ To _____
NE Salary _____ From _____ To _____
Exempt Salary _____ From _____ To _____ Qty. _____

		Cost	
		Estimated	Actual
	Model Shop		
I	Tooling (Tool cost, grind, etc.)		
R	Material (Cost per part)		
R	Labor (Cost per part)		
	N/C Shop		
I	Program Time (Est., Proc., Prog., and Deb.)		
I	Tooling (Tool Cost, grind, and setting)		
I	Fixture (Design and Fabrication)		
R	Material (Cost per part)		
R	Machining Cost (Cost per part)		
	Total Cost		
	Per Part Cost		

I - Process Preparation Cost
R - Machining Cost/Part
n - Number of Parts
X - Per Part Cost

$$X = \frac{I}{n} + R$$

Completion Date _____ Prepared by _____

Approval _____

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

ENGINEERING COMPUTATION SHEET

SHEET NO.

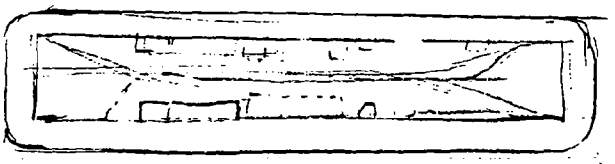
TITLE OF PROBLEM OR STUDY

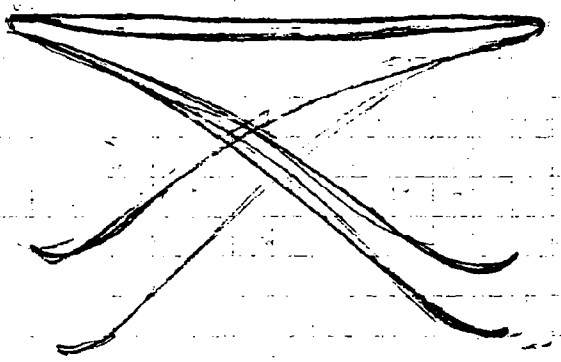
PROBLEM OR STUDY NO.

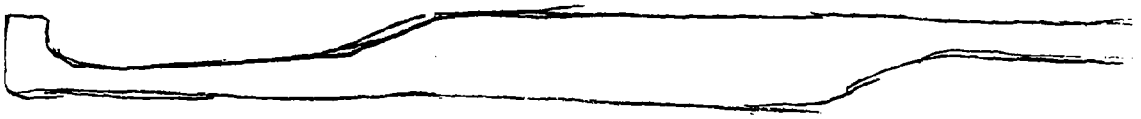
SUBJECT

WORK BY

COMPUTER DATE 19





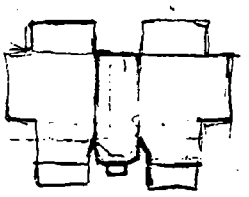


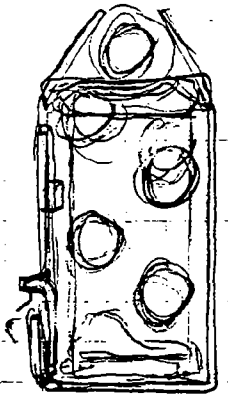
ENGINEERING COMPUTATION SHEET

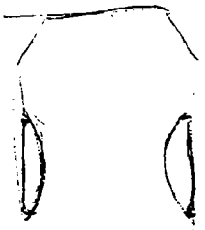
TITLE OF PROJ OR STUDY _____ PROJ OR STUDY NO _____

SUBJECT _____ WORKS _____

COMPUTER _____ DATE _____ 19 _____







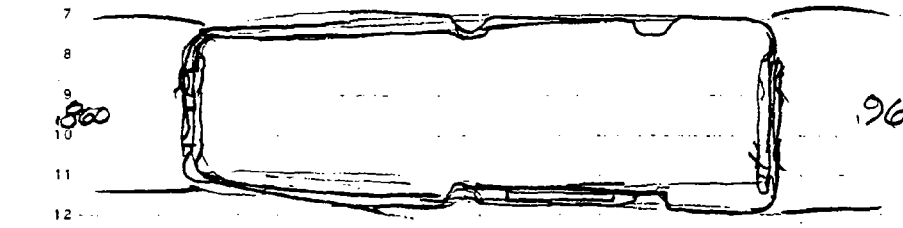
CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

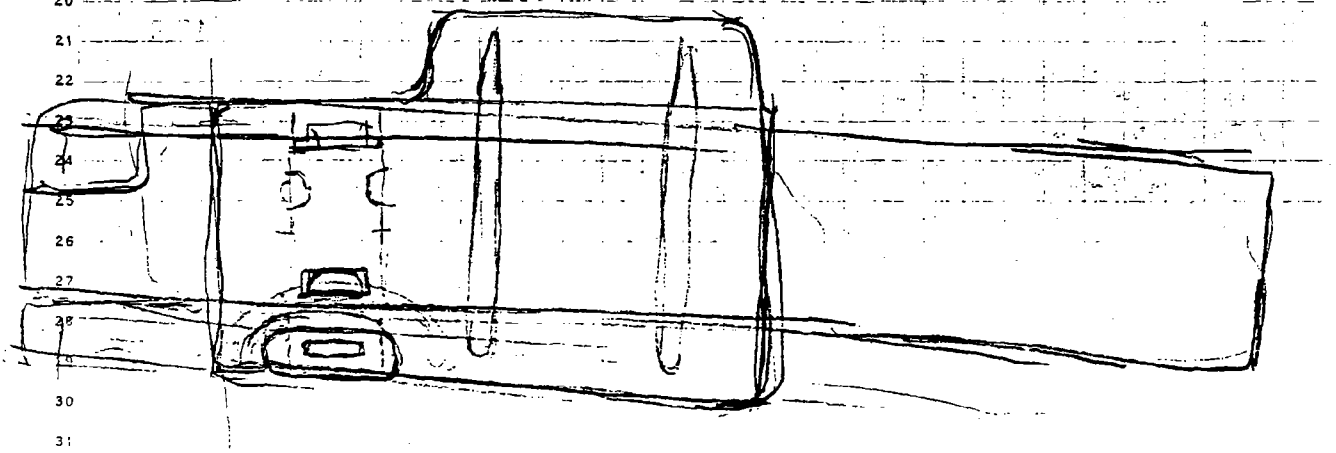
ENGINEERING COMPUTATION SHEET

TITLE OF PROJ OR STUDY _____ PROJ OR STUDY NO _____

SUBJECT _____ WORKS _____

COMPUTER _____ DATE _____ 19 _____





USE STANDARD FORM [illegible] ESSENTIAL INSTALLATIONS

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

ENGINEERING COMPUTATION SHEET

TITLE OF PROJ. OR STUDY _____ PROJ. OR STUDY NO. _____

SUBJECT _____ WORK _____

COMPUTER _____ DATE 2/18 19 87

N BAR - - DETACHABLE MAGAZINE -

NEED TO KNOW -

- STOCK BEDDING INSERT ?
- SYNTHETIC STOCK ?
- LATCH INDIRECTLY INTO RECEIVER ?

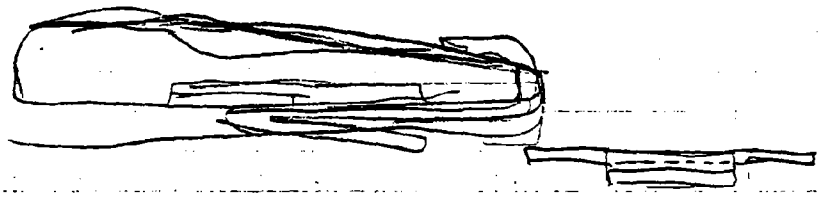
CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

ENGINEERING COMPUTATION SHEET

TITLE OF PROJ. OR STUDY _____ PROJ. OR STUDY NO. _____

SUBJECT _____ WORKS _____

COMPUTER _____ DATE _____ 19 _____

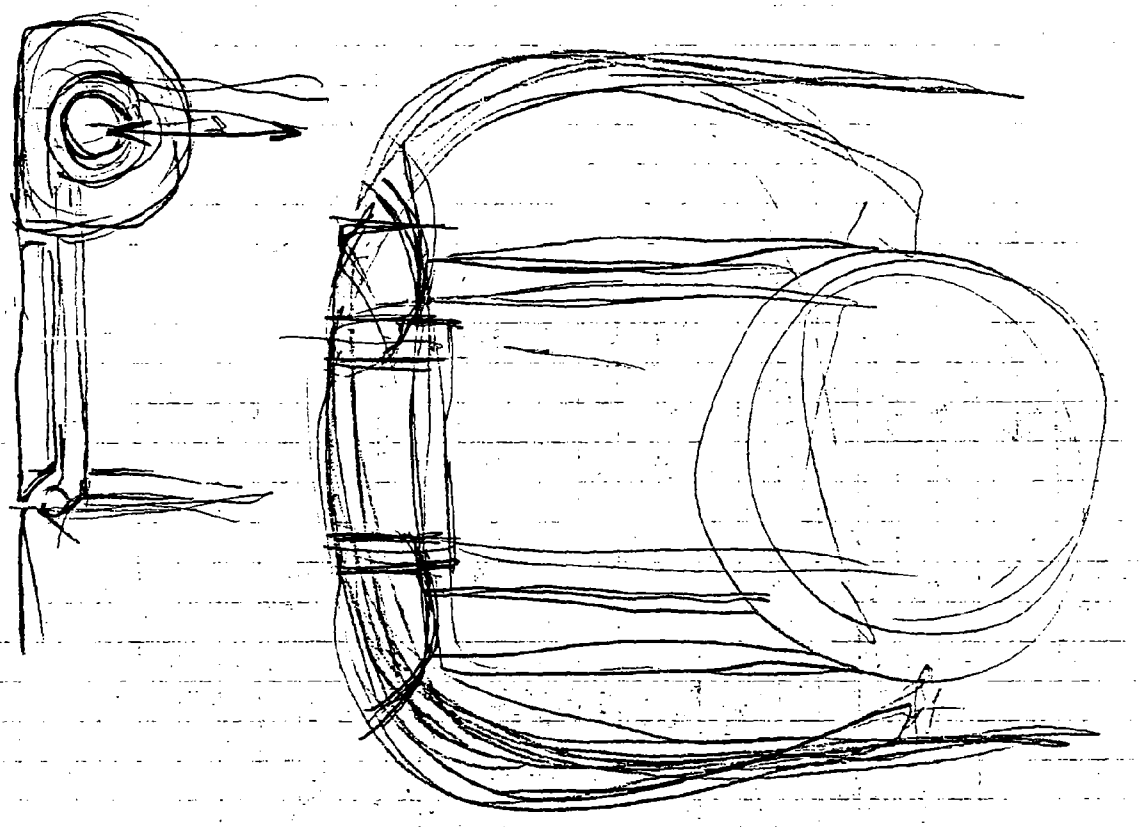


ENGINEERING COMPUTATION SHEET

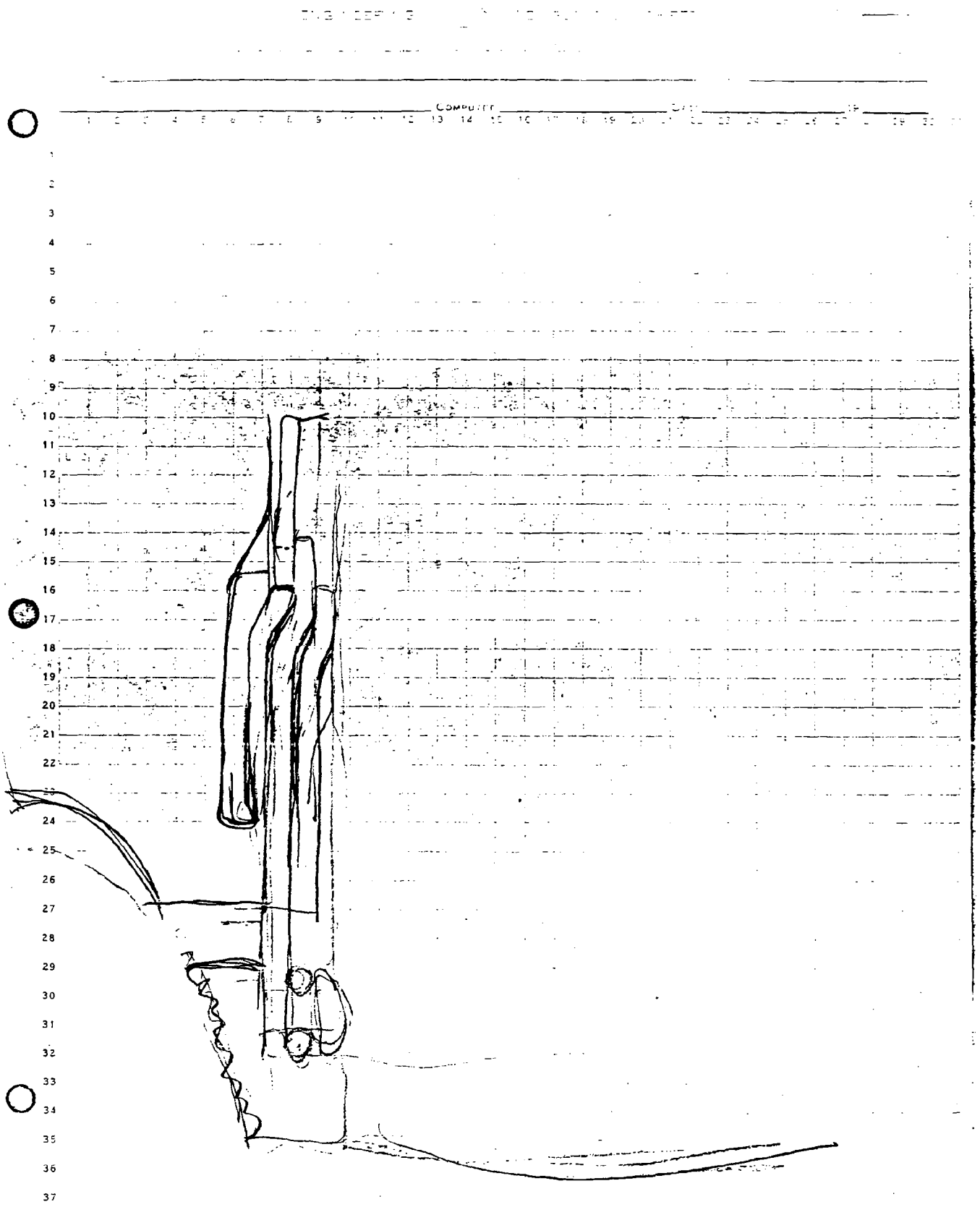
TITLE OF PROJ OR STUDY _____ PROJ OR STUDY NO _____

SUBJECT _____ WORKS _____

COMPUTER _____ DATE _____ 19 _____



CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON



USE STANDARDS FOR MINIMUM ESSENTIAL INSTALLATIONS

ENGINEERING COMPUTATION SHEET

TITLE OF PROJ OR STUDY

PROJ OR STUDY NO

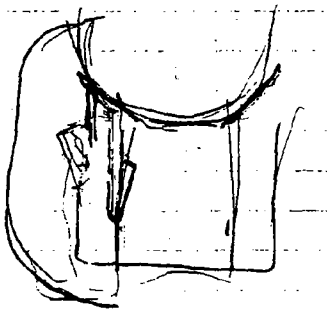
SUBJECT

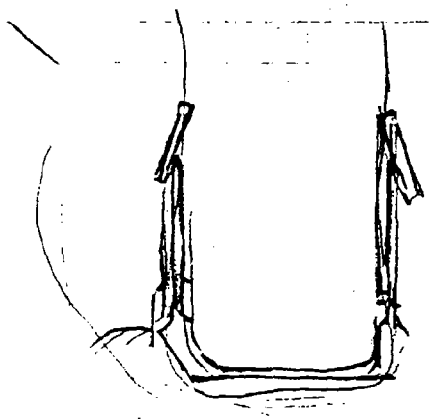
WORK#

COMPUTER DATE 19

ELOSOM

EO 505





G-46 REV 5-77 ENGINEERING DUPONT COMPUTATION SHEET SHEET NO

TITLE OF PROJ OR STUDY PROJ OR STUDY NO

SUBJECT NBAR WORKS

COMPUTER ERD DATE 1/29 19 87

ESTIMATED TIME TO COMPLETE DEVELOPMENT OF THE MAGAZINE SYSTEM FOR NBAR:

	HOURS
• TRIGGER GUARD WITH INTEGRAL MAG. BOX WELL.	
DESIGN PROTOTYPE - SIMILAR TO KWIK KLIP -----	120
- VENDOR FOR PROTOTYPE (BARDANE?) - (4-5 WEEKS)	160
- REDESIGN & REVISE MODELS - (PROTOTYPE)	200
- * + TESTING	60
• MAGAZINE BOX - (COMMON - LATCH DESIGN TO FOLLOW)	
DESIGN PROTOTYPE -	120
- VENDOR - PROTOTYPE (TREXLER) (3-4 WEEKS)	160
- REDESIGN & REVISE MODELS - (PROTOTYPE)	160
- * + TESTING	60
* • ASS'Y. DESIGN - LATCHING SYSTEM.	
DESIGN LATCHING SYSTEM FOR MAG. & GUARD ASS'Y.	80
- INCORPORATE DESIGN INTO GUARD & MAG BOX	160
- FINALIZE DESIGN -	80
- TESTING -	60
- PRODUCTION PARTS - (5-6 WKS.)	220

TRANSMIT —

USE STANDARDS FOR MINIMUM ESSENTIAL INSTALLATIONS

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

ENGINEERING DUPONT COMPUTATION SHEET

NBAR

COMPUTER ERO DATE 1/29 87

ESTIMATED TIME TO COMPLETE DEVELOPMENT OF THE MAGAZINE SYSTEM FOR NRAR:

	Hours
• TRIGGER GUARD WITH INTEGRAL MAG. BOX WELL.	
DESIGN PROTOTYPE - SIMILAR TO KWIK KLIP ----	120
- VENDOR FOR PROTOTYPE (BARDANE?) - (4-5 WEEKS)	160
- REDESIGN & REVISE MODELS - (PROTOTYPE)	200
- * + TESTING	60
• MAGAZINE BOX - (COMMON - LATCH DESIGN TO FOLLOW):	
DESIGN PROTOTYPE --	120
- VENDOR - PROTOTYPE (TREXLER) (3-4 WEEKS)	160
- REDESIGN & REVISE MODELS - (PROTOTYPE)	160
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- PRODUCTION PARTS - (5-6 WKS.)	220

TRANSMIT —

USE STANDARDS FOR MINIMUM ESSENTIAL INSTALLATIONS

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

ENGINEERING DUPONT COMPUTATION SHEET SHEET NO. _____

PROJECT OR STUDY NO. _____

WORK _____

COMPUTER _____ DATE 1/30 19 87

TREXLER IND — (KWIK KLIP)

215 433-2400

GENE TREXLER.

↳ - 3 OR 4 WKS - FOR PROTOTYPES —

ASKED HIM ABOUT NON DISCLOSURE SITUATION — WOULD WORK WITH US - IN ANY CAPACITY —

USE STANDARDS FOR MINIMUM ESSENTIAL INSTALLATIONS

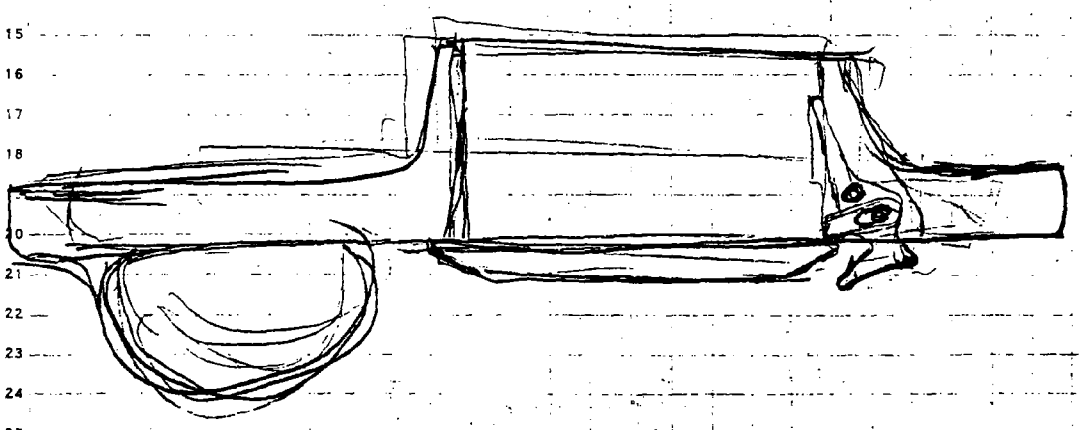
CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

ENGINEERING COMPUTATION SHEET

TITLE OF PROJ OR STUDY _____ PROJ OR STUDY NO _____

SUBJECT _____ WORKS _____

COMPUTER _____ DATE _____ 19 _____



CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

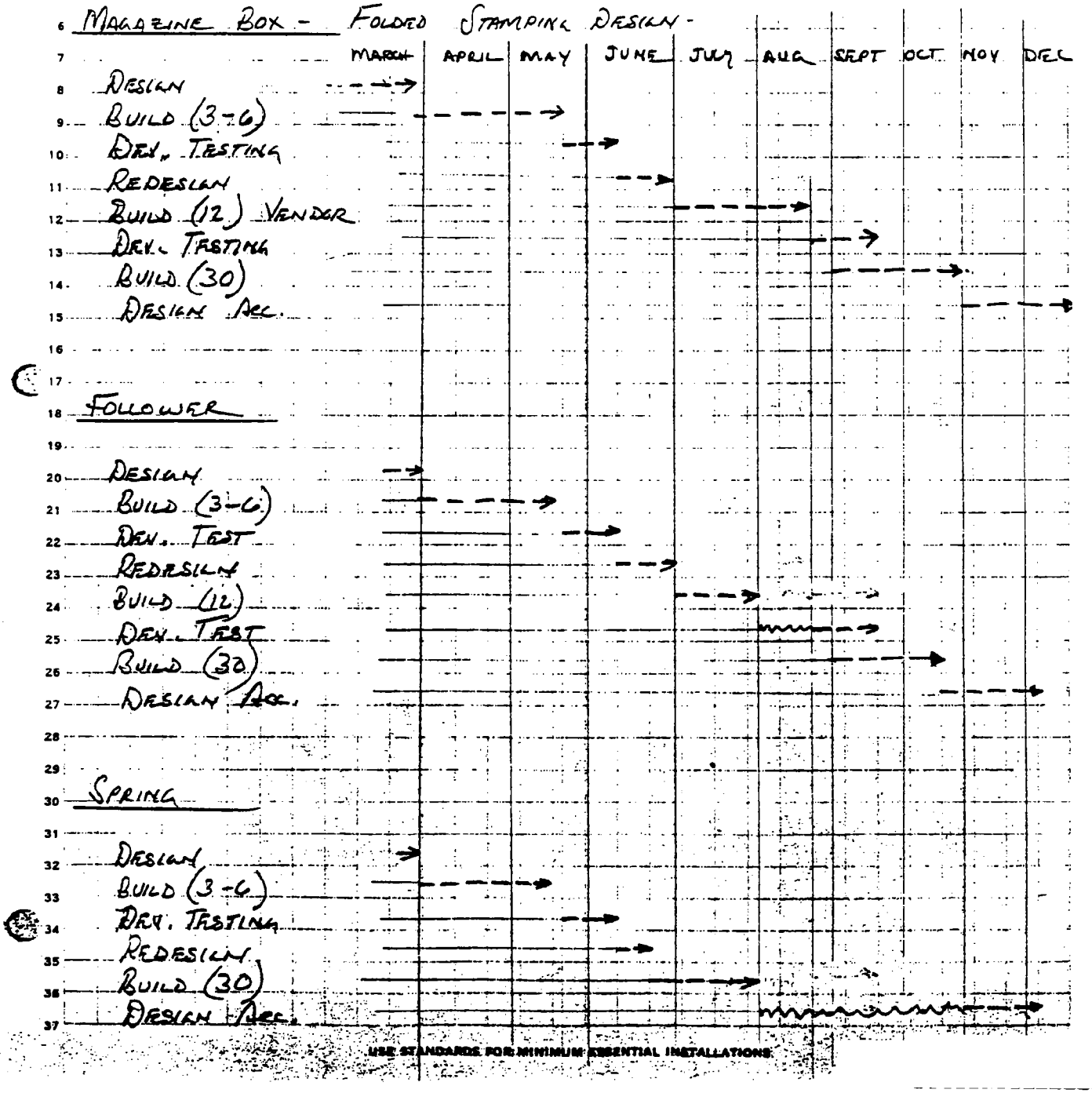
TITLE OF PROJ OR STUDY _____ PROJ OR STUDY NO ERD

SUBJECT _____ WORKS _____

COMPUTER _____ DATE 5/19 19 87

NBAR - DETACHABLE MAGAZINE

MAGAZINE BOX - FOLDED STAMPING DESIGN -



USE STANDARDS FOR MINIMUM ESSENTIAL INSTALLATIONS

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

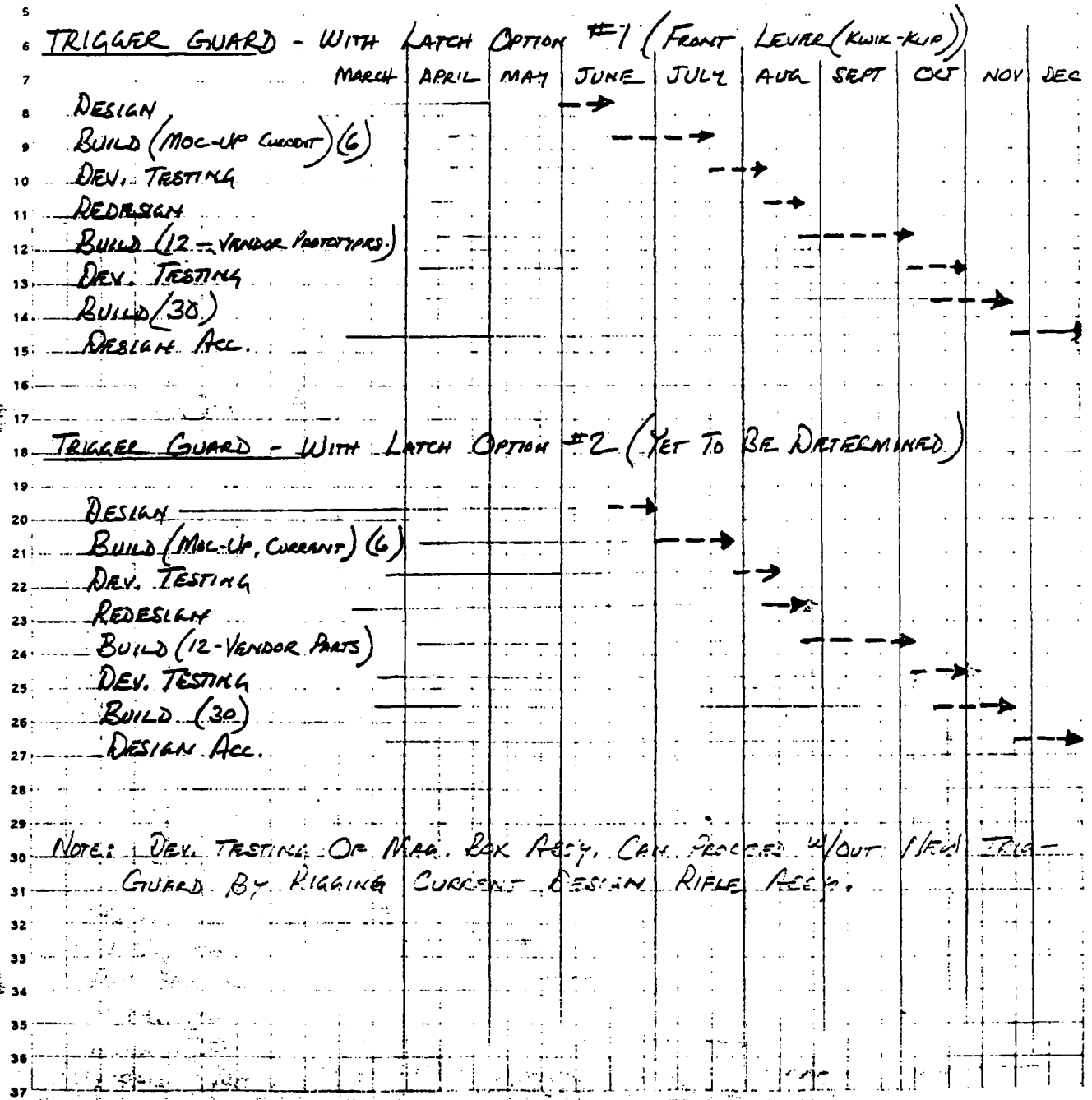
TITLE OF PROJ OR STUDY _____ PROJ OR STUDY NO ERO

SUBJECT _____ WORKS _____

COMPUTER _____ DATE 5/19 19 87

NBAR - DETACHABLE MAGAZINE

TRIGGER GUARD - WITH LATCH OPTION #1 (FRONT LEVER (KWIK-KLIP))



TRIGGER GUARD - WITH LATCH OPTION #2 (YET TO BE DETERMINED)

NOTE: DEV. TESTING OF MAG. BAK ASSY, CAN. PROCEED W/OUT NEW TRIG-GUARD BY RIGGING CURRENT DESIGN RIFLE ASSY.

USE STANDARDS FOR MINIMUM ESSENTIAL INSTALLATIONS

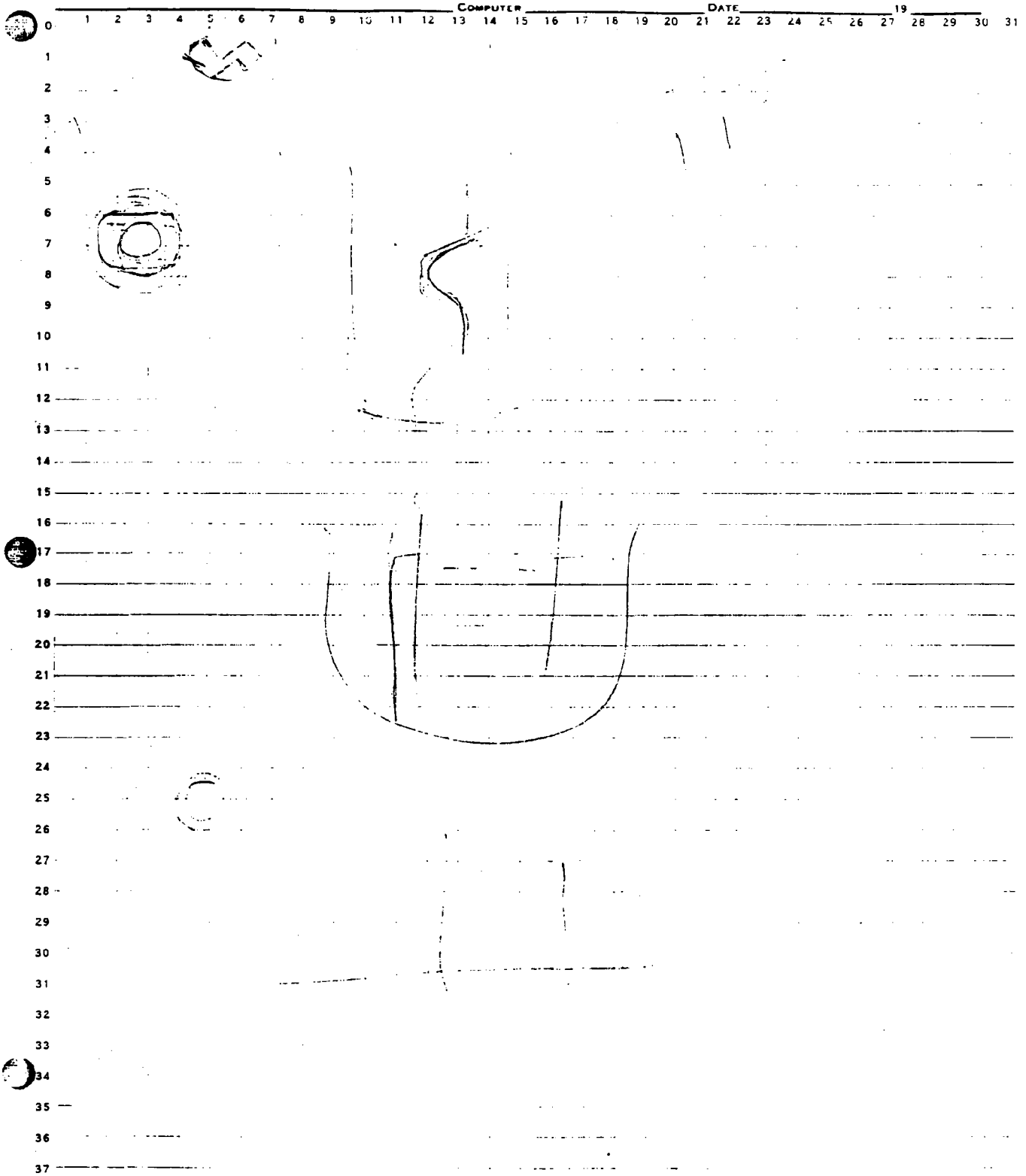
CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

G-46 REV 5-77 ENGINEERING DUPONT COMPUTATION SHEET SHEET NO _____

TITLE OF PROJ OR STUDY _____ PROJ OR STUDY NO _____

SUBJECT _____ WORKS _____

COMPUTER _____ DATE _____ 19 _____



USE STANDARDS FOR MINIMUM ESSENTIAL INSTALLATIONS

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

S-46 REV. 5-77 ENGINEERING DUPONT COMPUTATION SHEET SHEET NO. 1 OF 2

TITLE OF PROJ OR STUDY _____ PROJ OR STUDY NO ERD

SUBJECT _____ WORKS _____

COMPUTER _____ DATE 5/19 19 87

NCAR - DETACHABLE MAGAZINE

MAGAZINE BOX - FOLDED STAMPING DESIGN -

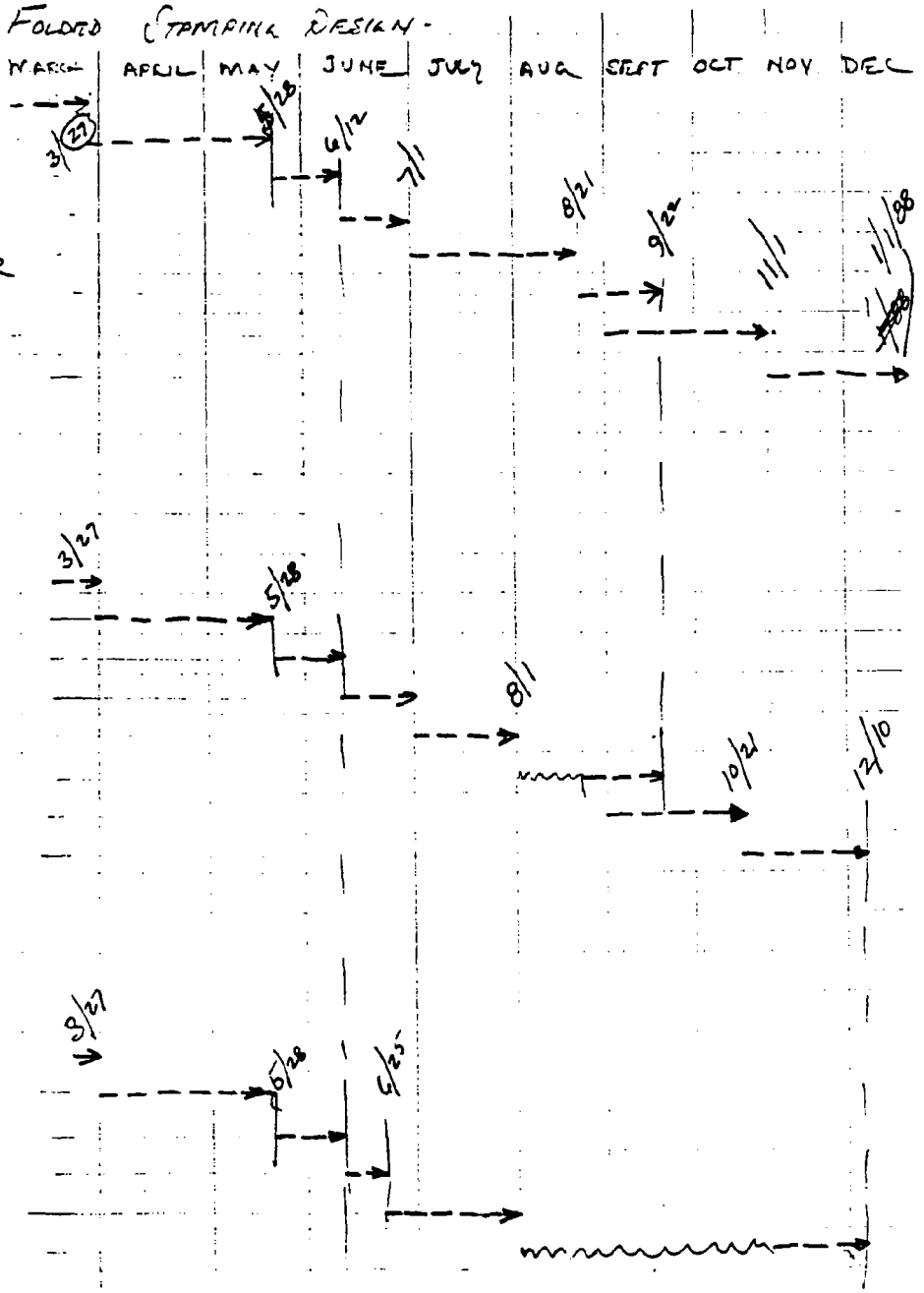
- DESIGN
- BUILD (3-6)
- DEV. TESTING
- REDESIGN
- BUILD (12) VENDOR
- DEV. TESTING
- BUILD (30)
- DESIGN ACC.

FOLLOWER

- DESIGN
- BUILD (3-6)
- DEV. TEST
- REDESIGN
- BUILD (12)
- DEV. TEST
- BUILD (30)
- DESIGN ACC.

SPRING

- DESIGN
- BUILD (3-6)
- DEV. TESTING
- REDESIGN
- BUILD (30)
- DESIGN ACC.



USE STANDARDS FOR MINIMUM ESSENTIAL INSTALLATIONS

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

G-46 REV 5-77 ENGINEERING DUPONT COMPUTATION SHEET SHEET NO 2 OF 2

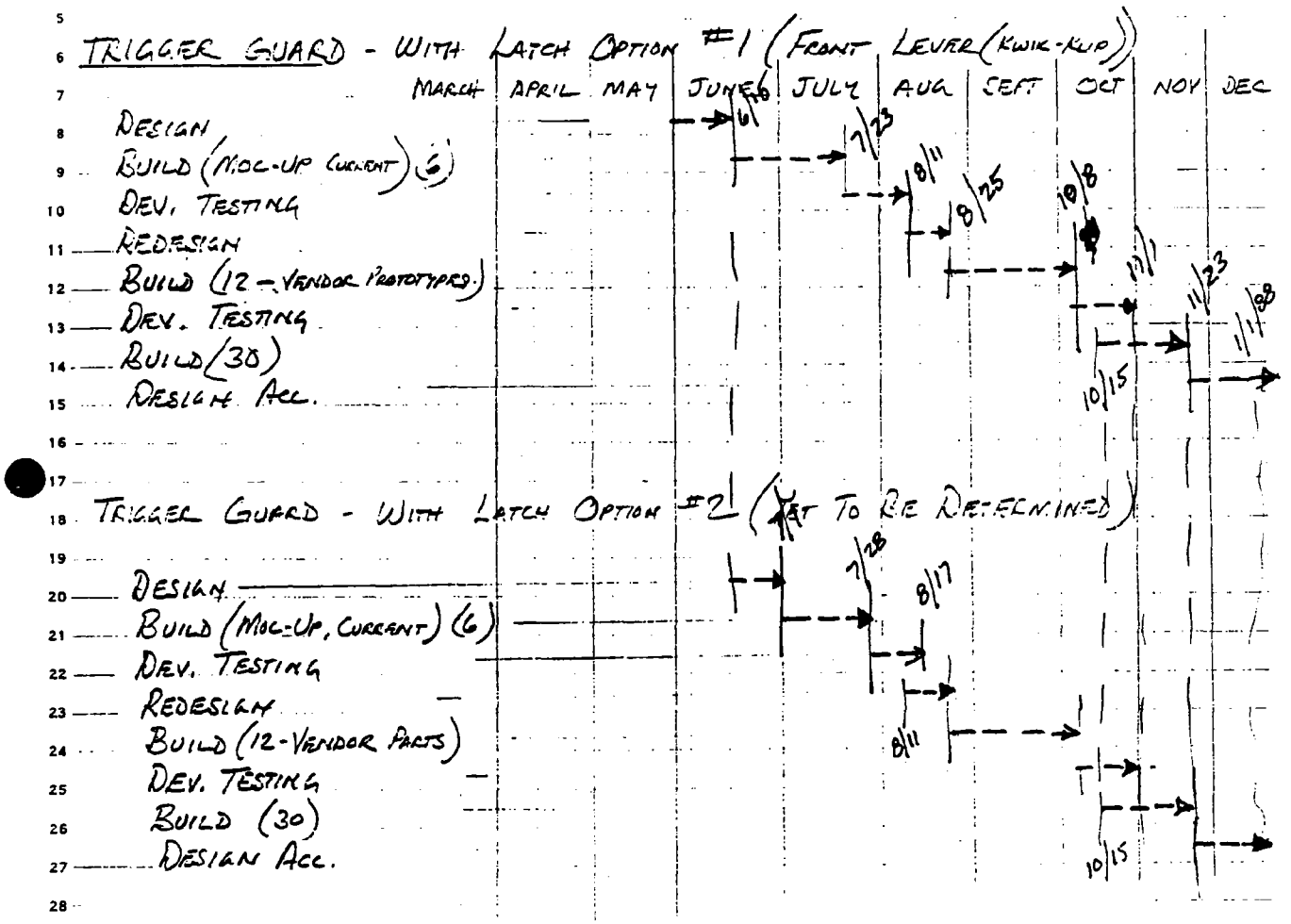
TITLE OF PROJ OR STUDY _____ PROJ OR STUDY NO ERD

SUBJECT _____ WORKS _____

COMPUTER _____ DATE 5/19 19 87

NBAR - DETACHABLE MAGAZINE

TRIGGER GUARD - WITH LATCH OPTION #1 (FRONT LEVER (KWIK-KUP))



TRIGGER GUARD - WITH LATCH OPTION #2 (YET TO BE DETERMINED)

NOTE: DEV. TESTING OF MAG. BOX ASS'Y. CAN PROCEED W/OUT. NEW TRIG.-GUARD BY RIGGING CURRENT DESIGN 700 RIFLE DESIGN.

USE STANDARDS FOR MINIMUM ESSENTIAL INSTALLATIONS

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

Start May 26

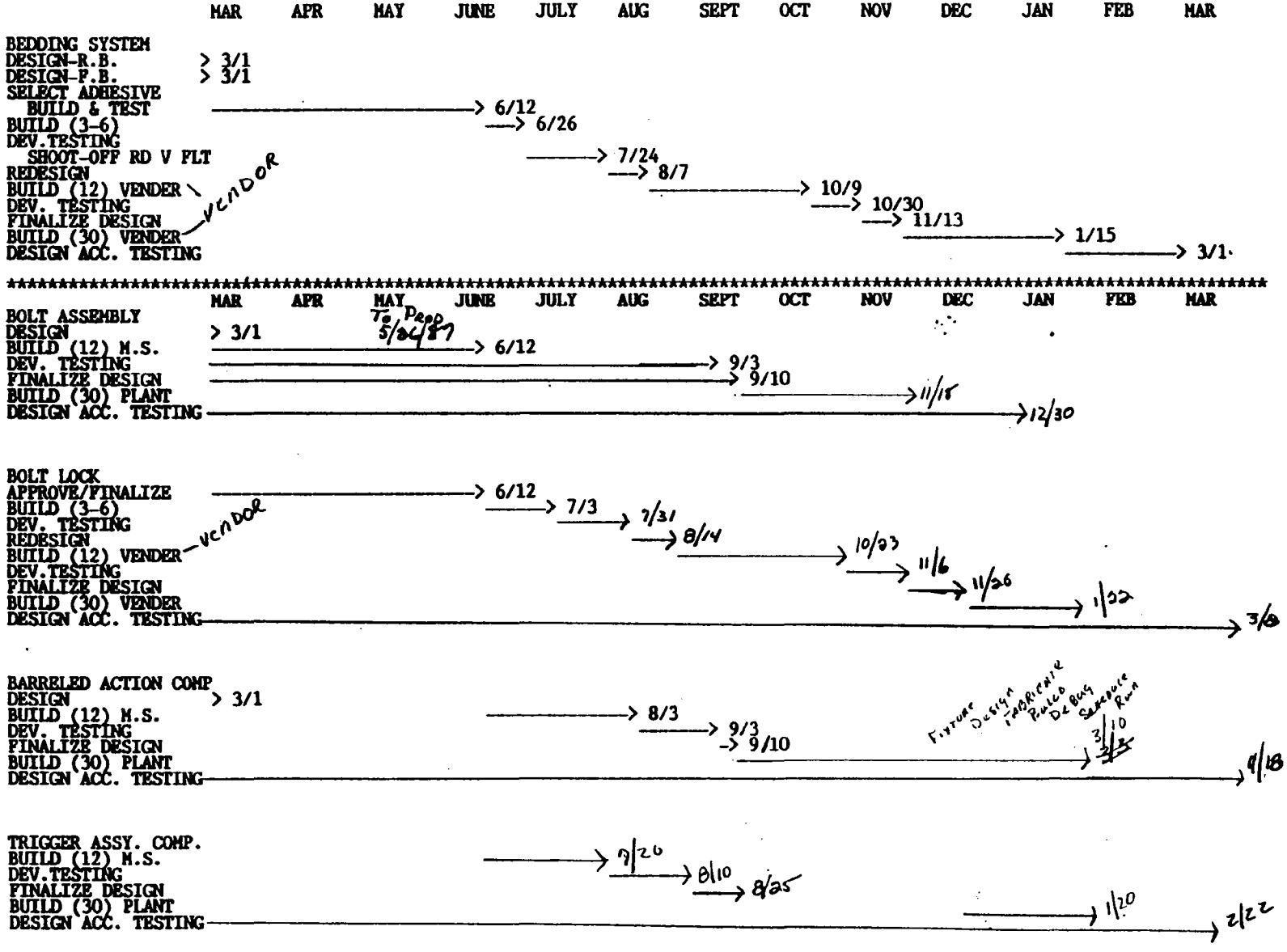
Status

	Trig. Assy. Complete	1 Day ( )
	Trig. Housing Assy.	
	Trig. Side Plate - Right	8 Days
	" " " - Left	8 Days
	" Spacer - Front	3 Days
	" " - Rear	3 Days
Add Use	" Housing Rivets	
	" Spring	3 Days
	Trigger	10 Days
Add Use	" Pivot Pin	
Add Use	Sear Spring	3 Days
	Sear	10 Days
	Trigger Block Plunger	3 Days
	" " " Spring	
	Back Stop Release	
	Safety Assy. Assembled Color	1 Day
	Safety	7-8 Days
Add Use	Safety Button	
	Safety Pivot Pin	3 Days
Purchase	" Detent Ball	
	" " Spring	1 Days
Add Use	" " Snap Washer	

Unknown: Component Part Quantity
Is Trig. Assy To Have Reduced Safety Operating Forces - If So We Need Housings Skeletonized With New Detent - Safety Pivot Pins - Detent Springs

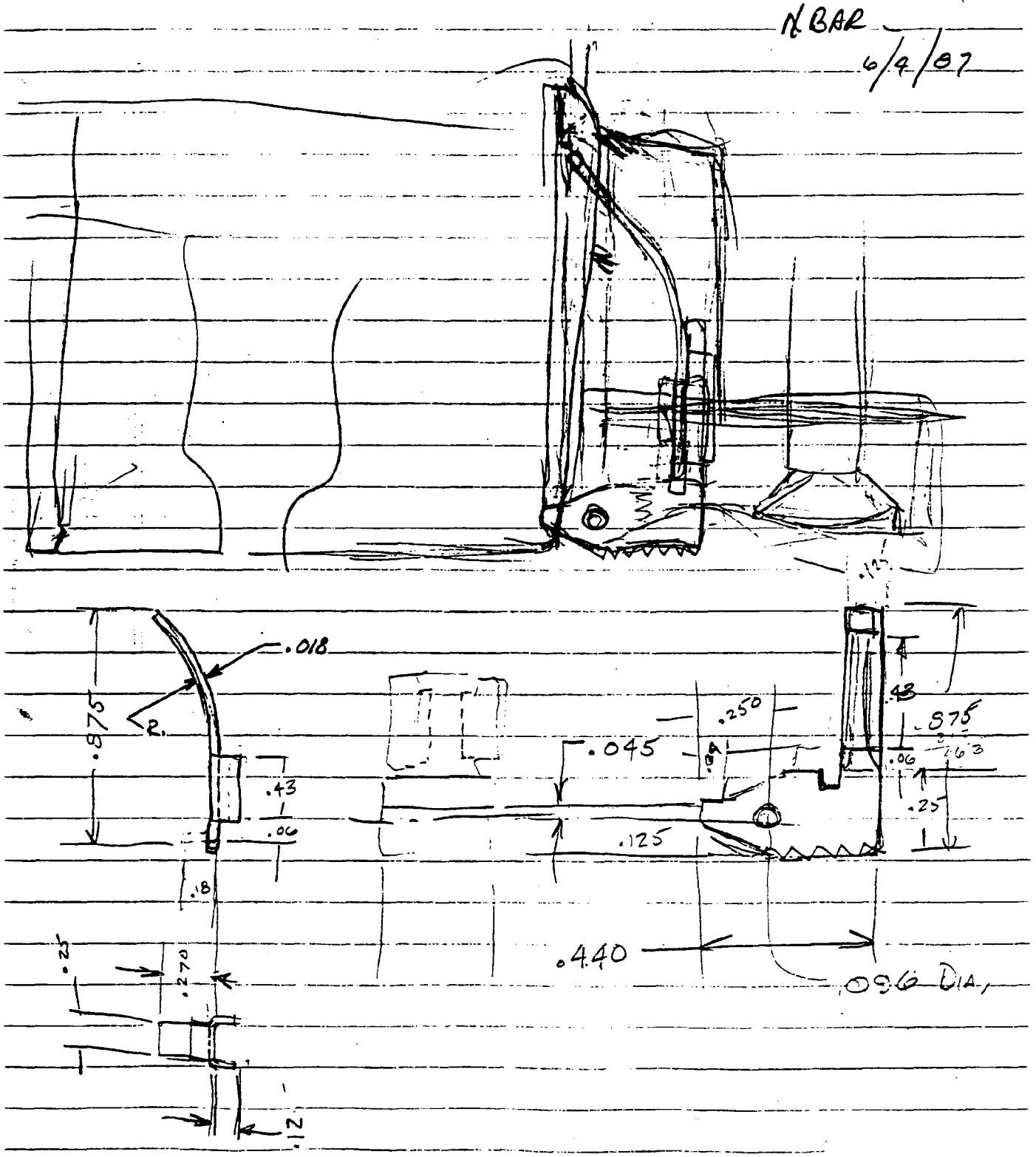
CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

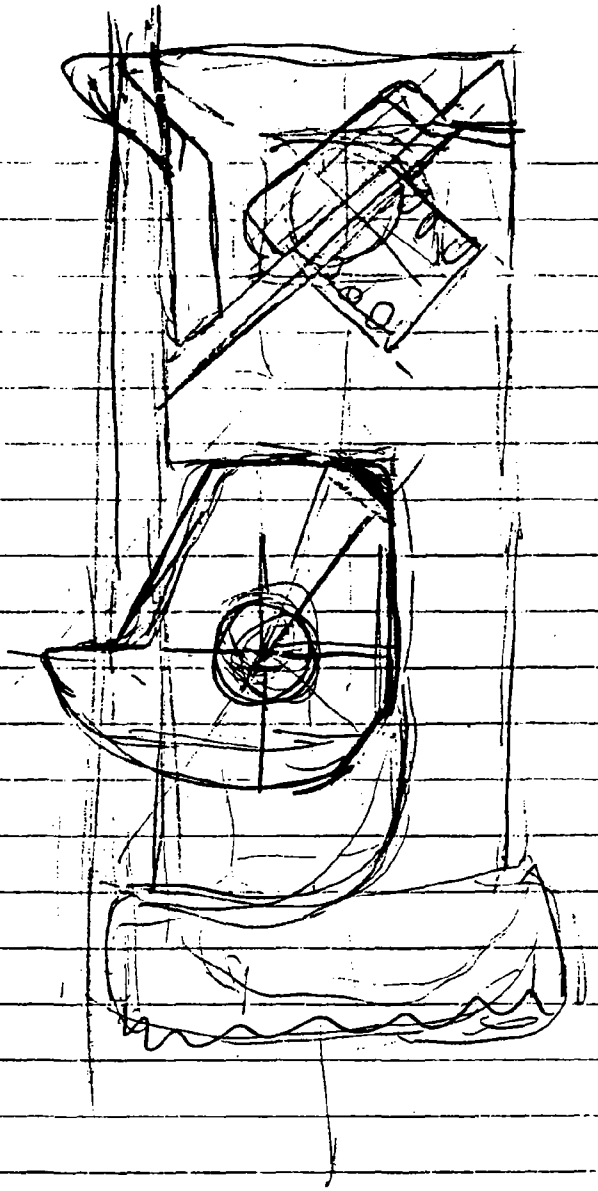
CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

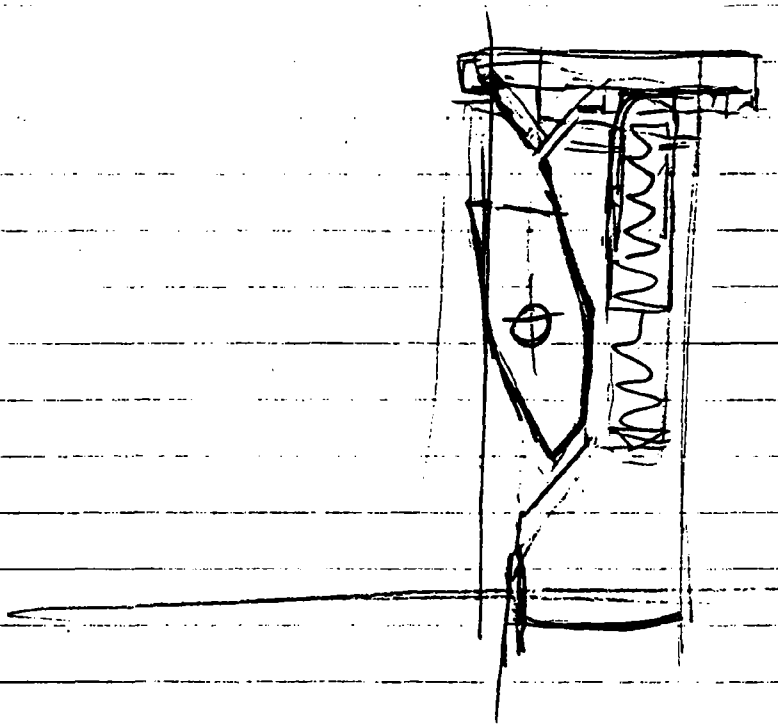


R2540524

June
July
Aug
Sept
Oct
Nov.
Bolt Assy Complete
Firing Pin Assy
Firing Pin
Main Spring
Main Spring Stop
Washer
Firing Pin Head
F.P. Cross Pin
Bolt Plug
Extractor
Ejector
Ejector Spring
Ejector Rear Pin
Bolt Body Assy
Bolt Handle Ass.
Bolt Handle
Bolt Body
Barrel Assembly Complete
Receivers
Barrels
Bolt Cover Finalizer
Done
Done
Done


N BAR
6/4/07
.018
.875
R.
.43
.06
.18
.25
.270
.12
.250
.045
.125
.13
.43
.875
.06
.25
.440
.096 DIA.





M/700 CALIBERS-

17 REM	SHORT
222	"
22-250	"
223	"
6MM	"
243 WIN	"
25-06	LONG
264	"
270	"
280	"
7MM-08	"
30-06	"
308	SHORT OR LONG
300 WIN MAG	LONG
375	"
458	"

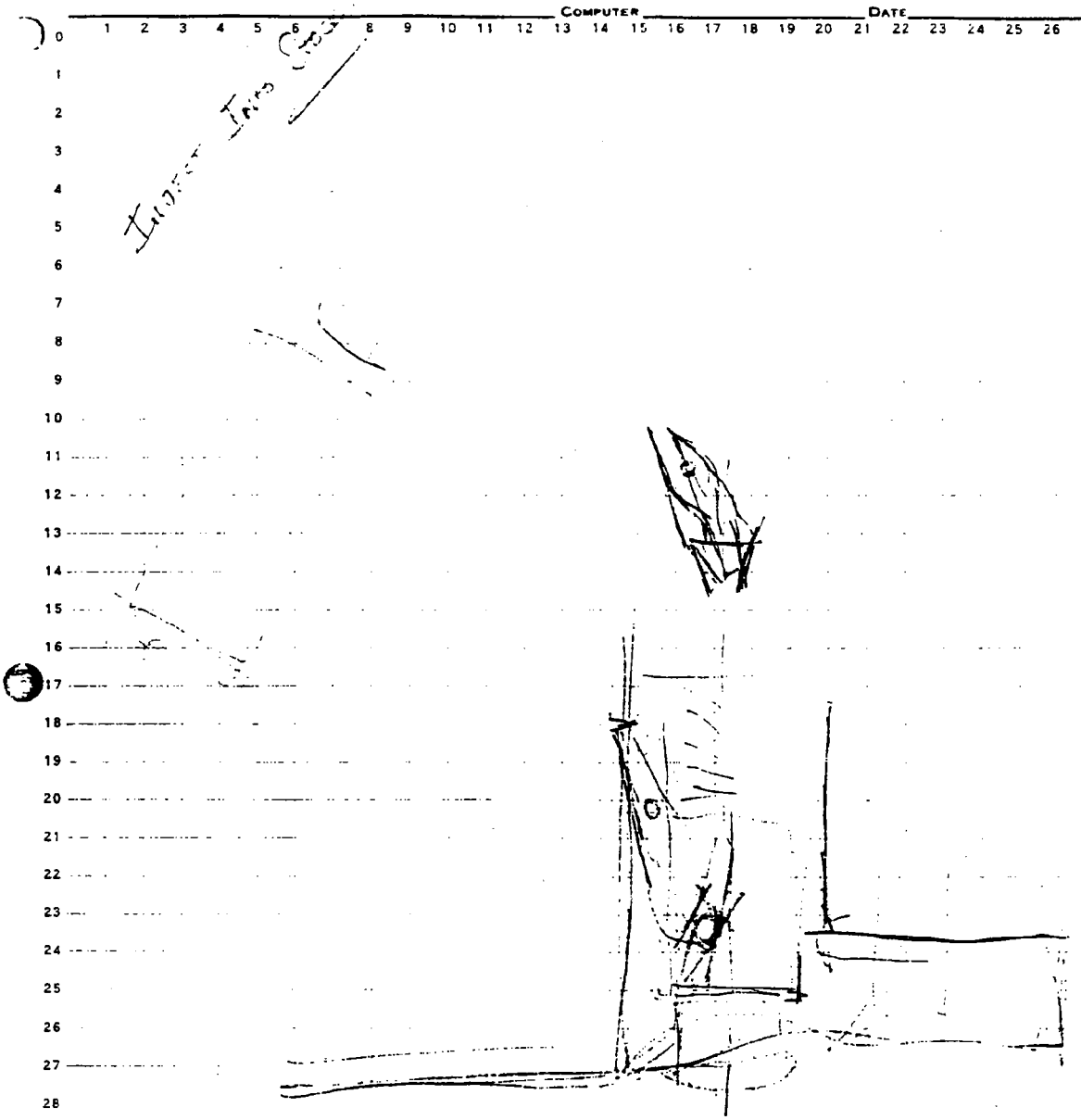
G-48 REV 9-57 ENGINEERING DUPONT COMPUTATION SHEET SHEET NO

TITLE OF PROJ OR STUDY PROJ OR STUDY NO.

SUBJECT WORKS

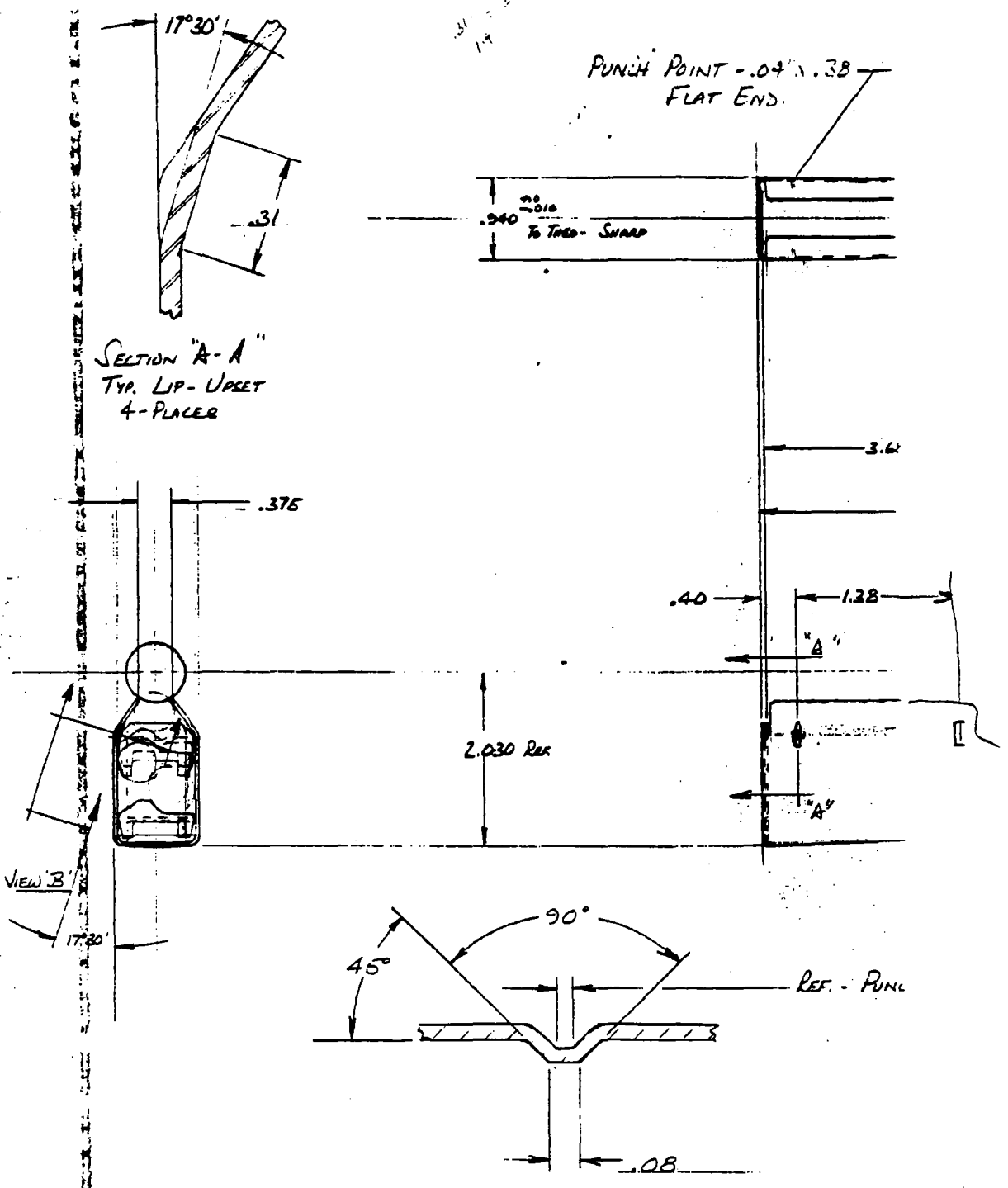
COMPUTER DATE 19

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31



USE STANDARDS FOR MINIMUM ESSENTIAL INSTALLATIONS

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON



SECTION "A-A"
TYP. LIP - UPSET
4 - PLACES

SECTION @ VIEW 'B'

ERD 6/9/07

E. I. DU PONT DE NEMOURS & CO., (INC.)

DU PONT

200 OLD WILSON BRIDGE RD.
WORTHINGTON, OHIO 43085-2261
☑ REMINGTON ARMS CO., INC.
HOEFLER AVE., ILION, NY 13357

PURCHASE ORDER
LRI 45314
PURCHASE ORDER NO. | ALT NO.
RELEASE NUMBER

SITE NO | TAX CODE | DIRECT ALL INQUIRIES
DATE OF ORDER 1-7-87
ISSUED BY Jim Simpson
TERMS OF PAYMENT NET 30
REQUIRED SHIP DATE Dec 31-87
PROMISED SHIP DATE
F.O.B. ☐ DEST. (DEL'D) ☐ SHIP PT. | ☐ PREPAID ☐ PREPAID ADDED ☐ OTHER (SEE BELOW) ☐ COLLECT*
FREIGHT TERMS (If Ship Pt. Show City & State) FREIGHT TERMS

PAGE OF

RECEIPTS	SHIPMENT NUMBER 1	2	3
DATE RECEIVED			
CHECKED BY			
FREIGHT: DATE SHIPPED			
VIA			
PRO. NO. or CAR NO.			
F. B. WGT.			
FREIGHT CHARGES			
NO. AND/OR KIND PKGS.			
INVOICE: DATE RECEIVED			
AMOUNT			
CHECK NO.			
DATE			

VENDOR CODE H+P DIE & STAMP
PAYEE CODE 4650 TRIDENT BLVD
CLEVELAND, OHIO 44144

SHIP TO
E. I. DU PONT DE NEMOURS & COMPANY
c/o REMINGTON ARMS CO., INC.
HOEFLER AVENUE
ILION, NY 13357
ORDER NO. LRI-

SHIP VIA:

TO RECORD ADDITIONAL SHIPMENTS SEE REVERSE SIDE

ITEM	QUANTITY	UNIT	DESCRIPTION (NOUN, ADJECTIVE, MANUF. NAME & NO.)	PRICE	QUANTITY RECEIVED 1	2	3
	50		PROTOTYPE MAGAZINE BOXES				
			PART NUMBER EXP 11758				
			- LARGE CAPACITY MAGAZINE #78.00				
			PER HOUR DOCUMENTATION TIME				
			HAVE TO BE PROVIDED BY				
			VENDOR				
			- ADDITIONAL DIMENSIONS NEEDED AND				
			MADE TO PROVIDE THE PARTS				
			AT COST PAID BY VENDOR				
			ACTUAL TIME SPENT TO BE				
			PAID				
			- TOTAL COST NOT TO EXCEED #4114.-				
			- REPORT QUARTERLY OF				
			EXPENDITURES				

CONFIRMING TO: BY: DATE: 14 WEEKS

REQUISITIONED BY	EXTENSION	REQUISITION APPROVED BY	DATE	AUTH. LEVEL	DATE DELIVERY REQ'D	ESTIMATED WEIGHT	ESTIMATED COST
K. JANSEN	321		1-7-87	5	4-1-87	25 #	W.I.E. 4114.-

ITEM NO	GENERAL LEDGER ACCOUNT/SUB ACCOUNTS	DETAIL ACCOUNTING	AMOUNT
	1112 -		
	481153-1611		

52-4 R&D
DELIVERY SPOT #
LAST ORDER NO. OR SUGGESTED VENDOR & ADDRESS

REASON VENDOR SELECTED: ☐ LOWEST PRICE ☐ BETTER QUALITY ☐ REQUIRED DESIGN ☐ ONLY KNOWN SOURCE ☐ CONTRACT/P.A.

ORDER APPROVED BY

ORDER EXECUTED BY

U879289
REQUISITION NO.

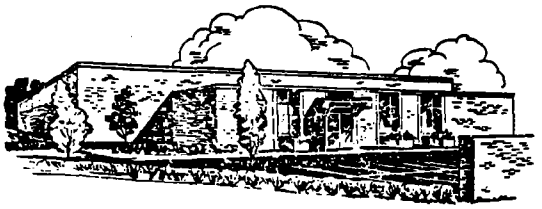
REQUISITIONER'S COPY

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

		SHIPMENT NUMBER							
		4	5	6	7	8	9	10	11
RECEIPTS	DATE RECEIVED								
	CHECKED BY								
FREIGHT	DATE SHIPPED								
	VIA								
	PRO NO. OR CAR NO.								
	F.B. WGT.								
	FREIGHT CHARGES								
	NO. AND/OR KIND PKGS.								
INVOICE	DATE RECEIVED								
	AMOUNT								
	CHECK NO.								
	DATE								

ITEM	QUANTITY	QUANTITY RECEIVED							
		4	5	6	7	8	9	10	11

QUOTATION



216-671-8000

THE H&P DIE & STAMPING COMPANY
DIV. OF UNITED SCREW AND BOLT CORP.

Engineering • Development • Tools • Dies • Stampings
Sub-Assemblies • Bus Supplies
4650 Tiedeman Road • Cleveland, Ohio 44144

To
Remington Arms Co., Inc.
Ilion, NY 13357

Attn: John Simpson

Date August 31, 1987

Terms 1% 10 days—30 days NET

F.O.B. Our Plant—Cleveland, Ohio

Replying to your inquiry of 8-14-87 #214 we take pleasure in quoting as follows:

Quantity	Description	Price
	Part Number EXP-1758 Magazine Box	
	Total: $620.00 per M in 25,000 piece lot	
	Note: H & P will hold this price on any quantity of 5000 + pieces.	
	Tools:	$17,060.00
	Delivery: Samples 21/24 weeks after receipt of order. Production 10/11 weeks after sample approval based on a 25,000 piecellot.	

Ron Stevens

14 weeks for pre-Atypes

LRI number by end of wk.

per conversation W/Ron Stevens on 10-6-87.

14 weeks - Jan 18th

The above Quotation is subject to acceptance within 30 days from date hereof; thereafter, prices are subject to change without notice, according to fluctuation of market prices of material, over which we have no control. We are not responsible for delays in deliveries due to strikes and conditions beyond our control.

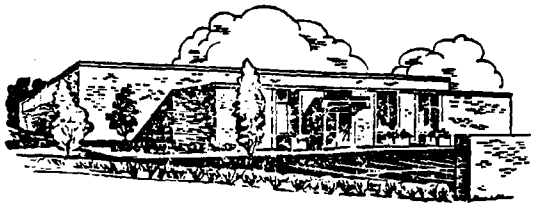
Very truly yours,

H & P DIE & STAMPING CO.

By.....

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

QUOTATION



THE H&P DIE & STAMPING COMPANY

DIV. OF UNITED SCREW AND BOLT CORP.

216-671-8000

Engineering • Development • Tools • Dies • Stampings

Sub-Assemblies • Bus Supplies

4650 Tiedeman Road • Cleveland, Ohio 44144

To

REMINGTON ARMS COMPANY
Ilion, New York 13357

Attn: Richard Jackson
John Simpson

Date September 11, 1987

Terms 1% 10 days—30 days NET

F.O.B. Our Plant—Cleveland, Ohio

Replying to your inquiry of 8-14-87 #214 we take pleasure in quoting as follows:

Quantity	Description	Price
	Part Number D-EXP-1758 Magazine 50 Prototypes Labor at the rate of $28.00 per hour. Documentation of hours provided by H & P if necessary. Outside purchases needed and made to produce the parts at cost paid by H & P. Actual invoices will be provided by H & P, if necessary not to exceed $4704. (168 hours)	

The above Quotation is subject to acceptance within 30 days from date hereof; thereafter, prices are subject to change without notice, according to fluctuation of market prices of material, over which we have no control. We are not responsible for delays in deliveries due to strikes and conditions beyond our control.

Very truly yours,

H & P DIE & STAMPING CO.

By.....

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

E. I. DU PONT DE NEMOURS & CO., (INC.)

DUPONT

200 OLD WILSON BRIDGE RD.
WORTHINGTON, OHIO 43085-2261
REMINGTON ARMS CO., INC.
HOEFLER AVE., ILION, NY 13357

PURCHASE ORDER

LRI

PURCHASE ORDER NO. | ALT NO.

RELEASE NUMBER

SITE NO | TAX CODE | DIRECT ALL INQUIRIES | DATE OF ORDER | ISSUED BY

PAGE OF

TERMS OF PAYMENT | REQUIRED SHIP DATE | PROMISED SHIP DATE

F O B: DEST (DEL'D) SHIP PT — FREIGHT TERMS (If Ship Pt Show City & State) — FREIGHT TERMS: PREPAID, PREPAID ADDED, OTHER (SEE BELOW), COLLECT*

*If COLLECT, Mail Freight Bill To:
FMIS
BOX 9964
WILMINGTON, DE 19899

VENDOR CODE

PAYEE CODE

SHIP TO
E. I. DU PONT DE NEMOURS & COMPANY
c/o REMINGTON ARMS CO., INC.
HOEFLER AVENUE
ILION, NY 13357
ORDER NO. LRI-

SHIP VIA:

INSTRUCTIONS TO VENDOR

PLEASE ENTER OUR ORDER AS SPECIFIED BELOW SUBJECT TO CONDITIONS AND INSTRUCTIONS LISTED ON BOTH THE FACE AND REVERSE SIDE OF THIS PURCHASE ORDER.

1 IF PRICE, TERMS, REQUIRED SHIPPING DATE OR OTHER CONDITIONS AND INSTRUCTIONS ARE NOT ACCEPTABLE-IMMEDIATELY ADVISE INDIVIDUAL INDICATED BY RED ARROW ABOVE.

2 FURNISH COMPLETE SHIPPING INFORMATION AND INCLUDE 2 COPIES OF PACKING LIST WITH EACH SHIPMENT. SHOW PURCHASE ORDER NUMBER ON EACH PACKAGE, PACKING LIST, BILL OF LADING, INVOICE AND ALL CORRESPONDENCE.

3 · · · MAIL YOUR INVOICE TO ADDRESS INDICATED BELOW:

REMINGTON ARMS CO., INC.
ACCOUNTS PAYABLE DIVISION
P.O. BOX 179
ILION, NY 13357

4. DO NOT INSURE U.P.S. OR PARCEL POST. DO NOT DECLARE AIR EXPRESS AND AIR FREIGHT IN EXCESS OF $50.00. IF LOWER CHARGES RESULT TO DUPONT, DECLARED VALUE SHALL NOT EXCEED LOWEST AMOUNT IN APPLICABLE TARIFF.

ITEM	QUANTITY	UNIT	DESCRIPTION (INCLUDE ABBREVIATIONS, MANUF. GRADE & NO.)	PRICE
	50		PROTOTYPE MAGAZINE BOXES PART NUMBER EXP. 17,58 - LABOR AT RATE OF $28.00 PER HOUR. DOCUMENTATION OF HOURS TO BE PROVIDED BY VENDOR. - OUTSIDE PURCHASES NEEDED AND MADE TO PRODUCE THE PARTS AT COST PAID BY VENDOR. ACTUAL INVOICES TO BE PROVIDED. - TOTAL COST NOT TO EXCEED $4704.- - REFERENCE QUOTATION OF SEPT. 11, 1987.	

DO NOT WRITE BEYOND THIS LINE

CONFIRMING TO:

BY: DATE:

REQUISITIONED BY	EXTENSION	REQUISITION APPROVED BY	DATE	AUTH. LEVEL	DATE DELIVERY REQ'D	ESTIMATED WEIGHT	ESTIMATED COST
R. JACKSON	307				21-2 WKS. ARO.	25 ##	W.T.E. 4704.-

ITEM NO	GENERAL LEDGER ACCOUNT/SUB ACCOUNTS	DETAIL ACCOUNTING	AMOUNT
	481153-1611		

52-4 R&D
DELIVERY SPOT #
LAST ORDER NO. OR SUGGESTED VENDOR & ADDRESS

REASON VENDOR SELECTED: ☐ LOWEST PRICE ☐ BETTER QUALITY ☐ REQUIRED DESIGN ☐ ONLY KNOWN SOURCE ☐ CONTRACT/P.A.

ORDER APPROVED BY | ORDER EXECUTED BY | U879289 REQUISITION NO.

COPY 2 - ☐ WILM. ACCT'S. PAY. ☐ LOCAL ACCT. SECT.

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

RD-69-B

REMINGTON ARMS COMPANY, INC.

INTER-DEPARTMENTAL CORRESPONDENCE

Remington DUPONT PETERS DUPONT

"CONFINE YOUR LETTER TO ONE SUBJECT ONLY"_____

September 16,1987

NBAR Specification List

Bolt Assembly

* Enclosed Bolt Plug
* Lightweight Firing Pin/Faster Locktime
* Claw Type Extractor

Firecontrol

* Pre-set Engagement and Overtravel
* Weight of Pull Adjustable in Stock
* Trigger and Sear Block Two Position Safety
* Skeletonized Housing
* No Connector

Receiver

* Integral Recoil Lug
* Integral Scope Mounts
* Independent Bolt Lock
* Detachable Magazine Box

Stock

* Walnut with Synthetic Bedding Block
* Rynite
* Satin Finish

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

MODEL	NBAR	NBAR	NBAR
PART NAME	Mag/spring-follower	Mag. spring	Mag. follower
DRAWING NO.	B-expl673A	B-expl760	C-93701
OUT TO QUOTE			
ORDER 1ST PROTOS	7/13/87	8/14/87	8/26/87
VENDOR	modelshop/ Haynes	modelshop/ Haynes	modelshop/ wire
PROTOS RETURNED			
PROD QTY EST $ea			
1ST TEST COMPLETE			
1ST REDESIGN DONE			
ORDER 2ND PROTOS			
PROTOS RETURNED			
2ND TEST COMPLETE			
2ND REDESIGN DONE			
DESIGN TEST BEGUN			
DESIGN ACCEPTED			
DESIGN TRANSMITTED			

MODEL	NBAR	NBAR	NBAR
PART NAME	Mag. box	Trig. guard	Mag. release
DRAWING NO.	D-expl758	E-expl350	B-expl759
OUT TO QUOTE	8/14/87		
ORDER 1ST PROTOS	10/2/87		8/13/87
VENDOR	H&P		model shop
PROTOS RETURNED			
PROD QTY EST $ea	$0.62		
1ST TEST COMPLETE			
1ST REDESIGN DONE			
ORDER 2ND PROTOS			
PROTOS RETURNED			
2ND TEST COMPLETE			
2ND REDESIGN DONE			
DESIGN TEST BEGUN			
DESIGN ACCEPTED			
DESIGN TRANSMITTED			

MODEL	NBAR	NBAR	NBAR
PART NAME	Mag. Latch Housing	Mag. Latch	Latch Release
DRAWING NO.	C-exp. 1762	B-exp. 1761	B-exp. 1763
OUT TO QUOTE			
ORDER 1ST PROTOS	9/1/87	9/1/87	9/1/87
VENDOR	modelshop/ wire	model shop	model shop
PROTOS RETURNED		9/10/87	9/14/87
PROD QTY EST $ea			
1ST TEST COMPLETE			
1ST REDESIGN DONE			
ORDER 2ND PROTOS			
PROTOS RETURNED			
2ND TEST COMPLETE			
2ND REDESIGN DONE			
DESIGN TEST BEGUN			
DESIGN ACCEPTED			
DESIGN TRANSMITTED			

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

11-18-87

NBAR STATUS

- ACCURACY TESTING UNDERWAY ON 22 M/78 .30-06
  → with exception of control guns, these will be sent to D.C. Brennan Firearms for barrel modification — then returned to Remington for evaluation of proposed new technology
- Vendor has sent us a 1st prototype trigger guard
  → we have approved this and have 99 more due by 12-16-87.
- Magazine bot vendor is to begin work on tooling next wk. with delivery of 50 prototypes 2-1-87.
- Waiting for stocks and bedding blocks from model shop
  → need these to proceed w/ testing for accuracy
- Various small parts such as mag. follower and mag. latch housing prototypes due from model shop (N.C.) by 1-1-88

- 10 - BARREL ACTION ASSEMBLY POLISH & COLOR READY FOR ASSY
  FIRE CONTROLS LESS SAFETY ASSY & BOLT LOCK READY

- SAFETY ASSY & BOLT LOCKS NOT COMPLETED ALT. MANU. METHOD - STAMPING VENDOR - QUOTING EXPECT REPLY 11-20-87

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

RD-49-B

REMINGTON ARMS COMPANY, INC.

INTER-DEPARTMENTAL CORRESPONDENCE

Remington DUPONT PETERS DUPONT

"CONFINE YOUR LETTER TO ONE SUBJECT ONLY"

xc: R. A. Darby
R. F. Ulak
J. F. Winske
T. C. Douglas
J. R. Snedeker
File

Ilion, New York
November 18, 1987

TO: W. H. COLEMAN, II

FROM: T. C. DOUGLAS TCD

NEW PRODUCTS DEVELOPMENT MONTHLY REPORT - NOVEMBER

SYNTHETIC LONG STOCK - MODEL 700 RS

Due to extra work required to keep the Grey stocks clean during handling in the plant it was decided by the Product Team to change the stock color to Black for 1988. Transmittals have been made and the vendor has been notified. In addition, it was decided to add a barrel bedding point in the fore end to eliminate the problem with the barrel laying left/right and touching the fore end causing visual quality problems. The drawing changes have been made and the vendor is being contacted through Purchasing for mold modifications.

SNIPER WEAPON SYSTEM

Nineteen First Article and six Initial Production Test systems were presented to the Government on October 28th as required for the start of First Article Testing. The Government was notified prior to the start of the testing that we felt that there would be a problem with the trigger pull specifications. It was determined during the trigger pull testing that "technically", the rifles failed that test. It was decided to continue with the First Article Test as is and Remington would conduct a Failure Analysis of the fire control. Eleven of the nineteen guns did pass the test and it appears that the majority of the remaining guns just had an adjustment problem (we were not allowed to re-adjust the fire controls). It appears that the "worst case" solution to the problem is a more precise method of setting the trigger pull during build coupled with selective assembly methods.

Ten systems were shipped to the Government on November 16th for testing to be conducted by the Government.

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

PARKER

Program efforts are primarily being directed towards the production of a non-functioning "show sample" for the Shot Show in mid-January 1988. A receiver is due from Kolar by November 25th for engraving. A second receiver will be sent to Fajen who will produce the stock blanks and send them to Delgrego for finish work and stocking of the show gun. Concurrent with this effort, Kolar will complete their barrel brazing development so that a finished gun can be assembled by year end.

Prototypes for testing will be produced similar to the show gun except for the barrels and the engraving. Barrels will be made from 4142 blanks to be supplied from Mike Rock. Due to concern over timely delivery of production barrels from Mike Rock, an alternate method (Pilger Process) of manufacture is being investigated.

SP-10 MAGNUM

Three prototype guns were sent to the gun writer's seminar in Texas for their evaluation. The guns were functional and visually correct.

The twelve gun test is now scheduled for mid-December due to the decision to wait for Remington receivers and barrels needed to perform ultimate strength testing.

One gun with all the non-interchangeability features as well as a new bolt buffer, firing pin, and firing pin spring has been sent to the Test Lab for endurance testing.

High strength alloy steel choke tubes, developed specifically for steel shot, have been tested to 4000 rounds with steel BB's, with only .001" growth. The choke tube could still be easily removed and re-installed. Work is now underway to determine the necessary choke constrictions, using steel BB's as the benchmark ammunition.

The change in scope of the program necessitated by the need for a new fire control and non-interchangeability concerns, SWS efforts, quality program needs, and Resource limitations has caused us to re-evaluate the timing of the program. This showed the need to revise the schedule to a warehouse position in 2Q 1989.

MODEL 700 CLASSIC .35 WHELAN

Design acceptance testing is complete, with the design being approved for transmittal. The design was transmitted on June 10th. Trial and Pilot machining should start late 4Q 1987 for 1988 introduction.

MODEL 700 MOUNTAIN RIFLE CALIBER ADDITIONS

Five rifles of each caliber offering(.308, 243, and 7mm-08) were tested for accuracy and function. The Design Verification Test was acceptable(Report #871111) and the design has been transmitted. Trial and Pilot assembly is scheduled for January 1988 for 1988 introduction.

NEW BOLT ACTION RIFLE

Fabrication of prototype parts necessary for the next phase of testing is on hold in the Model Shop and the N/C area pending completion of parts for the SP-10 Magnum program. Parts to be produced by an outside vendor have been sent to vendors to provide those prototype parts.

Testing of a patented new technology rifle barrel is currently underway in a joint program with Remington and D. C. Brennan Firearms, Inc. The Brennan technology promises a 25% increase in accuracy with reduced recoil. This testing will probably be completed in January 1988.

SHOTGUN BARREL AUTOMATION

Four additional M/11-87 Pilger barrels cold formed from AISI 4130 welded steel tubing underwent ultimate strength testing against five of our current C-1140 modified steel GFM barrels. All of the Pilger barrels performed equal to or better than the control barrels.

Addition barrel forming tests are now being planned to produce more 12 gauge Pilger barrels. New tooling drawings have been completed to provide a finish-formed chamber in addition to the finished bore and a near-net shaped outside configuration. Tooling has also been designed for 29 gauge Parker barrels. The new tooling is expected to be available for testing 1Q 1988.

MODEL 700 CLASSIC .300 WEATHERBY MAGNUM

The Classic offering for 1989 will be the .300 Weatherby Magnum. This will be a synergistic offering from Firearms and Ammunition. Lonoke is providing Ilion with chamber drawings and reamers. Ilion will then provide Lonoke with three pressure barrels and one completed firearm for their ammunition development. Ilion will have five more completed rifles awaiting shipment of pilot run ammunition for Design Acceptance Testing.

xc: R. A. Darby
R. F. Ulak
J. F. Winske
T. C. Douglas
J. R. Snedeker
File

Ilion, New York
November 18, 1987

TO: W. H. COLEMAN, II

FROM: T. C. DOUGLAS

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CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

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Remington.

DUPONT

REMINGTON ARMS COMPANY, INC.

SPORTING ARMS-AMMUNITION-TARGETS-TRAPS

ILION, NEW YORK 13357

TELEPHONE (315) 894-9961

19 November 1987

To: Roy Bernard
Connecticut Spring Co.
Farmington, Conn.

LR1 47970

From: Dick Jackson
R&D
Remington Arms Co.
Ilion, N.Y. 13357

Per our conversation of this morning, I am enclosing a drawing of a prototype spring (B-EXP.1760A) that I'd like you to take a look at. I'm interested in having some of these made up using a couple of different wire diameters if we can agree on the timing.

I'll give you a telephone call on Friday 11/20/87 to talk timing and wire diameters as well as answer/ask other questions.

Thanks for your time,

Dick Jackson

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

Remington.
DUPONT

REMINGTON ARMS COMPANY, INC.

SPORTING ARMS-AMMUNITION-TARGETS-TRAPS

ILION, NEW YORK 13357

TELEPHONE (315) 894-9961

24 November 1987

To: Mr. Ron Stevens
H&P Die and Stamping Company
4650 Tiedeman Road
Cleveland, Ohio 44144

From: Dick Jackson
R&D
Remington Arms Co.

As we discussed by telephone on Friday Nov. 20, I am enclosing two copies of Remington's NBAR magazine box drawing D-EXP.1758-A. This drawing supersedes D-EXP.1758 in reference to LRI #45394.

The primary changes are:

* elimination of a fold in the side of the box (formerly section B-B)
* change in angle and length of lip upsets as indicated in section A-A
* change in width of lips at front (was .425" ; now is .385")
* overall height of box increased by approximately .060".

Please contact me (315-894-9961-ext.307) if you have any questions or difficulties.

Thanks for your patience,

Dick Jackson

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

E. I. DU PONT DE NEMOURS & CO., (INC.)

DUPONT

200 OLD WILSON BRIDGE RD.
WORTHINGTON, OHIO 43085-2261
☑ REMINGTON ARMS CO., INC.
HOEFLER AVE., ILION, NY 13357
☐

SITE NO | TAX CODE N | DIRECT ALL INQUIRIES

DATE OF ORDER 12/4/87

ISSUED BY JOHN SINGER

PURCHASE ORDER

LRI 47970
PURCHASE ORDER NO. | ALT NO

RELEASE NUMBER

TERMS OF PAYMENT N/T 30

REQUIRED SHIP DATE | PROMISED SHIP DATE 12/21

PAGE | OF

F.O.B. ☐ DEST. (DEL'D) ☑ SHIP PT. | ☐ PREPAID ☐ PREPAID ADDED ☐ OTHER (SEE BELOW) ☐ COLLECT*

FREIGHT TERMS | (If Ship Pt. Show City & State)

$175.

VENDOR CODE

(203) 677-1341
CONNECTICUT SPRING CO.
5 SPRING LANE
FARMINGTON INDUSTRIAL PARK
FARMINGTON, CONN. 06032

PAYEE CODE

SHIP TO
E. I. DU PONT DE NEMOURS & COMPANY
c/o REMINGTON ARMS CO., INC.
HOEFLER AVENUE
ILION, NY 13357
ORDER NO. LRI-

SHIP VIA:

RECEIPTS	SHIPMENT NUMBER 1	2	3
DATE RECEIVED			
CHECKED BY			
FREIGHT: DATE SHIPPED			
VIA			
PRO. NO. or CAR NO.			
F. B. WGT.			
FREIGHT CHARGES			
NO. AND/OR KIND PKGS.			
INVOICE: DATE RECEIVED			
AMOUNT			
CHECK NO.			
DATE			

TO RECORD ADDITIONAL SHIPMENTS SEE REVERSE SIDE

ITEM	QUANTITY	UNIT	DESCRIPTION (NOUN, ADJECTIVE, MANUF. NAME & NO.)	PRICE	QUANTITY RECEIVED 1	2	3
1	100		MAGAZINE SPRINGS PER REMINGTON	4.50 EA			
	50		DRAWING B-EXP 1760A OF .045" WIRE				
			DIAMETER				
2	100		MAGAZINE SPRINGS PER REMINGTON	4.50 EA			
	50		DRAWING B-EXP 1760A OF .048" WIRE				
			DIAMETER				
3	100		MAGAZINE SPRINGS PER REMINGTON	4.50 EA			
	50		DRAWING B-EXP. 1760A OF .051"				
			WIRE DIAMETER				
			N.Y. SALES & USE TAX EXEMPTION CERTIFICATE ACCOUNT IDENTIFICATION #06-0507970C ☐ TAX ☐ EXEMPT				

CONFIRMING TO: JOHN DOE BY: TOM SIMPSON DATE: 12/4/87

REQUISITIONED BY	EXTENSION	REQUISITION APPROVED BY	DATE	AUTH LEVEL	DATE DELIVERY REQ'D	ESTIMATED WEIGHT	ESTIMATED COST
R. JACKSON	307	TOM SIMPSON	11/30/87	52	12/23/87	5 lbs.	$700.

ITEM NO	GENERAL LEDGER ACCOUNT/SUB ACCOUNTS	DETAIL ACCOUNTING	AMOUNT
	1118-481153-1611		

R&D
DELIVERY SPOT # 52-4
LAST ORDER NO. OR SUGGESTED VENDOR & ADDRESS

REASON VENDOR SELECTED ☐ LOWEST PRICE ☐ BETTER QUALITY ☐ REQUIRED DESIGN ☐ ONLY KNOWN SOURCE ☐ CONTRACT/P.A.

ORDER APPROVED BY

ORDER EXECUTED BY

X526866
REQUISITION NO

REQUISITIONER'S COPY

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

		SHIPMENT NUMBER							
		4	5	6	7	8	9	10	11
RECEIPTS	DATE RECEIVED								
	CHECKED BY								
FREIGHT	DATE SHIPPED								
	VIA								
	PRO NO. OR CAR NO.								
	F.B. WGT.								
	FREIGHT CHARGES								
	NO. AND/OR KIND PKGS.								
INVOICE	DATE RECEIVED								
	AMOUNT								
	CHECK NO.								
	DATE								

ITEM	QUANTITY	QUANTITY RECEIVED							
		4	5	6	7	8	9	10	11

RD-49-B

REMINGTON ARMS COMPANY, INC.

INTER-DEPARTMENTAL CORRESPONDENCE

Remington DUPONT PETERS DUPONT

"CONFINE YOUR LETTER TO ONE SUBJECT ONLY"

xc: R. A. Darby, R. F. Ulak, J. F. Winske, T. C. Douglas, J. R. Snedeker, L. B. Bosquet, D. J. Anderson, H. C. Munson, K. C. Rowlands, S. R. Franz, R. A. Jackson, R. S. Murphy, T. P. Powers, T. G. Bauman, F. E. Martin, File

CONFIDENTIAL

Ilion, New York
December 20, 1987

TO: W. H. COLEMAN, II

FROM: T. C. DOUGLAS TCD

NEW PRODUCTS DEVELOPMENT MONTHLY REPORT - DECEMBER

SYNTHETIC LONG STOCK - MODEL 700 RS - Skip Smith

Due to extra work required to keep the Grey stocks clean during handling in the plant it was decided by the Product Team to change the stock color to Black for 1988. Transmittals have been made and the vendor has been notified. In addition, it was decided to add a barrel bedding point in the fore end to eliminate the problem with the barrel laying left/right and touching the fore end causing visual quality problems. The drawing changes have been made and the vendor was contacted by Skip on December 22nd. The drawing of the stock changes is being shipped overnight air to the vendor.

SNIPER WEAPON SYSTEM - Jim Snedeker

Ten of the nineteen First Article Test rifles were shipped on schedule to Aberdeen Proving Grounds in mid-November via Army helicopter from the Oneida County Airport. These weapons are being put through hot and cold environmental tests, noise testing and endurance testing.

Three of the ten systems are scheduled to be returned to Ilion after the Christmas holidays and additional testing will be conducted at the Ilion site and at Dayton T. Brown Testing in Long Island(for the fungus and corrosion testing).

The new trigger pull test fixtures are scheduled to be completed by the middle or end of January and will be used to resolve the question of trigger pull. Additionally, parts for fifty more SWS fire controls have been brought through the production line and critical dimensions, surface roughness, and spring weights are being examined to determine the characteristics that need to be controlled to consistently attain the $\pm$ 4 ounce specification required by the government.

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

PARKER - Randy Murphy

Program efforts are primarily being directed towards the production of a non-functioning "show sample" for the Shot Show in mid-January. Due to difficulties in brazing the barrel assembly, the metalwork will not be delivered to the engraver on December 21, putting us several days behind schedule. Without another unforseen problem, the show gun metalwork should be delivered to Remington on December 21. Remington will hand-deliver the metalwork to the engraver who will attempt to complete his work within the schedule, getting the metalwork back on schedule.

Fajen has delivered stock blanks to Delgrego, and the stock and fore end for the show gun is ahead of schedule.

Prototypes for testing will be produced similar to the show gun except for the barrels and engraving. A barrel process was finalized with our materials consultant, Fred Schmidt on December 9th. Current 1140 Modified barrel steel will be used with an induction hardening heat treatment of the chamber to strengthen this area. Barrels for the test guns are through our GFM and are ready to be turned.

SP-10 MAGNUM - Ken Rowlands and Tom Bauman

The three prototype guns sent to the gun writer's seminar for evaluation were well received. Unfortunately, the ammunition did not arrive in time for field evaluation. It was recommended that the trigger pull be reduced from 14.25" to 14". The nonreflective satin finish on the exposed stainless steel components was acceptable. The Product Team approved the checkering patterns on December 15th.

One gun with all the non-interchangeability features as well as a new bolt buffer, firing pin, and firing pin spring was endurance tested to 4000 rounds, 80% of which were steel loads. The results were very encouraging, with no parts breakages and a 1.3% malfunction rate.

High strength alloy steel choke tubes, developed specifically for steel shot, have been tested to 4000 rounds with steel BB's, with only .001" growth. The choke tube could still be easily removed and re-installed. Work is now underway to determine the necessary choke constrictions, using steel BB's as the benchmark ammunition.

Delays are being experienced in completing components for the twelve gun test. Late delivery of investment cast bolts, start-up up problems of needed Ithaca equipment, and Model Shop resources have combined to delay the test until early January.

MODEL 700 CLASSIC .35 WHELAN - Fred Martin

Design acceptance testing is complete, with the design being approved for transmittal. The design was transmitted on June 10th. Trial and Pilot machining is underway with final assembly scheduled for February 1988.

MODEL 700 MOUNTAIN RIFLE CALIBER ADDITIONS - Skip Smith

Five rifles of each caliber offering(.308, 243, and 7mm-08) were tested for accuracy and function. The Design Verification Test was acceptable(Report #871111) and the design has been transmitted. Trial and Pilot assembly is scheduled for early February 1988.

NEW BOLT ACTION RIFLE - Fred Martin and Dick Jackson

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MODEL 700 CLASSIC .300 WEATHERBY MAGNUM - Fred Martin

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Manfucturing cost to be less than or equal to the M/11-87.

Design must include wood stock/fore end with synthetic material optional.

Must operate all commercially available 12 gauge ammunition reliably.

Manual operation to be smoother than the M/11-87.

Weight to be approximately one pound less than the M/11-87.

Measurable recoil to be less than or equal to the M/11-87, based upon peak shoulder force.

"Family" shotgun design (Maximum commonality between autoloader and pump version for manufacturing flexiblity).

Safely contain excessive chamber pressure (Level TBD).

Primary efforts are being directed towards an inertia operated action system. This means that the action is driven by energy from mechanical systems versus using gas pressure. This energy comes from a mass/spring system using recoil as the initiating force. This type of system eliminates tight tolerances, critical gas sealing components, fouling problems, and minimizes ammunition sensitivity. Preliminary evaluations of the Benelli and the Browning A-500 inertia systems indicate that their performance is marginal on the low end of the ammunition spectrum. Our computer simulation also indicates that a "pure" inertia design would be marginal on the low end. We are working on a concept that will use a small amount of gas pressure to assist the recoil forces in compressing the "drive" spring. This should greatly improve low end performance. The concept is currently being drawn up and will be prototyped on an 11-87 type receiver.

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RD-51-B

REMINGTON ARMS COMPANY, INC.

INTER-DEPARTMENTAL CORRESPONDENCE

Remington (DUPONT) PETERS (DUPONT)

"CONFINE YOUR LETTER TO ONE SUBJECT ONLY"

xc:

R. A. Darby	K. C. Rowlands
R. F. Ulak	S. R. Franz
J. F. Winske	R. A. Jackson
T. C. Douglas	R. S. Murphy
J. R. Snedeker	T. P. Powers
L. B. Bosquet	T. G. Bauman
D. J. Anderson	F. E. Martin
H. C. Munson	File

CONFIDENTIAL

Ilion, New York
December 20, 1987

TO: W. H. COLEMAN, II

FROM: T. C. DOUGLAS TCD

NEW PRODUCTS DEVELOPMENT MONTHLY REPORT - DECEMBER

SYNTHETIC LONG STOCK - MODEL 700 RS - Skip Smith

Due to extra work required to keep the Grey stocks clean during handling in the plant it was decided by the Product Team to change the stock color to Black for 1988. Transmittals have been made and the vendor has been notified. In addition, it was decided to add a barrel bedding point in the fore end to eliminate the problem with the barrel laying left/right and touching the fore end causing visual quality problems. The drawing changes have been made and the vendor was contacted by Skip on December 22nd. The drawing of the stock changes is being shipped overnight air to the vendor.

SNIPER WEAPON SYSTEM - Jim Snedeker

Ten of the nineteen First Article Test rifles were shipped on schedule to Aberdeen Proving Grounds in mid-November via Army helicopter from the Oneida County Airport. These weapons are being put through hot and cold environmental tests, noise testing and endurance testing.

Three of the ten systems are scheduled to be returned to Ilion after the Christmas holidays and additional testing will be conducted at the Ilion site and at Dayton T. Brown Testing in Long Island(for the fungus and corrosion testing).

The new trigger pull test fixtures are scheduled to be completed by the middle or end of January and will be used to resolve the question of trigger pull. Additionally, parts for fifty more SWS fire controls have been brought through the production line and critical dimensions, surface roughness, and spring weights are being examined to determine the characteristics that need to be controlled to consistently attain the $\pm$ 4 ounce specification required by the government.

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PARKER - Randy Murphy

Program efforts are primarily being directed towards the production of a non-functioning "show sample" for the Shot Show in mid-January. Due to difficulties in brazing the barrel assembly, the metalwork will not be delivered to the engraver on December 21, putting us several days behind schedule. Without another unforseen problem, the show gun metalwork should be delivered to Remington on December 21. Remington will hand-deliver the metalwork to the engraver who will attempt to complete his work within the schedule, getting the metalwork back on schedule.

Fajen has delivered stock blanks to Delgrego, and the stock and fore end for the show gun is ahead of schedule.

Prototypes for testing will be produced similar to the show gun except for the barrels and engraving. A barrel process was finalized with our materials consultant, Fred Schmidt on December 9th. Current 1140 Modified barrel steel will be used with an induction hardening heat treatment of the chamber to strengthen this area. Barrels for the test guns are through our GFM and are ready to be turned.

SP-10 MAGNUM - Ken Rowlands and Tom Bauman

The three prototype guns sent to the gun writer's seminar for evaluation were well received. Unfortunately, the ammunition did not arrive in time for field evaluation. It was recommended that the trigger pull be reduced from 14.25" to 14". The nonreflective satin finish on the exposed stainless steel components was acceptable. The Product Team approved the checkering patterns on December 15th.

One gun with all the non-interchangeability features as well as a new bolt buffer, firing pin, and firing pin spring was endurance tested to 4000 rounds, 80% of which were steel loads. The results were very encouraging, with no parts breakages and a 1.3% malfunction rate.

High strength alloy steel choke tubes, developed specifically for steel shot, have been tested to 4000 rounds with steel BB's, with only .001" growth. The choke tube could still be easily removed and re-installed. Work is now underway to determine the necessary choke constrictions, using steel BB's as the benchmark ammunition.

Delays are being experienced in completing components for the twelve gun test. Late delivery of investment cast bolts, start-up up problems of needed Ithaca equipment, and Model Shop resources have combined to delay the test until early January.

MODEL 700 CLASSIC .35 WHELAN - Fred Martin

Design acceptance testing is complete, with the design being approved for transmittal. The design was transmitted on June 10th. Trial and Pilot machining is underway with final assembly scheduled for February 1988.

MODEL 700 MOUNTAIN RIFLE CALIBER ADDITIONS - Skip Smith

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To JWB
From RSM

Subject: 1987 Program Concept Statements

A NBAR

To complete the development and support the processing (and production efforts) as well as develop future calibers and improvements in a way that recognizes and meets the needs of our customers so that company goals are met.

b Mountain Rifle Short Action

To expand the Mountain Rifle line in a way that satisfies the needs of production and Marketing so that program timing makes sense and we are ahead of schedule for once.

B Low Cost Rimfire Rifle

To develop a low cost replacement for the Nylon 66 in a way that recognizes the budget and priority constraints in Research and Production so that Remingtons product line and profits are enhanced

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KINZER V. REMINGTON

B. - Weatherby

To support the manufacture of Weatherby bolt action rifles in a way is compatible with Remingtons legal and moral obligations so that profits are enhanced

B. Porter

To coordinate a program to accomplish the outsourced manufacture and assembly, and in-house test pack and shipment of this shotgun in a way that identifies and capitalizes on the vendors and Remington's strengths so that Dick Heckert can have his expensive toy. (so that Remingtons reputation of quality and craftsmanship will be enhanced

C. 3200 Improvement

To coordinate the outsourced development of a 3200 based competition shotgun family in a way that minimizes development and production expenditures so that a profit can be made recognizing that we are targeting a limited market.

1987 INTRODUCTIONS

-MODEL 11-87
-PRESSURE COMPENSATING GAS SYSTEM
-STAINLESS STEEL MAGAZINE TUBE
-DETENT SYSTEM [SPECIAL FIELD TYPE]
-THICKER EXTRACTOR
-SCREW MACHINE MAGAZINE CAP
-TWO-PIECE FIRING PIN RETRACTOR SPRING
- IMPROVED LATCH RETENTION
-PREMIER
-CUT CHECKERING
-30 GLOSS FINISH
-CHOKE TUBES
-PRESENTATION STYLE RECOIL PAD [BROWN]
-NO WHITE LINE SPACERS,
-RA GRIP CAP
-BRADLEY TYPE FRONT SIGHT, METAL MID BEAD
-3 IN CHAMBERS [EXCEPT SKEET AND TRAP]
-NO SCROLL ON RECEIVER OR BREECH BOLT

-PREMIER SKEET
-26 IN V. R. BARREL
-REMCHOKES [SKEET, IMP. SKEET, MOD]
-D
-2 3/4 TARGET MARKED ON BARREL [3 IN ACTUAL CHAMBER]
-PREMIER TRAP
-30 IN V. R. BARREL
-REMCHOKES [FULL, EXTRA FULL, SUPER FULL] ? NAMES
-STRAIGHT OR MONTE CARLO STOCK
-2 3/4 TARGET MARKED ON BARREL [3 IN ACTUAL CHAMBER]

~~-[illegible]~~
-R H SPECS ONLY, EXCEPT ~~DEER GUN RH AND~~ LH 28"
-26,28,30 IN V. R. BARREL
-REMCHOKES (FULL, I.C., + MOD)
~~-21 IN~~ DEER GUN ~~WITH RIFLE SIGHTS~~ BARREL ONLY STD FINISH
~~-PRESS CHECKERING~~
~~-HIGH GLOSS WOOD FINISH~~
~~-BLACK VENTILATED RECOIL PAD~~
~~-RA GRIP CAP~~
~~-NO WHITE LINE SPACERS~~
~~-NO SCROLL ON RECEIVER OR BREESH BOLT~~
~~-3 IN CHAMBERS~~

-SPECIAL PURPOSE MAGNUM
-R H ONLY
-26,30 IN BARRELS W/REMCHOKES
-21 IN DEER GUN W/RIFLE SIGHTS RH ONLY
-COSMETICS SAME AS CURRENT SP EXCEPT ROLL MARK

-POLICE
-26,30 IN V R BARREL W/REMCHOKES
-21 IN RIFLE SIGHT SLUG BARREL RH ONLY
-ROLL MARK M/11-87/POLICE
L R

-SPARE BARRELS
-WILL BE SOLD AS A UNIT: BARREL, REMCHOKES, WRENCH, PRESSURE SPRING AND COLLAR ALONG WITH SPECIAL INSTRUCTION SHEET. [NOT INTERCHANGEABLE WITH M/1100]

-DEER GUNS
-21 IN BARREL WILL NOT FUNCTION WITH ALL AMMUNITION LOADS. REPLACEMENT WITH A M/11-87 BARREL , 26 IN OR LONGER WILL MAKE IT COMPLETELY PRESSURE COMPENSATING.

-20 GA. CHOKE TUBES

-M/700 GUN KIT
-ADL ACTION
-270, 30-06, 243, 308,
-ADL MAGNUM ACTION
-7MM REM MAG
-IRON SIGHTS
-SWIVEL STUDS [NOT INSTALLED]
-ADL BUTT PLATE
-SPECIAL OWNERS MANUAL, INCLUDING CHECKERING TEMPLATES

-M/7 FS
-7MM-08, 308
-FIBERGLASS STOCK [REINFORCED WITH KEVLAR] SOURCED FROM BROWN
-IRON SIGHTS
-GRAY AND GRAY CAMO STOCK

-M/700 FS
-ADL AND MAGNUM ACTION
-RH SPECS
-243, 308, 7MM REM MAG
-LH SPECS
-270, 30-06, 308, 7MM REM MAG
-FIBERGLASS STOCK [REINFORCED WITH KEVLAR] SOURCED FROM BROWN
-GRAY AND GRAY CAMO STOCK

-M/700 RS
-BDL, LONG ACTION
-270, 30-06, 280
-RYNITE SST-35 STOCK
-INJECTION MOLDED
-SOURCED FROM CHOATE
-GRAY AND GRAY CAMO
-DIMPLED FINISH [AS MOLDED] EXCEPT FOR SMOOTH CHEEKPIECE
-MOUNTAIN RIFLE CONTOUR
-BLACK SOLID RECOIL PAD
-BLACK GRIP CAP W/RA LOGO

-M/700 CLASSIC - 338 WIN MAG
-24 IN
-IRON SIGHTS

-REMINGTON EXPRESS
-M/870 W/3 IN CHAMBERS
-ROLLMARKED ~~EXPRESS - NOT M/870~~ REMINGTON 870 EXPRESS
-ONE REMCHOKE - MOD ONLY WITH WRENCH
-V. R. BARREL
-METALWORK GRIT BLASTED AND BLACK OXIDED
-SPORTSMAN 12P WOOD
-BLACK, CLAY-FILLED RECOIL PAD
-REPLACES 12P

-M/700 POLICE
-223, 308

-LOW GLOSS OIL FINISH
-PARKERIZED METAL FINISH
-BLACK BOLT AND FOLLOWER
-NO CHECKERING OR WHITE LINE SPACERS
-BLACK BUTT PAD
-BDL KNURLED BOLT HANDLE
-ADL ACTION W/FLOOR PLATE
-MONTE CARLO STOCK W/CHEEKPIECE

-XP-100 IN 35 REM

-M/870 TC-TRAP [MID-YEAR INTRODUCTION]
-30 IN V. R. BARREL
-REPLACES COMP TRAP
-REMCHOKES- FULL, EXTRA FULL, SUPER FULL (NAMES?)
-SATIN FINISH
-CUT CHECKERING
-TARGET SIGHTS
-COMP TRAP WOOD B GRADE
-MARKED 2 3/4 IN [3 IN ACTUAL CHAMBER]

TERRY DOUGLAS

1. Order bags - get with Lou TYPE I, CLASS B, STYLE 2, OF MIL-B-11
2. ~~SEPT 9TH - Call Joanne if proof ammo not here.~~
3. Joanne will get decision on commercial item markings.
4. ~~Jim Glenn is tech rep. (has no authority)~~
5. ~~Get dbell bottles for guys at Hardigg~~
6. Case
   a. ~~Does case require data plate?~~ NEED BY 18th-and - What case 25rd.
   b. Write deviation request for pressure VS rain Test
   c. ~~Hardigg letter - add M16 test and Remington case letter - Joanne.~~ 9/10
7. Scope MIKE ZECCA 201-724-2894 Optical data
   a. ~~Who do we send scope data to?~~ Call Telly on ~~9/9~~.
   define high priority.
8. ~~What is CENTCOM~~
   ~~Stock~~
   a. ~~Send Deviation w/ photos for comb change~~ 9/11
   b
9. ~~Send~~ Letter ~~BCP (informational)~~ rear ~~sight~~ Base ~~plug~~ ~~ASSUME 30 DAY~~ 9/10 ~~D.RIT.~~
10. ~~Deliver 7 operator manuals to Joanne by OCT 23rd~~
1. ~~Dealer manuals to Joanne by 9/18.~~
1.5 ~~Six sets of color photos to Joanne Don Nitz~~
2. ~~Parts list keyed to exploded drawing~~ ASAP 30 DAC
3. ~~Joanne charge instruction card! ASAP~~

What do we charge against?

SWS

7/27/

1. 62 working days after contract award - FAT ready Oct 28th now approx 70 days

2. Barrels - 30 day 8/6/87
We have material certification

3. All parts go to 52-2B eventually. For now, they will go to Trial & Pilot crib.

(4.) Research will review finished Process records

(5.) Receives ahead of eight hole job (225).
~~** Do the drawings reflect the bolt lock cut? Should!~~ YES

(6.) ECP for bolt lock - submit ASAP ** John Rogers.

(7.) Change rear spacer block drawing to reflect new material! Fred.
~~Take all fire control parts and give them to Lou. - Fred~~

8. Purchase orders require special verbage from Lou.

9. Drop dead date on case is Oct 16. What is best delivery.

10. Bag for owner's manual.

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Post Award Survey

9/1/87

1. Mike Flannery (5251) & Harry Santa are only people can sign off.
2. Mike Veccio - POC for DCAS 315-423-5237
3. Transportation office 716-263-6450
4. Correspondence - Please send copy to Mike Flannery! If you don't know who to send it to, send to Mike
5. FAR 52
6. ECP's / Deviations / Waivers Look at A013 DD 1423
   CHANGE SPEC's / whole contract / 1 TIME
7. A013 & A016 "Letter of Transmittal ~~and use DD 250 at end~~ ?
   A012 C.8 vs C.5
8. DD-250 "Do it right or you don't get paid."
   H.15 on page 56 Change Picatinny Arsenal 07806-5001
9. Walter Lorenz 793-5355 Suggestion Program for Cost savings
   VALUE ENG CHG PROPOSALS.
10.

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KINZER V. REMINGTON

file copy

RD-69-B

REMINGTON ARMS COMPANY, INC.

INTER-DEPARTMENTAL CORRESPONDENCE

Remington PETERS

xc: R.A. Darby
R.F. Ulak

"CONFINE YOUR LETTER TO ONE SUBJECT ONLY"_____

CONFIDENTIAL

January 7, 1987

TO: M COBURN

FROM: WH COLEMAN, II

Quarterly R & D Division Report

January, 1987

REMINGTON

Rynite® Long Stock - Model 700 RS

Choate Machine and Tool Company has been selected to be our vendor and tooling development is progressing. The latest prototype stock samples received in December are acceptable, and the mold can be textured. The turnaround time to texture the mold is approximately one week. Choate is planning a prototype run of grip caps, stock inserts, and butt pads the first week in January.

The probability of Choate having 100 stocks by February for our Field Force and writers is high. The probability of having grip caps, inserts, and butt pads is lower since they have not been sampled yet. As a fallback position, Mountain Rifle butt pads and grip caps can be used with an interim insert.

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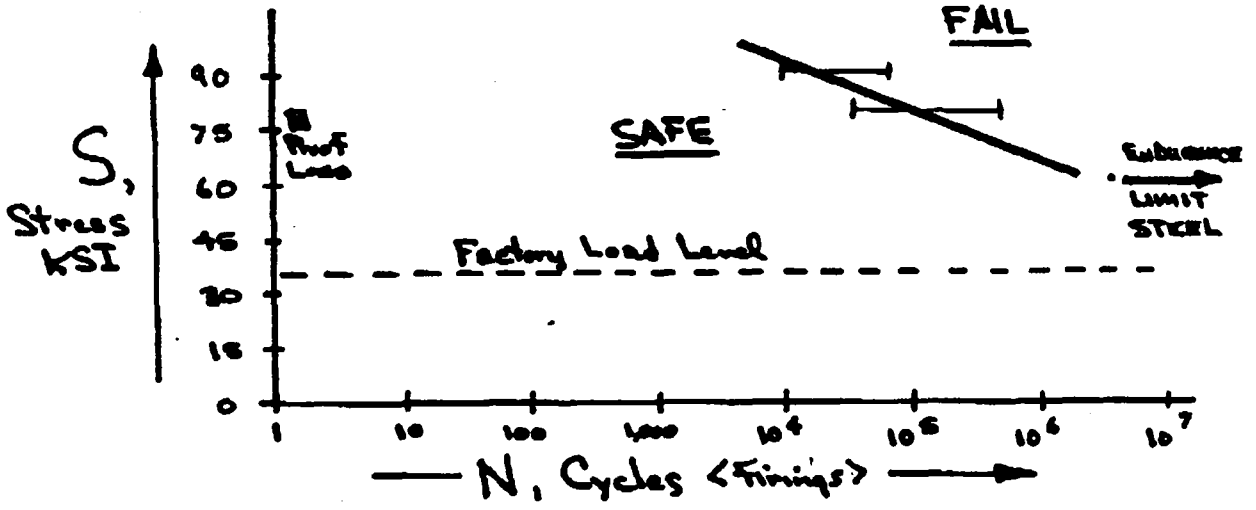
Shotgun Barrel Steel Materials Research

After more than 20 years of performance in the field, Remington's special 1140 modified steel is being challenged via litigation.

Frederick Schmidt (Metallurgist-Engr. R & D) and James Hutton (Remington R & D) requested in April, 1986, that Professor R.W. Hertzberg, (Lehigh University) author of "Deformation & Fracture Mechanics of Engineering Materials," make an intensive and independent analysis as our consultant. Over 50 shotgun barrels were evaluated after 1, 10, and 100 high pressure proof loads to determine a quantitative fatigue plot of stress vs. cycles shown below:



Professor Hertzberg has also analyzed failed barrels using the electron microscope under adverse and controlled conditions. He concludes, contrary to plaintiff's experts, that fatigue failures do not occur. Hertzberg also concluded that Remington's material exhibits a very desirable engineering design feature called "damage control." In the event an overloaded shell fails the barrel, no fragments are produced.

Hertzberg, Hutton and Schmidt have been deposed and will testify in court this spring regarding the engineering properties of Remington Arms special 1140 modified steel.

Sniper Weapon System

The Firearms Business Team has elected to take a more aggressive approach to military contracts. The M24 Sniper Weapon System is a new rifle/optics system for the United States Army (with marketing potential to the other military services, civilian law enforcement agencies, and competitive long-range shooters). It is designed to give pinpoint accuracy out to 800 meters. Remington's response to the Army's Request for Proposal was submitted on the due date of November 14.

Research completed the final testing stage of the rifle. It will be a Model 700 action with a Mike Rock barrel, H&S synthetic stock, and Leupold telescopic sight. Accuracy is well within requirements. Endurance testing to 5M rounds without going out of specification on accuracy and 10M rounds for the remainder of the rifle continue. Eight rifles were submitted to the Army on November 14.

The Army contract calls for 2M rifles over three years at an estimated (preliminary) selling price per rifle of $2.5M for a sales potential of $5MM. We believe we can manufacture in existing facilities.

Orientation courses for the Army have been conducted at Aberdeen, MD, and Fort Benning, GA. A Pre-Award Survey of the Ilion site is scheduled for January 7, 1987.

Steyr of Australia is the only other bidder. The award of the initial contract for 500 systems should be let in April.

WHColeman, II:sps

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KINZER V. REMINGTON

HERBERT J. BEIL, M.D.
658 WEST MARKET STREET
LIMA, OHIO 45801

PHONE 229-0816

RECEIVED
FEB 27 1987
E.F. SIENKIEWICZ

February 24, 1987

Mr. Edward Sienkewicz
Remington Arms Company, Inc.
Product Service
Ilion, New York 13357

Dear Mr. Sienkewicz,

As we discussed the other day on the telephone, I own a Remington Model 700 LH 7 mm Magnum (No. 36532467). This was purchased 9/27/84. The initial problem with the weapon was an unreliable extractor. The weapon was sent in and this taken care of adequately.

However, I have remained unhappy with the weapon, in that the bolt will not remain in the down and locked position when the safety is on. I used the gun to hunt in rugged country and carried the gun with a sling on my back. On several occasions, the bolt handle would open up and the round would fall out of the chamber and be lost. I had to improvise to avoid this by putting a rubberband around the trigger guard onto the bolt handle. This works well in warmer weather, but in sub-freezing is quite inadequate.

As we discussed, a modification is now possible to remedy this and restore the action to a bolt lockdown and secure position when the safety is on. I would kindly request that this bolt be modified accordingly and will be sending the rifledaction shortly by UPS.

Thank you for your kind attention.

Sincerely,

Herbert J. Beil, M.D.

SHIP GUN AFTER APRIL 1ST

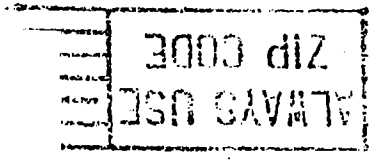
rk

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

HERBERT J. BEIL, M.D.
658 WEST MARKET STREET
LIMA, OHIO 45801

Edward Sienkewicz
Remington Arms Company, Inc.
Product Service
Ilion, New York 13357



R2540572

RD-69-B

REMINGTON ARMS COMPANY, INC.

INTER-DEPARTMENTAL CORRESPONDENCE

Remington. DUPONT PETERS DUPONT

"CONFINE YOUR LETTER TO ONE SUBJECT ONLY"

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K. C. Rowlands
J. R. Snedeker
File

Ilion, New York
February 25, 1987

TO: W. H. COLEMAN, II

FROM: T. C. DOUGLAS TCD

NEW PRODUCTS DEVELOPMENT MONTHLY REPORT - FEBRUARY

MODEL 11-87 AUTOLOADING SHOTGUN

On February 6th, 5000 early production(small orifice) guns were released for shipment. The remaining warehouse guns are on hold pending additional screening tests.

Twenty current production guns were put through a cold weather field test designed to simulate actual hunting conditions with new guns. The guns, with three rounds in the magazine, were exposed to twenty degree conditions for three hours. Each gun was then fired with the three cold rounds of Remington Dove/Quail loads followed by an additional twenty-two rounds of Dove/Quail loads that had been in a simulated "hunting coat" condition for three hours. All twenty guns fired their twenty-five rounds each with no power related problems.

Production has completed design and build of a bolt velocity device to record new gun bolt velocity during gallery testing. The device has been calibrated to the Research bolt velocity device and is currently in use by Production. All new guns must pass the gallery function tests and pass a minimum bolt velocity of 107 inches/second with each of the three gallery light loads fired. With an average break-in of approximately 20 inches/second within the first box of shells fired, this should ensure that all guns shipped will meet the design specifications of 140 ± 20 inches/second bolt velocity after break-in.

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SYNTHETIC LONG STOCK - MODEL 700 RS

Vendor sampling of the latest mold modifications were acceptable and the mold has been textured. The next sampling run is scheduled for the week of February 27th. No problems are anticipated with the texturing.

Prototype stocks of the last non-textured run were brought back to Ilion to be assembled into salesman guns. It was found that the barrel channel was consistently off to one side. It is believed that this is being caused by uneven heating of the mold halves, causing a warpage to the cold side. It is planned to have a representative from DuPont on site during the textured sampling run.

A non-textured camouflage gun was shown to the Firearms Product Team on February 17th. Camouflage pattern, gun weight, and balance were approved at this meeting. It was also agreed on to change the metal finish specifications to a uniform black matte finish to complement the non-reflective stock finish.

The first production run of 2,000 stocks is scheduled for delivery April 1st. There are approximately 1000 guns on back order.

SNIPER WEAPON SYSTEM

The first negotiation session was held on February 24th, at Dover, New Jersey. The primary concern during this session was the Contractor Logistics Support portion of our proposal. Additional information was requested by March 2nd, with the second negotiating session being scheduled March 4th and 5th. The Army has waived the requirement for a 300 yard range, and will allow the use of a 200 yard range.

NEW CONCEPT SHOTGUN

A meeting was held on February 5th to review the direction of the NCS program. Tom Powers will be the program leader while Ken Rowlands is working on the MAG 10 program. It was decided to devote our resources towards Recoil/Controllability and Action/ Operating Systems. A new schedule is being developed.

Computer modeling and preliminary lay-out work for an inertia operating system has begun. A Winchester Super X-1 will be retrofitted with the inertia operating system as a test vehicle. The current plans are to develop an inertia system as the primary system with a debris-proof gas operated system as a back-up system.

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SYNTHETIC SHORT STOCK AND FORE END

M/870 textured prototype stocks and fore ends are scheduled to be molded the first week of March.

MAG 10 PROGRAM

Initial designs are complete for the 10 guage Rem Choke tube system, improved fire control, and slide extension assembly. Prototype parts are being fabricated.

A copper crusher test indicated a .003" firing pin indent upon action closing. A method of blocking the firing pin until the action is locked up will be developed.

The agreement for purchase of the Ithaca MAG 10 has been signed. Remington personnel went to Ithaca February 24th-26th to bring back the Ithaca assets.

G-88 File XP100 **DON'T SAY IT—*WRITE IT***

To Bill Date 3/12/87

From Terry

Bill Calfee (.22 XP-100) called again. He had not gotten your letter yet. He wants to know if we are going to produce a .22 XP-100 or not. He is ready to go into "Hock" for everything he's worth to make this gun. He just doesn't want us to blow him out of the water. "He doesn't care who makes it, but one of us is going to make it." I told him that the info is confidential and I could be fired for giving it out. Can you call him? PH (812) - 967-2413

"ACCIDENTS HAPPEN IN SECONDS, THE RESULTS CAN LAST A LIFETIME!"

RD-49-S

REMINGTON ARMS COMPANY, INC.

INTER-DEPARTMENTAL CORRESPONDENCE

Remington DUPONT PETERS DUPONT

"CONFINE YOUR LETTER TO ONE SUBJECT ONLY"

xc: R. A. Darby
R. F. Ulak
T. C. Douglas
J. R. Snedeker
File

Ilion, New York
March 24, 1987

TO: W. H. COLEMAN, II

FROM: T. C. DOUGLAS

NEW PRODUCTS DEVELOPMENT MONTHLY REPORT - MARCH

MODEL 11-87 AUTOLOADING SHOTGUN

On March 19th, a 16 gun field test was held using guns that had been rejected by the gallery bolt velocity device. The guns and ammunition were stored in the Research van overnight. Each gun was fired with 25 rounds of PT12L-8 light target loads. There were 64 malfunctions out of 400 rounds for an overall malfunction rate of 16%. The following is the number of guns that had 0, 1, 2..12 malfunctions during the field test.

0	XX	7	
1	XXXX	8	XX
2	X	9	X
3	X	10	
4	XX	11	
5	XX	12	X
6			

Malfunctions by Shooter:

Shooter #	Malfunctions
1	5
2	6
3	25
4	28

The four worst guns were reshot with 25 rounds each and had 2 malfunctions out of 100 rounds for a 2% reject rate.

A meeting was held on March 19th to review the results of this testing with representatives of Process Engineering, Production, and Research. Based on the reasoning that:

1. The "worst case" ammunition type was used.
2. The ammunition was shot on a 30 degree F day.
3. The guns and ammunition were both cold (overnight storage).
4. Shooters 3 and 4 have very "light shoulders" and had 83% of the malfunctions.
5. The reject rate dropped significantly on the four worst guns after "break-in".

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NEW CONCEPT SHOTGUN

The computer simulation program for modeling an inertia operated action system is complete and is being checked for accuracy. Trial runs will be made shortly for the Winchester Super X-1 retrofit design. Prototype work on the Winchester retrofit will begin the last week in March.

A proposed gas-operated recoil reduction system for the Benelli Model 121 is currently in the prototype stage.

SYNTHETIC SHORT STOCK AND FORE END

Prototype M/870 textured fore ends and stocks have been molded and delivered. They are currently being prepared for assembly to guns for development testing.

MAG 10 PROGRAM

Listed below are the 10 guage Remington specifications that will be available in 1988:

- Express-type metal finish(matte black)
- Exposed stainless steel to be satin stainless finish
- Walnut stock and fore end w/Special Purpose-type finish
- Cut checkering
- 26 and 30 inch barrel lengths
- Rem Chokes for lead and steel shot
- Remington design, welded vent rib w/steel front sight
- Special Purpose camouflage sling
- Brown vented recoil pad
- Clean receiver panels except for serial number and model designation to be rolled in the normal M/1100 position
- 3 1/2 inch magnum version only
- Full radius receiver top w/no raised or lowered rib
- Model designation to be determined (can not use the MAG 10 designation)

Cosmetic changes have been developed for the trigger plate profile, receiver, and vent rib. A redesign of the stock and fore end cap are also being considered.

Parts for the 10 guage Rem Choke system should be available for testing by April 1st.

Methods of converting the Ithaca drawings to Remington format are being researched for the best method. A computer program has been developed to keep track of the status of the 10 guage drawings.

The receiver has been modeled on the CV system and is being reviewed with FMS personnel.

The Test Lab has been requested to build a dry cycle device for testing MAG 10 guns. They will also develop 10 guage bolt velocity capability.

Redesign of critical areas to meet Remington safety and endurance specifications are progressing well.

First year sales could be 10,000 guns.

MODEL 700 CLASSIC .35 WHELAN

This offering for 1988 catalog introduction is a synergistic program between Ilion and Lonoke. Four prototype rifles have been built at Ilion, with one prototype being sent to Lonoke for use in testing of their new .35 Whelan ammunition.

U. S. ARMY M12 MATCH RIFLE

Remington is preparing a quotation for a .22 caliber, Match Grade bolt action target rifle. This solicitation is for 12,607 rifles total over the life of the contract. Remington must have their offer in by May 5, 1987. Research has provided a marked-up parts list to the plant for estimating purposes. This solicitation does not require sample rifles, only a Request For Proposal.

Automotive Products Department

and

Fabricated Products Department

Research & Development

Quarterly Summary

January - March 1987

CONFIDENTIAL
SPECIAL CONTROL
NOT TO BE REPRODUCED

Distribution on Back Cover

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AUTOMOTIVE PRODUCTS DEPARTMENT

FINISHES

LAMINATION COATING OF AUTOMOTIVE BODY PLASTICS.....9

In cooperation with G.M. Research and Avery International a prototype plastic quarter panel for the Pontiac Fiero was produced in a red color using the Thermark lamination process, as a potential alternative to conventional paint application. The system is based on a polyvinylidene fluoride/acrylic coating on ABS plastic. Results were sufficiently encouraging for G.M. to initiate on-car proving ground tests.

PLASMA TREATMENT OF PLASTIC SURFACES.....10

Adhesion of coatings to thermoplastic olefins and other plastic substrates is greatly enhanced when the substrate is first treated with radio frequency generated oxygen plasma. This would eliminate the need for costly substrate preparation prior to painting and for special priming. A program is focused on defining the system parameters and with Marketing, determining the commercial feasibility of this approach.

AUTOMOTIVE CATIONIC ELECTROPRIMER.....10

Attempts to develop and commercialize a cathodic electroprimer based on technology licensed from Hoechst, have not been successful because of product deficiencies in surface smoothness and corrosion resistance compared to PPG's ED-3150A "Uniprime" control. Because it is unlikely that Hoechst can further improve their technology, other options are being considered. A promising lead is ICI's "ICICLE" technology, samples of which are being obtained for further characterization.

COLOR STANDARDS AUDIT.....12

A project has been initiated to develop a system to automatically audit color standard panel preparation. It is intended to tighten color tolerances of color standard panels and increase panel yields by making in-process adjustments. This would result in better customer service and an ATOI savings of $50MM/year, primarily in reduced material costs.

POLYESTER RESIN PROCESSING.....12

Low molecular weight polyester resins are being produced with tighter molecular weight control, reduced glycol loss, and shorter reactor cycle time by using a newly developed "Solvent/Water" process. About 3MM pounds were

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produced in the Fort Madison plant last year, and this process will be introduced at the Flint plant during the next quarter.

REFINISH HIGH SOLIDS IMRON® BASECOAT/CLEARCOAT.....13

Encouraging field test results are being obtained with newly developed basecoat, clear, and tints in an EPA conforming high solids Imron® urethane topcoat quality for use at plants manufacturing truck and fleet vehicles. Properties are equal to or better than the current low solids Imron® system. The program is aimed at protecting $50MM/year of sales and $7MM/year ATOI.

REFINISH - CRONAR® PROGRAM.....13

Initial commercialization of Cronar® has been successful based on feedback from sixty Refinish jobbers. Staged commercialization will continue concurrent with ongoing product optimization. Cronar® is expected to add $3.8MM ATOI during 1987.

REFINISH CENTARI®.....13

Some customers have been substituting lower cost isocyanate activators supplied by competitors for use with Centari® resulting in less durable topcoat repairs. By analyzing these products, as well as paint films from vehicles where the finish has failed, tools are being provided to Market to audit customers and to help deter continuation of such practices. Centari® topcoats represented $100MM in sales in 1986.

NON-ISOCYANATE CLEARCOAT FOR REFINISH.....14

A second generation non-isocyanate clearcoat, based on epoxy/anhydride chemistry is being developed to replace the first generation of Cronar® clearcoat. Field tests with over 20 cars, initiated last year, are encouraging. Two deficiencies, color in the clearcoat and too short a pot-life during application are being addressed through catalyst and additive modifications.

DYNAMIC MIXING MACHINE COLOR MANAGEMENT.....15

Computerized instrumental color technology developed over the past year will be used to reformulate over 3,000 mixing machine color formulas utilizing minimum manual labor. Most of these reformulations are caused by pigment unavailability, and will allow us to continue to provide customer service without interruption.

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QUALITY CONTROL OF REFINISH PRODUCTS.....15

Statistical quality control in the manufacture of Refinish paint is being implemented based on QFACS, a computerized data base for product and process information. During system development, the analysis of one product alone resulted in an ATOI savings of $400M. This new tool enhances the capability of reducing failure costs through prevention activities.

REFINISH FIELD COLOR TECHNOLOGY.....16

Computer generated tinting instructions, designated "Spectrum Shading Tips", are being issued for all 1987 Lucite® and Centari® factory packaged colors, to better enable Refinishers to match customer colors with little training. Longer term plans involve use of computer assisted instrumental color adjustment in the field. These programs are aimed at improving field color service for our customers by maintaining our color leadership capability.

ISOCYANATE-FREE HIGH PERFORMANCE COATING FOR MAINTENANCE FINISHES.....17

Two high solids prototype coatings based on epoxy/anhydride chemistry have been developed as potential replacement for Imron® poyurethane finishes. Programs are aimed at optimization and end-use performance testing with field tests planned later this year. Current sales of Imron® are $22MM, and have been eroding.

FABRICATED PRODUCTS DEPARTMENT

SPECIALTY PRODUCTS AND SERVICES

DYMETROL® MECHANICAL CABLE.....18

A 3 mm round Dymetrol® Mechanical Drive Tape has been developed that shows dramatic cycle life around tight bends compared to steel cable. Initial market focus is for power antenna cables and automatic seat belt drives with the eventual market opportunity as large as that for Dymetrol® tape. An opportunity plan has been written that targets specific accounts, and positive feedback is expected soon from customer testing in a power antenna drive application.

LOW ETHYL ACRYLATE EP-2504 (EP-2627).....18

A process modification was successfully implemented to reduce the ethyl acrylate monomer content to less than .01% in an extruded version of Electronic Products

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Department's aqueous developable Riston®. Positive feedback was received on the 2M pounds shipped to Towanda for evaluation. The next step is to product 100M pounds in the second quarter to retain this 1MM pound opportunity.

METHYL METHACRYLATE MANUFACTURE - SPENT ACID RECYCLE.....18

A $175M R&D project, with a 58% net operating return, has been authorized to implement spent sulfuric recycle for plant testing. The return is based on fuel savings from not burning the recycled acid. In addition, the recycle acid will be used to increase process yield 0.5%, worth $300M per year or to increase plant capacity when required for an ATOI of $1.5MM. Equipment is being installed in the 2Q1987 maintenance shut-down period.

LUCITE® XL PRODUCTIVITY/CAPACITY INCREASE.....19

A new high rate XL formulation has been developed which increased productivity by 42%, and represents an incremented ATOI of $1MM when fully implemented. Extensive trade testing was conducted in 1986 to ensure customer acceptance. Conversion to the new high rate formulation began in January 1987, and should be completed in the second quarter.

IMPROVED COLOR UNIFORMITY WITH GTP DISPERSANTS.....19

A substantial improvement in color uniformity in Lucite® XL colored acrylic sheet has been identified through the use of a pigment dispersant prepared by group transfer polymerization. Initial evaluation of all eleven pigment concentrates will be completed in the second quarter, with transition of all XL products to GTP dispersions by the end of the year.

CORIAN® CRACKING.....20

The most serious remaining Corian® quality issue is cracking of sheet materials. Implementation of an improvement in cracking resistance, demonstrated last summer, by reducing alumina trihydrate filler from 66 to 62%, was delayed because of lack of sirup capacity and increased tendency of sheets to warp. Recent improvements in warp control and the probability of increasing sirup capacity has enabled this program to be reactivated with an additional large plant trial scheduled for the second quarter.

CORIAN® SIERRA PRODUCT/PROCESS DEVELOPMENT.....21

A $2.7MM project was authorized in 1986 to produce a new version of Corian® known as Sierra, which provides a

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unique granite-like appearance. Commercial start-up is scheduled for May 1987. Meanwhile, over 250 sheets have been produced in semiworks to support Marketing introduction. Market acceptance has been excellent. Formulations and process control have been optimized to produce uniform sheet.

SILVERSTONE® SUPRA DARK PEWTER..... 22

A dark pewter mid-coat was developed for use with standard topcoat and primer to mask heat discoloration on aluminum clad stainless steel substrate in top-of-range cookware. This construction represents a new business opportunity for Silverstone®. Alignment of the mid-coat at Toledo has been completed.

HIGH EFFICIENCY COATING TECHNOLOGY FOR SILVERSTONE®..... 23

A silk screen printer is being installed in the laboratory and will be used to evaluate silk screening as a potentially more cost efficient application process for coating cookware as compared to spray application. Operability demonstration is planned for the third quarter.

SPORTING GOODS, EXPLOSIVES AND ENGINEERED PRODUCTS

SPORTING GOODS

NEW FISHLINE QUALITY CONTROL TEST..... 23

Because of quality concerns related to Prime® fishing line last year, a computerized quality control test was developed to monitor product quality. As a result, about 50M pounds of inventory and plant production representing $3.5MM in sales were qualified and about 20% of inventory was scrapped. This test and the resulting data base will be useful in developing improved versions of fishline and to demonstrate competitive advantages.

MODEL 700 CENTERFIRE RIFLES - RYNITE® STOCK..... 23

Rynite® stocks are now being made in production quantities for Model 700 RS rifles. Sales in 1987 are forecasted at 3,000 guns. Because of its value in use, this synthetic rifle stock will enable the Model 700 RS to provide the highest profit margin of all centerfire rifle offerings.

ENGINEERED PRODUCTS

VESPEL®..... 24

As a result of the commercial success of Vespel® ST,

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solid phase imidization technology has been extended to a broader range of compositions. During this work, another exciting product candidate was identified, based on a substitution of metaphenyline diamine for oxydianiline. The new molding resin candidate has superior oxidative stability for potential use in jet engine bearings, now the single largest segment of Vespel® parts business with sales of $5-6MM/year.

KALREZ®.....24

As a result of further investigation of free radical cure of functional curesites, the ability to radiation cure certain Kalrez® compositions without using extractable reagents was identified. This capability opens up new market opportunities for an extremely safe material such as in medical applications, as well as in exisiting markets such as semiconductors where there is a great sensitivity to contamination. A patent application is being prepared and discussions are underway with the marketing group.

EXPLOSIVE PRODUCTS

FASTORQ® BOLT SCALE-UP.....25

A successful large scale field test with Fastorq® resin anchored bolts as a coal mine roof support system has resulted in approval from the Mine Safety and Health Administration. Subject to local district approvals, the 1987 sales forecast for Fastorq® is $900M. Full quantity production is now scheduled to begin in May.

DEPARTMENTAL ANALYTICAL AND PHYSICAL TESTING

COMPOSITIONAL ASSURANCE TESTING SYSTEM.....26

The "CATS" system is starting to produce the manufacturing cost savings for which it was developed. During the last quarter, six domestic finishes plants recorded savings of $960M compared to $240M with previously used systems. Better monitoring of raw materials identified wide variations in purchased melamine resins. The system also detected a large error in composition in a batch of automotive paint prior to shipment, saving the batch and a potential customer claim and disatisfaction.

MOLECULAR WEIGHT DISTRIBUTION OF MACROMOLECULES BY MASS SPECTROSCOPY.....26

A new ionization technique, K-ionization of Desorbed Species, acronym "KIDS", enables accurate measurement of molecular weights over 800. In studies of MMA/BMA

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macromonomers with molecular weights less than 2000, the absolute molecular weight, specific chemical composition of the chains, and quantity of macromonomer terminated with a double bond was obtained. This technique holds promise for characterization of new families of macromonomers.

DEPARTMENTAL STATEGIC RESEARCH

GTP PREPARED STAR POLYMERS IN FOAMS.....27

Hydoroxyl functional star polymers show promise as stiffeners in urethane foam carpet underlays at Scotfoam Company. GTP enables preparation of polymers with low but effective hydroxyl content, making these materials cost competitive. Potential at Scotfoam is $4.4MM. Application of this knowledge to other versions of these polymers and to other polyurethane markets is being sought.

POLY GLYCIDYL METHACRYLATE.....27

Samples of a very low molecular weight homopolymer of poly-GMA have been provided to a number of potential customers. The homopolymer cures with various amines and may offer significant advantages over triglycidyl isocyanurate in the powder coating and adhesives market.

GTP-PMMA/MICROGEL FOIL TOPCOAT.....28

A GTP prepared 10M molecular weight polmethyl methacrylate solution containing 10% acrylic microgel shows promise as a clear topcoat for hot stamp foils, where uniform molecular weight gives clean edge fracture and the microgel restores toughness lost by going to this low molecular weight. Field testing at Kurz-Hastings offers the potential for sales of $1.6MM.

GTP PIGMENT DISPERSANTS FOR AUTOMOTIVE ENAMELS.....28

GTP pigment dispersants are particularly effective in red and blue organic pigments, allowing for higher pigment loading and greater color saturation. Two red colors have been developed at Troy and will be field tested at GM in the second quarter. Potential savings in pigment cost by 1988 is estimated at $750M.

COBALT CATALYZED SYNTHESIS AND UTILIZATION OF MACROMONOMERS. 28

Research in the past quarter has focused on utilization of cobalt complex catalysts in free radical polymerizations to synthesize macromonomers, coplymerization of macromonomers, as well as further catalyst development. Appropriate patents have been

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filed. Premanufacturing notices have been filed for two catalysts now that pound quantities have been routinely prepared. Process patents covering the use of these catalyst have been allowed. Scale-up in cooperation with Chemicals and Pigments Department is still in progess.

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AUTOMOTIVE PRODUCTS DEPARTMENT

FINISHES

LAMINATION COATING OF AUTOMOTIVE BODY PLASTICS

Consistent with their goal to compete more cost effectively with foreign imports, General Motors has several initiatives underway to explore alternatives to conventional paint application. PPG is working with G.M. Research on a "shrink-wrap" process; Inmont and 3M are working together on a "decal" transfer process; and we have a cooperative program underway with Thermark, a division of Avery International on lamination coating. Our efforts are aligned with CPC Division of G.M. Our initial objective has been to fabricate 100 red quarter panels for the Pontiac Fiero using the Thermark process.

The Thermark process is comprised of reverse roll coat application to a 2 mil polyester film (web) of first a clearcoat; followed by a colored basecoat; followed by gravure application of an adhesive size. The sized side of this film is then laminated to a 20 mil plastic substrate (face sheet). The polyester film is then removed and the laminate is heated and vacuum formed (thermoformed) to the desired part shape. The final step involves insertion of the vac formed part into an injection mold face and back-filling (injection-cladding) the part with plastic to the specified thickness.

We encountered several problems in our initial attempts at scaling the process for making the quarter panels to production size equipment. From a part integrity standpoint, parts made with "Bexloy" C nylon showed poor adhesion of the injection clad to the face sheet. Additionally, the "Bexloy" C face sheet detracted from coating gloss after thermoforming due to a roughening of the face sheet surface. We learned that this was due to relaxation of rubber particles which were oriented during the sheet extrusion process. Parts made with ABS plastic did not exhibit these specific problems, but as with the "Bexloy" C parts, gloss and surface defects, such as microcracking and popping, did occur in the coating system during thermoforming and injection cladding.

Because we were unable to resolve the adhesion and deglossing problems with the "Bexloy C" system, we conducted our next trials in February with ABS only. Results were greatly improved using a modified and upgraded paint formulation based on Polyvinylidene Fluoride/"Elvacite" binder. Part integrity and paint film physical properties, with the exception of mar resistance, met specifications. While visual appearance characteristics were at minimum acceptable commercial levels, the more objective DOI and gloss measurements were not acceptable and need upgrading. In spite of these shortcomings, CPC personnel were sufficiently

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encouraged by the results to recommend on-car G.M. proving ground evaluation which has recently been initiated.

Efforts in the coming period will continue at furthering technical understanding and evaluating alternate coating chemistries to upgrade appearance characteristics. Engineering Department cost studies will also be completed and we will initiate studies on the application of this process to the SMC compression molding technique. Appropriate patents are being prepared.

PLASMA TREATMENT OF PLASTIC SURFACES

We are investigating plasma treatment of plastic surfaces, primarily to improve adhesion of coatings. In general, plasma cleans the surface of contaminants, removes static charges and generates surface polarity that enhances adhesion. Using a radio frequency generated Oxygen plasma, we treated a number of thermoplastic olefins, "Bexloy" plastics and other plastics. In all cases, adhesion of our coatings direct to the treated surface is excellent. Without treatment, adhesion is marginal to very poor. The results we attained thus far indicate we can minimize the costly preparatory cleaning procedures currently used for painting plastics and eliminate the need for an intermediate adhesion promoting coat.

Our program focus is now on:

- Determining the effects and limits of the variables involved in plasma treatment.
- Optimizing coating systems and establishing performance.
- Extension to a variety of applications, problems and opportunities - including non-finishes applications.
- Working with Marketing to define the economic impact and establishing strategy in dealing with suppliers of equipment. In this, we are coordinating our efforts with those of Textile Fibers Department and Polymer Products Department who are also active in plasma technology.

AUTOMOTIVE CATIONIC ELECTROPRIMER

The objective of this program is to develop and commercialize a cathodic electroprimer licensed from Hoechst. The incentive to do this arises from our desire to be a full line finishes supplier to G.M. and thus protect our competitive position in the marketplace.

Recently, we have been pursuing parallel paths within the

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Hoechst technology, simultaneously working with their SWE-5244 system and modified SWE-5260 system (current Hoechst offering). The SWE-5244 system was originally designed for body applications, however, its surface smoothness deficiency precluded its use in that area. Pending the development of a true body system, we have been utilizing the SWE-5244 technology in a number of programs with G.M. in order to keep customer interest alive. These programs include a small parts usage demonstration at E-Coat Industries and a high build corrosion study by the AES Group at the G.M. Tech Center. Problems have been encountered in both of these programs which may force us to reconsider our participation.

We have found that the low build tank fill material which we have imported from Hoechst for the E-Coat Industries' tank does not have the corrosion performance of earlier submission panels. We believe the cause of this fall-off in performance is related to a change that was made in the pigment dispersion to improve its settling performance. We have recommended to Hoechst a change in the pigmentation for the dispersion and they are preparing sufficient material for the E-Coat Industries run. At a minimum, we expect the E-Coat Industries tank load to be delayed four weeks.

The high build formulation of SWE-5244 which is being used in the AES program is also showing corrosion deficiencies. Prior to loading the tank at the G.M. Tech Center, we were asked to submit panels for pre-load testing at the G.M. Proving Grounds and at an independent laboratory. Preliminary results have indicated that the high build SWE-5244 system is considerably weaker in corrosion performance than the PPG ED-3150A "Uniprime" control. G.M. is now questioning the value of our participation in this particular program. A final decision on whether we will load the AES tank will be made at the completion of the Proving Grounds test which will occur in mid-April.

Because the SWE-5244 system has insufficient surface smoothness to be used as a body quality electroprimer, Hoechst has been exploring some different chemistries. This work has culminated in the SWE-5260 system. Recently, we completed an evaluation on another prototype in this system. In the critical performance properties of surface smoothness and corrosion however, it continues to be inferior to the competitive standard, PPG's ED-3150A. Hoechst has a program to further refine this prototype. We expect this program to arrive at the best balance of properties achievable within the SWE-5260 chemistry by June 1st. It is our opinion however that the likelihood of Hoechst being able to further improve their technology to be equivalent to ED-3150A is low. We have thus reopened our dialog with ICI relative to their ICICLE electrocoat technology and will be sampled in the next few weeks.

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COLOR STANDARDS AUDIT

A project is underway to develop and implement a system that will automatically audit color standard panel production. The equipment will monitor color and film build after release from the baking ovens and via sequential statistical control will anticipate when the spraying/baking process is drifting. This project is a part of the larger objective of closed loop spraying control. The data collected and analyzed with this system will ultimately feed back to a computerized pumping system for automated film build control.

Previous studies have shown that color and film build tend to drift during a multiple day production run. During the run, multiple groups of large sheets are produced prior to the out-of-tolerance condition being detected. This automated monitoring system will minimize poor color performance and increase panel yields by anticipating, while the process is still in control, that process changes must be made.

The auditing system will consist of a robot to handle the large sprayed sheets, colorimeter, a film build monitor and a computer to assimilate the data and administer the sequential control monitoring scheme. The robot will pick the sheet from the staging area, run the analysis equipment and place the sheet in a packing crate for off-site cutting into the final panels. Incentives for this program are (1) perceived quality leadership by the Automotive customer, improved customer service and ATOI savings of $50M/year, primarily in reduced material costs. This technology will also assist the Business in negotiating with G.M., Ford, etc. to become their sole producer of standard panels.

POLYESTER RESIN PROCESSING

We have been working to develop low cost, high quality processesfor the manufacture of low molecular weight hydroxylated polyester resins. The total program involves some 15 polyester resins for finishes and offers quality improvements as well as an ATOI cost savings of abour $300M. About 3MM pounds of such resins were produced last year in Fort Madison Reactor #4, with the majority being produced by the "Solvent/Water" process developed through this program.

In the last quarter there have been two successful alignments of polyester resins in the Fort Madison Reactor in which glycol loss was reduced to 3% of the total weight of glycol charged, down from an average of 10-15% with previous processing techniques. An additional benefit is improved product quality from tighter molecular weight control and from improved functional distribution, as well as reduction in reactor cycle time. The Fort Madison reactor will realize

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further improvements in product quality and cycle time when the existing 3-plate scrubber is replaced with a 6-plate column in the next quarter. We hope to eliminate glycol loss altogether.

We have now characterized the Flint Reactor #3 and find that comparable improvements can be made with it, although it is not a computer controlled reactor. During the next quarter, the Flint Plant will introduce these improvements during their resin production campaigns.

REFINISH HIGH SOLIDS "IMRON" BASECOAT/CLEARCOAT

A High Solids "Imron" Basecoat/Clearcoat Finish for the Refinish Direct Account Business has been developed and is undergoing extensive field testing prior to commercialization. Some of the Tints in the system are of higher solids and with new pigments to extend color capability. The clearcoat has a Volatile Organic Content of 3.5 (pounds/gallon). The combined new Tints, Basecoat and new Clear are performing quite well in the field testing. Appearance, application and physical film properties are equal to or superior to our traditional low solids "Imron" system. The program is intended to protect $50MM/year sales and $7MM/year ATOI.

REFINISH - "CRONAR" PROGRAM

Early field reports indicate that the "Cronar" commercialization has been successful to date based on the feedback from the sixty Refinish Jobbers to whom the product mix has been released. The staged commercialization will continue. Several property improvements to the "Cronar" system have been made over the past Quarter. Appearance and repairability of the Single Stage system have been upgraded permitting the release of an additional 275 color formulas. Programs are in place to improve the early cure water spotting resistance of the Clearcoat and to complete the development of a general holdout sealer. "Cronar" is expected to add $3.8MM ATOI during 1987.

REFINISH "CENTARI"

For many years, "Centari" has been, by far, the largest single volume topcoat in our Refinish product line ($100 MM sales in 1986). The product can be used as is or activated with an isocyanate activator for faster cure time and better durability. Activators are used with over 50% of current "Centari" sales. We have been concerned that some of our customers use competitive activators since we have shown through durability testing that many competitive activators are based on less durable isocyanates, lower concentrations and contain no light stabilizers. Thus, use of these products with "Centari" not only costs us loss of sales, but also

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undermine "Centari's" quality reputation by producing non-durable topcoats.

Some suppliers will actually counterfeit our products. We have recently tested and analyzed samples of one such example which was 15% lower in solids, contained a different grade of isocyanate with different solvents, and had no stabilizers, but had the "Du Pont" label.

A more difficult problem to analyze is the case of aged "Centari" topcoat on automobiles. We have now analyzed paint from a complaint hood purported to be "Centari" with Du Pont activator that had severely faded and checked in about one year. Scrapings of the film showed that it contained activator, but did not contain the light stabilizers we incorporate and could not have been the product claimed to be used by the customer.

Marketing will utilize these results directly with the clients involved and also to let our customers in general know that we can determine whether "Centari" recommendations are being followed.

NON-ISOCYANATE CLEARCOAT FOR REFINISH

An alternative chemistry - epoxy/anhydride is under study as a 2nd generation non-isocyanate based clearcoat replacement for the current "Cronar" clearcoat used over "Cronar" basecoat. While this clearcoat candidate is expected to have a different balance of properties, the potential improvements are broadened application latitude, quicker cure response, higher solids and improved initial and retained appearance. The "Cronar" Refinish system is expected to generate $14 MM in annualized sales by the end of 1987 at an ATOI of 30%.

Field tests with this system began last year and over 20 cars have been repainted to date. This quality is judged to be almost commercial except for a need to reduce color and increase pot life. Several leads have been discovered. These are:

1. Catalyst

   Our approach was to explore catalysts that would activate the epoxy group in order to complement the activation of the anhydride group which Dabco (triethylene diamine) is thought to promote. The results are very encouraging. Potassium acetate in combination with a much lower level of Dabco gives better 24 hour and 7 day hardness development than Dabco alone. At the same time, a dramatic increase in pot life from less than 4 hours to about 24 hours

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is accomplished. Pot color is greatly reduced compared to the all Dabco system. Expanded evaluation is planned.

2. Additives

Studies are also progressing to assess the effects of various additives to accomplish our goal. These include carbodiimides, acrylic polyols, acrylic polyacids and polyesterurethanes. The acrylic polyols - Setalux C1152 from Synthese and Macrynal SM510N from Hoechst - produced films in the laboratory with an acceptable balance of hardness and cure at low levels of catalyst, which in turn resulted in lower pot and film color. These candidates will shortly be evaluated under shop conditions. Florida durability studies are underway and work has begun to assess efficiency of higher solids polyols.

DYNAMIC MIXING MACHINE COLOR MANAGEMENT

Maintaining and improving the Mixing Machine Systems requires obsoleting old Tints and the addition of new Tints in order to sustain field color leadership. However, the addition/deletion of Tints can affect thousands of existing color formulas in the field which may use an old Tint or a proposed new Tint. Our objective is to manage these changes in the customer's formulas so that there is no interruption in customer service but instead a perception of added product value.

During 1987, we anticipate that over 3,000 color formulas will be reformulated as part of the Mixing Machine Color Management program. Most of these reformulations are caused by a pigment unavailability issue which affects an existing Tint. Computerized instrumental color technology developed and refined over the past year will be used to reformulate these colors utilizing minimum manual labor. In addition, a computer-based microfiche system has been developed to provide direct, prompt formula availability to Marketing and, in turn, our customer.

QUALITY CONTROL OF REFINISH PRODUCTS

Statistical Quality Control in the manufacture of Refinish paint is being developed based on QFACS, a computerized data base for process and product information. The available batch history now identifies product variance from aim instead of the traditional "out-of-spec", allowing more opportunities for improvement in product uniformity. A method for effectively analyzing the QFACS data for quality improvement has been designed and demonstrated. An inter-Divisional team has developed new criteria for

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monitoring performance and uniformity. The seven criteria are:

1. Variance of product properties "on-load" versus aim.
2. Formula variance "on-load".
3. Number of batch adjustments to obtain an "okay".
4. Weight percent of the batch adjustments required for "okay".
5. Variance of properties versus aim at the "okay".
6. Yield loss as a percent of the batch .
7. Cost variance of the final batch as a percent of standard cost.

The criteria are scaled so that a value of 1 represents the current property limits and a value of 0 represents "on-aim" performance. Hence the goal: "Less than one is required -- zero is desired". Computerized reporting programs have been developed allowing flexibility to examine broad amounts of data between plants down to specific batch details. During system development, the analysis and troubleshooting of one product alone facilitated an ATOI savings of $400M. Implementation of this analytical system is occurring within various Refinish operating teams. This new tool greatly enhances our capabilities to reduce failure costs by allowing properly targeted prevention activities.

REFINISH FIELD COLOR TECHNOLOGY

Refinish paint in the field often does not match the car being repaired because of (1) poor OEM color match to standard, (2) weathering of the car finish, (3) body shop application variability and (4) other various reasons. In the increasingly competitive market environment, Du Pont is better positioned to assist the customer by adapting our instrumental color technology to field requirements.

"Spectrum Shading Tips" which are computer-generated tinting instructions showing how each color may be shaded with Mixing Machine tints are currently being implemented. Issued for all 1987 "Lucite" and "Centari" factory package colors, they have been well received by the field. They can be used immediately by the customer with little training.

Longer range plans include instrumental adjustment of color in the field using "automatic - easy to use" computer programs requiring no special operator skills. Laboratory experiments with off-standard car parts readily adjusted factory package paint to a blendable position. Feasibility

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was confirmed by a field simulation at the Atlanta Refinish Service Center (RSC). Current plans are to (1) further demonstrate the technology by doing actual car repairs and (2) develop color measuring instrumentation and computer programs for convenient field usage.

This technology is expected to increase market share, prevent erosion of business due to poor color match and enhance customer perception of Du Pont as a color innovator.

ISOCYANATE-FREE HIGH PERFORMANCE COATING FOR MAINTENANCE FINISHES

Maintenance Finishes currently uses "Imron" Polyurethane topcoats to provide long-term, high-performance protection of structural steel in hostile and corrosive environments. Maintenance Finishes' polyurethane sales and market share have eroded from $33MM/33% to $22MM/25%. In addition, several lawsuits are pending in connection with the spraying of isocyanates. Maintenance Finishes would like to replace "Imron" with a coating that does not require the use of isocyanates. The acrylic anhydride/epoxy ambient cure chemistry is being evaluated as a potential "Imron" replacement.

Maintenance Finishes' end-use requirements are more demanding than those of Automotive and Refinish. In addition to the need to perform as well as "Imron" in hostile environments, Maintenance also needs a pigmented version of this chemistry.

Two high solids, pigmented, anhydride/epoxy candidates have been formulated that have exhibited properties closely matching "Imron". Both are based upon a blend of Denecol EX-622 (sorbitol polyglycidyl ether) at approximately 17% of total binder solids in combination with either a GMA Acrylic (GMA/NBA/MMA//35/30/35) or Araldite CY-184 (Hexahydrophthalic anhydride polyglycidlyl ester).

Each of the above candidates has been tested against "Imron" for physical properties, salt spray/humidity resistance and accelerated weathering. Both compare favorably versus control with each experimental system exhibiting certain strengths relative to each other. In defining a pigmentation system to be used with either candidate, it was found that the 974-line, a commercial line of acrylic dispersions used in automotive finishes, appear to be the best choice. A rheology package has been defined consisting of polyvinylpyrrolidlone (0.025%)/Aerosil, colloidal silica (0.5%) that gives a good balance of film build capability and appearance.

Issues that still need to be resolved include the optimization of the amount and type of catalyst, definition of

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application parameters and end-use performance testing. Field tests are being planned for later in the year.

FABRICATED PRODUCTS DEPARTMENT

SPECIALTY PRODUCTS AND SERVICES

DYMETROL® MECHANICAL CABLE

Since the introduction of Dymetrol® Mechanical Drive Tape in 1979 there has been substantial customer interest in a round polymeric product to replace steel cable. Until recently, this was given limited attention because of past bad experiences with quenching voids and ovality in large diameter extrusions caused by differences in melt and solid densities. Recently, increased interest for automatic seat belt drives and power antenna cables caused us to undertake a dedicated research effort. We have succeeded in making 3mm round tape that shows dramatic cycle life around tight bends compared to steel cable and we see no reason that we will not be able to make larger diameters using this new process.

We feel that the eventual market for this product is as large as that for Dymetrol® tape. An opportunity plan has been written that targets specific accounts and we expect positive feedback from customer testing in a power antenna drive application soon. We could make up to 1MM ft/year of cable in our semiworks equipment. Beyond that, new manufacturing equipment will be required.

LOW ETHYL ACRYLATE EP-2540 (EP-2627)

Electronic Products Department is commercializing an extruded version of their aqueous developable Riston®. In this process the level of residual ethyl acrylate monomer in EP-2540, used in their solution casting process, is unacceptable. A concept for a process modification, suggested at Marshall Laboratory, and demonstrated at Washington Laboratory, was quickly and successfully tried by Manufacturing. This process change requires a steam stripping and venting step and, therefore, some equipment modification. Material made by this process is generally below 0.01% residual monomer. Positive feedback was received on the 2M pounds shipped to Towanda for evaluation. The next step in retaining this 1MM pound opportunity is a 100M pound campaign scheduled for 2Q'87.

METHYL METHACRYLATE MANUFACTURE - SPENT ACID RECYCLE

A $175M R&D project, with a 58% net operating return, has been authorized to implement spent sulfuric acid recycle for plant testing of this yield/capacity improvement project. The return is based on fuel savings from not burning the recycled acid. In addition, the recycle acid will be used to either increase process yield 0.5%, worth $300 per year or to

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increase plant capacity when required for an ATOI of $1.5MM. Equipment is being installed in the March/April, 1987 Maintenance shut-down.

The methyl methacrylate process has three steps: (1) formation of acetone cyanohydrin, (2) amidation and (3) esterification. The objective of this project is to recycle sufficient spent acid, which contains water, sulfuric acid, ammonium bisulfate and traces of organics, from the esterification step to the amidation step to just compensate for the water now added for normal acid strength control. The extra acid value of this recycle, which will be 6% of the virgin acid feed, will initially be used to raise the acid-to-acetone cyanohydrin feed ratio. Increasing acid ratio improves amidation yield, thus, a yield increase of 0.5% is expected in addition to the fuel savings.

The plant is expected to operate at maximum capacity in 1987 and the extra acid value can be used to increase plant capacity by providing additional acid at a constant ratio. At 6% recycle, an additional 15MM lb/yr of MMA can be produced. Technology is being developed to recycle 15% or more spent acid, with proportional capacity benefits.

LUCITE® XL PRODUCTIVITY/CAPACITY INCREASE

Sales on Lucite® XL acrylic sheeting for the saniware market are expected to grow rapidly from the current 5MM pounds per year to greater than 10MM pounds per year by 1989. The sheeting plant is currently operating at capacity, thus, sales growth of the profitable Lucite® XL, which is produced at a 40% rate penalty, is reducing the quantity of Lucite® L clear and tinted sheet available. A new, high-rate XL formulation has been developed which increased productivity by 42%. An incremented ATOI of $1 MM is anticipated with complete conversion of the product line and full execution of the high-rate XL program. No capital, net ingredients, or labor cost increases are required for this program.

Lucite® XL is a crosslinked, pigmented acrylic sheet product sold for thermoforming into bath tubs and spas. The new high rate formulation consists of a slightly increased initiator concentration, optimized crosslinking additive concentration and a new addition point for the thermal stabilizing comonomer, n-butyl acrylate. Extensive trade testing was conducted during 1986 to ensure customer acceptance with very positive results. Conversion to the high rate formulation began in January, 1987 and is expected to be complete in the second quarter, 1987.

IMPROVED COLOR UNIFORMITY WITH GTP DISPERSANTS

Lucite® XL, colored acrylic sheet, is the highly profitable portion of the Lucite® sheet business. Currently, this includes fifty certified solid colors and seven marble

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pattern colors. Significant color improvements have been made in recent years; however, these products continue to be plagued with quality problems which result in inconsistent color matches from campaign to campaign and uneven color distribution within the sheet. Both problems are due to the instability of our pigment dispersions. However, the former was particularly troublesome due to unpredictable differences between the colors of lab castings and plant castings of the same material. The recent commercialization of a dispersant prepared by group transfer polymerization (GTP) has allowed us to apply this technology to our dispersion problems with outstanding results.

Plant and laboratory testing of pigments dispersed with the GTP dispersant RCH76501 (block copolymer of methyl methacrylate/butyl methacrylate and nitrobenzoate esters of methacrylate polymer) have shown a substantial reduction of the within sheet color variances for the GTP material versus the standard product. Even more remarkable, the test pigments showed little or no change in colors between the lab and plant castings and will greatly reduce the time and cost of color matching. Testing has begun with material produced by our vendor in commercial sized batches with excellent results, thus demonstrating that the dispersions scale up well. Sheets produced with the GTP dispersions also meet all quality specifications.

A patent application is being prepared for the use of GTP based dispersants in acrylic sheet containing specific additives. Initial evaluation of all eleven pigment concentrates used in Lucite® XL will be completed in April, 1987. Product testing will continue throughout 1987 with transition of all XL products to GTP dispersions late in the year.

CORIAN® CRACKING

The most serious remaining Corian® quality issue is cracking of sheet materials. Most cracking problems arise at cutout corners, i.e., stove cutouts or at inside corners as are typically found in "L" shape kitchen countertops. This problem is particularly insidious since it occurs after installation and is expensive and disruptive to the consumer.

Great strides in preventing cracking have been made in the fabrication techniques to avoid stress concentration points and to minimize heat effects. However, a general property improvement is necessary to make the product more foolproof. Optimization of the Shape formula and lowering of the filler level have greatly reduced Shape product cracking. For Sheet product, an improvement by reducing alumina trihydrate filler level from 66 to 62% was demonstrated in the plant last summer. However, implementation has been delayed by lack of sirup capacity and an increased tendency for the

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sheets to warp. Recent improvements in our ability to control warp and a high probability of increased sirup capacity near term have encouraged the reactivation of the reduced filler approach. An additional large plant trial is scheduled for April to determine if warp improvements are adequate.

Additionally, other approaches that would be additive to lower filler are being explored. The addition of soft core, hard shell microgels shows real promise. Other leads being pursued include initiator changes, additives, copolymers and rubber toughening approaches. We plan to implement lower filler this year and perhaps a second improvement.

CORIAN® SIERRA PRODUCT/PROCESS DEVELOPMENT

The Corian® Product Group plans to introduce a new version of Corian® known as "Sierra." Manufacture of this product requires additional facilities at Yerkes. To meet the pressure of competitive offerings, these facilties had to be installed as quickly as possible. To meet this objective, a team was formed with members from Research & Development, Technical, Manufacturing, Marketing, and Engineering Department organizations. A $2.7MM project was authorized in September and the commercial startup is scheduled for May 1987.

The unique esthetics of the granite look require large particles of various sizes and colors to be blended into the Corian® mix in a controlled way. We will initially commercialize two granite products, Sierra Dusk and Sierra Midnight. These products will contain five different grades of ground up Corian® in different blends. One of these grades consists of Standard Corian® recycle material for cost savings. All product development and marketing samples have been produced in the plant semiworks in 50 lb. batches.

To satisfy the needs for Sierra Granite for Marketing display samples and for R&D performance testing, over 250 sheets were produced in the semiworks since the beginning of the year. Initial sheets showed pattern variation due to mix particle settling, and unacceptable product properties resulted from high heat losses to the mold during the curing step. These problems were overcome and good quality sheets made by developing special mixing and casting techniques and by using a new heat retaining mold. The new formulation incorporates a new particle size range to eliminate top vs. edge and sanded vs. unsanded pattern variations. Along with mechanical and chemical testing, the new Sierra granite is being evaluated for flooring and furniture applications.

Our Corian® Sierra composition falls within the claims of a 1978 Du Pont patent. There are two later patents by Avonite Corp. which describe a process similar to Du Pont's for the addition of particles to a polymerizable resin to produce a

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stone or granite appearance. Legal has determined that we are free to make a granite product with our present composition. On the other hand, there has been some question whether Avonite's composition falls within the Du Pont patent claims. Our patent claims a mixture of (a) matrix containing a resin and a filler, (b) opaque particles and (c) translucent or transparent particles. Specific limitations are given for each part on volume percent, refractive index, particle size, and particle and finished piece optical density. Measurement of these parameters on thin sections of Avonite product using computerized image analysis confirms that 12 of 13 criteria of the claim are present. More measurements of optical density are required to determine if the 13th criteria is exactly met or marginally outside of our patent claims. Legal has sent Avonite Corp. a letter calling its attention to our patents. A similar letter was sent to Nevamar Corp. who may also be commercializing a granite composition.

Market acceptance of the new products has been excellent. Over 11,000 hand samples were produced in our semiworks and distributed to our customers worldwide. Marketing has already accepted orders for the new products of about 1.85MM lbs. We plan to produce 2MM lbs. of material by the end of June. In preparation for the commericalization, we have produced over 650M lbs. of special pure white and pure black sheet for grinding. This material is currently being ground up into a 25-50 mesh grade and a 50-100 mesh grade. These particulates will be combined with a 25-50 mesh grade of Cameo White rework material and blended into the Corian® Mix in the new facilty. Overall grinding yield has been approximately 70% so far. The grinding contract payments are on a product which meets specification basis which increases the contractor incentive to improve yields to the highest level possible. We are exploring an outlet for the 'fines' within our own process and to outside customers for use as a filler.

A very tight project schedule was necessary due to the critical marketing need and has been followed since September. The new facility is mechanically complete as of March 31 and has been turned over to the Plant for equipment checkout and final acceptance. A detailed startup plan including equipment checkout and operator training has been developed. The plan requires the whole month of April with the first commercial run scheduled for early May.

SILVERSTONE® SUPRA DARK PEWTER

Marketing has identified a significant business opportunity for the use of Silverstone® Supra on aluminum clad stainless steel substrate. Because this material reaches higher local temperatures under cooking conditions than rolled aluminum, a certain amount of discoloration of the primer occurs, detracting from the appearance (but not the utility) normally experienced with Silverstone®. We have now developed

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a dark pewter midcoat which when used with our standard primer and topcoat greatly reduces visually detectable discoloration. Alignment of the new product was accomplished at Toledo within the narrow time frame set by the Teflon® Marketing group.

HIGH EFFICIENCY COATING TECHNOLOGY FOR SILVERSTONE®

As the top-of-range release coating market in which we sell Silverstone® becomes increasingly competitive, our licensees have been forced to find more efficient methods of coating their substrates, such as frying pans, than the currently used spray painting. In Europe, where such pressures are greatest, many licensees have been using roller coating as an alternative, especially for the lower end of the market.

As mentioned last quarter, we have identified silk screening as an alternate high efficiency coating technique which has a much higher probability of success for the quality coatings such as Silverstone®. This technique is faster than roller coating, involves less investment, and could give us a proprietary position. During the last quarter, we have secured a screen printer and are in the process of having it installed and approved for safe operation. Our intent is to formulate coatings for this technology to optimize application and develop a proprietary technology. Our goal date for demonstrating operability is the third quarter of this year.

SPORTING GOODS, EXPLOSIVES AND ENGINEERED PRODUCTS

SPORTING GOODS

NEW FISHLINE QUALITY CONTROL TEST

Because of quality concerns related to Prime® fishing line last year, we developed a new test for monitoring product quality. In this quarter we tested most Prime® inventory and all plant production using this Long Line Test on wet samples. As a result, about 50M lbs. of inventory and plant production, representing $3.5MM sales, were qualified and about 20% of inventory was scrapped. All hardware and software for this computerized test were then transferred to Manufacturing who are using it on a routine basis. While the test was developed to catch low breakload problems due to carbon contamination, statistical plots have already correlated with carbon void, caliper control and steaming process problems. Also, this test and the data base developed will be important in programs to develop improved versions of both Prime® and Stren® and to demonstrate competitive advantages.

MODEL 700 CENTERFIRE RIFLES - RYNITE® STOCK

The joint program between FPD (Remington), PPD and Choate Machine & Tool Co., Inc. in Arkansas to produce long stocks

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from Rynite® Polyester Thermoplastic Engineering Resin for Model 700 centerfire rifles has been completed and stocks are being made in production quantities. This stock has proven to be so tough that Choate has indicated they will replace any broken stock. 1987 sales are forecasted at about 3,000 guns. The Model 700 RS gives the highest profit margin of all centerfire rifle offerings due to the Rynite® stock price/value relationship.

ENGINEERED PRODUCTS

VESPEL®

Vespel® ST is the name of our new super tough version of Vespel® polyimide, based on pyromellitic dianhydride and oxydianaline. The two-fold increase toughness is obtained through a reduction in crystallinity by a process change in which the imidization step is carried out in the solid phase. A patent covering this composition has issued recently. Early test market reaction to the product has tied up the entire capacity of our small pilot unit, and we are limiting further market development activity while we attempt to ream out our pilot unit and scale-up the process in our current commercial resin plant.

In the meantime, the solid phase imidization technology has been extended to other compositions to provide the basis for a patent application covering a broad range of materials of interest to us or to our competitors; the application has been filed. During this work, another exciting product candidate has surfaced based on a substitution of metaphenylene diamine for oxydianaline. Preparation of this composition via the ST process results in a molding resin with mechanical properties close to our existing product, but with two to four times the oxidative stability as evidenced in high temperature, 360°C, exposure tests. This composition is a natural for jet engine bearing applications, now the single largest and most profitable segment of the Vespel® parts business with sales of $5-6MM per year.

KALREZ®

The Kalrez® new product development strategy has been based on the copolymerization of small amounts of various functional curesite monomers with the basic Kalrez® tetrafluoroethylene/pefluoromethyl vinyl ether composition in combination with a corresponding cure system tailored to each particular functionality. To date, we have commercialized three of these systems and have a fourth sitting on the shelf. Our most recent product is a lower performance Kalrez®, based on a free radical cure of a bromine-containing curesite monomer, utilizing triallylisocyanurate as a necessary coagent. The product is being introduced to go head-to-head

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with Daikin's competitive perfluoroelastomer, which utilizes the same cure system, so that we can protect the margins of our higher performance products.

Triallylisocyanurate is incorporated into the crosslink network and forms the weak link in this product, subject to both fluid and oxidative attack. Recently, we have been investigating the free radical cure of our other functional curesites utilizing both radiation and peroxide-generated free radicals, with and without the coagent. In most cases the coagent is required to achieve adequate cure, but with one polymer, our K4000, containing a nitrilie curesite monomer, we can obtain good cures with all combinations. The result is the possibility of specialty products outside the range of our current business as well as some very significant performance improvements of value in our existing business.

In the former area, Kalrez® is being examined for vascular grafts. The ability to radiation cure the pure polymer without the addition of any extractable reagents gives us the potential of an extremely safe material for medical use. This safe feature is of great value in an existing market segment, semiconductor manufacture, where there is great sensitivity to contamination from seals used in the equipment. Market opportunity for these new compositions has not yet been defined. A patent application is being prepared, and discussions are underway with the marketing group.

EXPLOSIVES PRODUCTS

FASTORQ® BOLT SCALE-UP

A successful large-scale field test has been completed on a new roof support system which promises to compete with mechanical bolts (which use no resin) which now hold 60% of the total coal mine roof support market.

One thousand Fastorq® resin anchored bolts were installed at Consolidation Coal's Rowland No. 11 Mine in March. The bolts were successfully installed by mine personnel alone after initial training by Potomac River Works engineers. Bolt installation times achieved were competitive with mechanical bolts. Loads were about 30% higher than mechanical bolts, which translates into improved roof support and increased safety. As a result of this and other tests, the Mine Safety and Health Administration has given approval for Fastorq® to be used subject to acceptance by individual MSHA districts, normally a formality.

The 1987 forecast revenue for Fastorq® is $900M from sales of 4.5MM equipment feet of equivalent resin and associated bolts. A delay in executing an agreement with the bolt manufacturer (accomplished in mid-March) and a temporary

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shutdown of the Rowland Mine have put the program behind schedule to achieve those revenues. Full quantity production is now scheduled to begin in May. Potential market acceptance still appears good.

DEPARTMENTAL ANALYTICAL & PHYSICAL TESTING

COMPOSITIONAL ASSURANCE TESTING SYSTEM

Our Compositional Assurance Testing System, or "CATS" for short, is already producing the manufacturing cost savings for which it was developed. CATS is a unique quality concept in that it is designed to detect labeling and filling errors before they create major problems. It also provides a basis for corrective action so that off-standard batches can be reworked and recovered.

During the last quarter six domestic Finishes plants recorded savings of $960M. This is four times the $240M savings using the older MTAIRS system and results from its easier operation and wider range of materials tested. The savings are particularly significant since the project was only implemented in the third and fourth quarters.
MCCI (the former Ford Plant) will be added very soon.
All resin formulas have been modified to carry a CATS specification. Plants are testing incoming raw materials vs. their own standards until division wide standards and specifications can be established. Already, wide variations have been uncovered in some purchased materials, especially melamine resins. Savings are expected to increase as our international plants begin implementation of CATS.

Recently, during final testing of a large shipment of paint to a Japanese car maker, CATS indicated that the ratio of binder to melamine had inadvertently been reversed during the last formula revision. In this instance, CATS not only saved the batch, but avoided a potentially costly claim and customer dissatisfaction.

MOLECULAR WEIGHT DISTRIBUTION OF MACROMOLECULES BY MASS SPECTROSCOPY

A mass spectrometer is a tool which provides valuable molecular weight information about molecules, providing such molecules can be ionized without destroying them thermally or electronically. Conventional ionization and volatolization techniques are not suitable for molecules in the 800 plus molecular weight range. We have been working with an ionization technique based on the thermoionic emission of potassium from an aluminosilicate matrix containing potassium oxide (KO). This ionization technique, referred to as "KIDS" (for K-Ionization of Desorbed Species), affords a "psuedomolecular ion" in the form of the ion plus potassium. By this process the true molecular weight of the species can

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be obtained in a process where minimal electronic and thermal energy is imparted to the species, so that fragmentation is minimized.

We have studied MMA/BMA macromonomers using KIDS. For modest molecular weights (less than 2000) we have been able to obtain information about the absolute molecular weight, the specific chemical composition of the chains, and the relative abundance of the macromonomers which are terminated with a double bond. This technique appears to hold considerable promise for the characterization of our exciting families of macromonomers.

DEPARTMENTAL STRATEGIC RESEARCH

GTP PREPARED STAR POLYMERS IN FOAMS

SCOTFOAM Company seeks materials that will stiffen their urethane foam carpet underlay without significantly reducing elongation. We initially sampled them with the hydroxyl functional star polymer developed for flexible clear finishes and they found the property balance to be attractive but the price we estimated too high. We then submitted a series of samples that we knew could be made much less expensively because of lower hydroxyl content, method of incorporating the hydroxyl and lower cost solvents. The lowest cost sample gave equally good properties and they are proceeding with compression set testing. At the loading they have chosen, they would require 2.2MM pounds of dry star polymer a year and we could meet their required $2.00 per dry pound with accepable margins.

Based on this experience, we are re-looking at other previously explored uses of these star polymers to see if these lower cost versions might not also be suitable. We are also seeking to apply the knowledge gained working with SCOTFOAM to other polyurethane markets.

POLY GLYCIDYL METHACRYLATE

The first step in the preparation of GTP pigment dispersants is the preparation of a very low molecular weight block of poly GMA. This very low molecular weight homopolymer may be a viable alternative to triglycidyl isocyanurate (TGI) in the powder coating and adhesives markets. TGI is the only aliphatic epoxy crosslinking agent available for powder coatings, is very insoluble, has a high melting point and sells for $7-8 per pound. Samples of poly-GMA, which cure with various amines to clear essentially colorless resins, have been provided for evaluation in the epoxy/anhydride clear coat program, for evaluation as a more durable acid absorbent in Tedlar®, to Jim Walter Corporation for evaluation in making more rigid insulating foams, and to the Kansai Paint Co. As would be expected, some applications need a lower Tg

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crosslinker and we have supplied a very low molecular weight 2-EHMA/GMA copolymer to Jim Walter Corporation.

GTP-PMMA/MICROGEL FOIL TOPCOAT

Kurz-Hastings, a large manufacturer of hot stamp foils, seeks a clear topcoat that gives smoother edges after stamping than they currently obtain from Rohm & Haas' A-101. This is a $1.6MM opportunity, two-thirds at Kurz/USA and one-third at Kurz/Germany. Our experimental submission, E-500, gave better appearance, stamping, and release properties than their current product. E-500 is a 40% solids solution of GTP prepared, 10M molecular weight polymethyl methacrylate containing 10% acrylic microgel. Uniform low molecular weight gives the clean edge fracture and the microgel restores necessary toughness that is lost in going to this low molecular weight. Kurz-Hastings has begun field testing to obtain customer feedback.

GTP PIGMENT DISPERSANTS FOR AUTOMOTIVE ENAMELS

Group Transfer Polymerization is an ideal process for making pigment dispersants, as it allows good control of the polymer structure for maximum adsorption on the pigment surface and maximum entropic stabilization of the dispersed particle. Also important is the fact that the process is free of side-reaction products which can compete for the adsorbing sites but not provide stabilization. Previous investigations of specific GTP dispersants in a red automotive enamel base coat system have shown that the pigment dispersions are more fluid and as a result, we are able to produce higher solids content base coats at constant viscosity and these higher solids finishes have a more saturated color. The biggest impact will be in reds and blues which will be about 500M gallons in 871-Line in 1988. The savings in pigment cost is estimated at $1.50 per gallon, in addition to the savings in dispersion manufacturing costs.

Troy Laboratory has completed development and testing of two reds for submission to GM. Plant scale-up of the dispersions is about to begin. We expect line tests at two GM plants early in the second quarter.

COBALT CATALYZED SYNTHESIS AND UTILIZATION OF MACROMONOMERS

We have previously demonstrated the ability of our air-stable cobalt complexes, (I, and II), to control the molecular weight in free radical polymerizations. As a consequence of the mechanism, which involves termination by abstraction of hydrogen from the growing end of the chain, vinyl terminated polymer is produced. Research this past quarter has been focused mainly in three areas: (1) synthesis and characterization of these vinyl terminated polymers or macromonomers, (2) incorporation of macromonomers in

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copolymerizations, and (3) catalyst development.

We have filed patents on this technology to protect this process for generation of macromonomers and their use in co-polymerizations. We are currently optimizing the conditions for the syntheses of macromonomers rich in functional groups such as hydroxyl, acid, and fluorocarbons, which in turn will permit us to prepare copolymers with functional side chains and a non-functional backbone. We have also developed an analytical method to easily determine the percentage of vinyl end group in our methacrylate macromonomers, which uses thermal gravimetric analysis (TGA) under nitrogen to differentiate the distinct decomposition temperatures of polymer containing vinyl end groups from that with only saturated end groups. Percentages of about 95% vinyl ended polymer have readily been obtained. This tool also points to a possible use of these methacrylates as thermally labile binders for ceramics, where these macromonomers can all completely "unzip" under nitrogen at 70-90°C below the temperatures at which methacrylates normally decompose.

To eliminate the concerns associated with residual cobalt catalyst in these polymers, we have developed a method to completely remove the cobalt residues from the polymer solutions. Simple pressure filtration of the polymer solutions through a bed of alumina completely removes the cobalt in a fashion analogous to column chromatography. Catalyst-free macromonomers can be readily obtained.

We have previously demonstrated the ability of these macromonomers to be completely incorporated into copolymers, and have since addressed the uniformity of incorporation. The reactivity ratios of our methyl methacrylate macromonmers were determined in reactions with butyl acrylate, styrene, and butyl methacrylate. Our results indicate that the macromonomer reacts quite readily with mono-substituted monomers, and in fact, will react with an acrylic or styrenic radical more than twice as fast as will an acrylate or styrene. The driving force appears to be the formation of the tertiary "alkacrylic" radical. Although the macromonomer is sterically bulky, electronic factors outweigh the steric effects. Reaction of macromonomer with a methacrylic radical, however, is sluggish as there is no major electronic driving force for reaction. Macro monomer does not homopolymerize.

A major program underway is the preparation of graft copolymers consisting of butyl acrylate with methyl methacrylate macromonomer. This combination of soft backbone/hard graft looks promising as a pressure sensitive adhesive. Using the reactivity ratios, we can optimize the uniform incorporation of macromonomer by skewed addition of macromonomer in a commercially viable reaction system. Sheer fail tests on the pressure sensitive adhesives have indicated large improvements when compared to batch mode reactions. Further studies are in progress.

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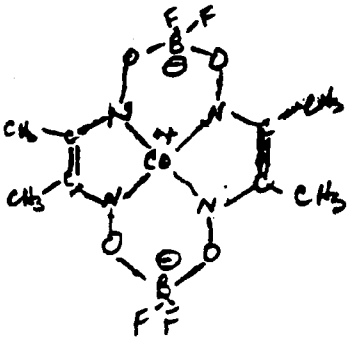
The concept of utilizing macromonomers in a UV cured system has been demonstrated in a joint effort between the Specialty Resins group and the Phillips/Du Pont Optical venture (PDO). A macromonomer prepared in butanol for evaluation as a component in a radiation curable topcoat system for an optical disc provided the necessary clear films, fast cure, and improved the adhesion of the topcoat to the polycarbonate substrate. In addition to providing a promising lead for this venture, the technology of using macromonomers as reactive diluents has potential in a number of other coating and non-coating applications.

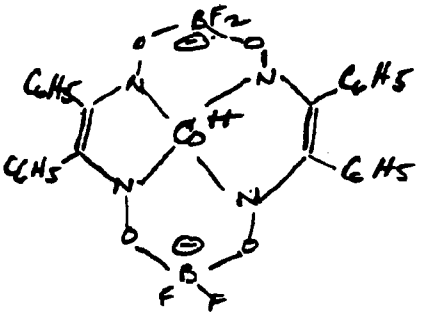
Premanufacturing notices have been filed for two cobalt catalysts now that pound quantities of the cobalt catalysts have been routinely prepared. The catalysts covered are the preferred solution and emulsion polymerization catalyst, (I), and the preferred suspension polymerization catalyst, (II). Toxicology studies have shown that (I) and (II) are considered slightly toxic and non-toxic, respectively. Process patents covering the use of these catalysts have also recently been allowed. Further scale-up of the catalysts in conjunction with Chemicals and Pigments Department is still in progress.

Co(DMG-BF2)2, Co(DPG-BF2)2.

I II

DMG = Dimethylglyoxime DPG = Diphenylglyoxime





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Research & Development

Quarterly Summary

October - December 1986

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ABSTRACTS

AUTOMOTIVE PRODUCTS DEPARTMENT

FINISHES

LOW TEMPERATURE CURE FINISHES..... 8

Field testing of automotive topcoat systems curing at 160-180°F was extended to include six cars painted with waterborne basecoats and several clearcoat candidates. The finishes displayed excellent appearance, application latitude, and cure properties. All six cars are in service, and in car use performance data will be obtained on these finishes.

LOW COST NON-AQUEOUS DISPERSION FOR CLEAR COATS..... 8

A lower cost non-aqueous dispersion based on higher styrene content and a lower cost polymerization process, has been developed. When used as a replacement for the current dispersion in commercial automotive clearcoat, the resultant finish has improved clarity and represents a potential cost reduction of $400M/year. Optimization of application properties is under way.

AUTOMOTIVE PRIMERS FOR PLASTIC SUBSTRATES..... 9

G.M. Truck and Bus Division has requested submission of a complete electrically conductive primer system for Sheet Molding Compound based on a positive performance review of a prototype product. A primer for use with thermoplastic substrates including "Bexloy C" amorphous nylon, has also been submitted to G.M.

HIGH SOLIDS TOPCOATS FOR REFINISH..... 10

High solids versions of our thermosetting acrylic enamels and Imron® urethane topcoats are being developed to meet EPA requirements for solvent reduction at plants manufacturing truck and fleet vehicles. The acrylic quality can be modified by use of a clear resin additive, but Imron® topcoats require reformulation of the color tints used. Some 18 new and revised tinting dispersions are involved, with commercialization planned for the 3Q 1987.

REFINISH CRONAR® PROGRAM..... 11

Commercialization of Cronar® non-isocyanate refinish enamel system was initiated in the 4Q 1986 at jobber customer conferences. The commercialization involves some 37 products, a pipeline fill of 400,000 gallons and the development of over 2000 color formulas.

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COLOR QUALITY TOLERANCES..... 12

A joint research program with Rochester Institute of Technology is aimed at development of an improved numeric color tolerance model which more fully agrees with human color quality decisions. To date, 45 color tolerances have been identified, with another 106 tolerances expected to be determined over the next two years, which should result ultimately in improved color matching instrumentation.

FURTHER IMPLEMENTATION OF "CATS" - QUALITY TESTING..... 12

CATS (Compositional Assurance Testing System) has been extended to all domestic Finishes sites. Testing of the fifty largest volume resins, accounting for 97% of production, is expected to be converted to CATS shortly. The Instrument Products Group has been offered this system for possible commercial sale.

IMPACT TESTING OF COATED PLASTIC SUBSTRATE..... 13

Recent studies demonstrated that a brittle plastic substrate can be toughened by coating it with a tough, flexible finish as well as the earlier observation that a tough plastic can be embrittled by applying a brittle coating over it. This increases the importance of dealing with coated polymers as systems, and the need to expand our capabilities in the physical testing of such systems.

ELECTROCOATING PRIMER RESINS..... 14

A study to provide backup resin facilities for Mt. Clemens Coatings' electrocoating resin manufacture to ensure continuity of supply to Ford, concluded that duplicate facilities would be uneconomical and the preferred approach will be to reduce equipment and process risk elements in existing Mt. Clemens facilities.

NEW DISPERSION PROCESS STUDIES..... 14

A preliminary mathematical model has been developed to predict process parameters to improve dispersion quality and throughput rates, thereby reducing pigment utilization and processing costs. The model was used in conjunction with a small tandem mill to disperse a difficult transparent pigment. Subsequent test runs are planned to establish the commercial viability of this approach to pigment dispersion processing.

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FABRICATED PRODUCTS DEPARTMENT

SPECIALTY PRODUCTS AND SERVICES

MOLECULAR WEIGHT CONTROL OF METHACRYLATE BEAD RESINS..... 16

Methacrylate bead resins prepared in semi-works using a proprietary cobalt chain transfer catalyst have been sampled to customers and commercial introduction is expected in 1987. Residual cobalt content in these resins is reduced by the addition of disodium phosphate which enhances catalyst activity and allows utilization of about one-fifth of the catalyst amount, thereby further improving color as well as having cost saving implications.

ELVERON 300® HYDROXYLATED POLYESTER RESIN.....16

This low molecular weight polyester resin has been produced in semi-works quantities and has been sampled to Specialty Resin customers as a potential expansion of current product lines.

METHACRYLIC ACID COST REDUCTION PROGRAM..... 17

A computer model has been developed to address yield improvement in methacrylic acid, from the current 81% to 86%, worth $1MM per year in ingredient savings. A low investment yield improvement project is anticipated in 1987.

METHYLMETHACRYLATE PROCESS YIELD IMPROVEMENT..... 17

A 0.3% yield improvement in the methacrylamide conversion step was effected, worth $150M/year, by increasing plug flow behavior in the reactor, through the use of packing and an efficient liquid distributor.

FILAMENTS - NEW HEXAGONAL SHAPED TOOTHBRUSH BRISTLES..... 17

A 10-20% improvement in toothbrush bristle packing has been demonstrated with hexagonal shaped bristles as compared to the standard round shape without increasing stiffness. Customer sampling has identified advantages such as improved wear. The new bristle could command a price premium or result in a significant volume increase pending customer orders.

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DYMETROL® FABRIC - SCALE-UP OF COEXTRUDED MONOFILAMENT..... 18

A coextruded monofilament of Hytrel® elastomer was successfully produced at 1,000 lbs./day rate on the No. 19 Prime® spinner at Washington Works this quarter. A route to increase production rates to 3,000-4,000 lbs./day was also developed. This will enable not only production of monofilament for Dymetrol® fabric, but also for other new filament products as well.

DYMETROL® TAPE - NEW PASSIVE RESTRAINT PRODUCT..... 18

The use of Teflon® coated tape for passive seat belt restraints in automobiles greatly enhances durability of the product. A new Teflon® coating development will allow in-house coating thereby eliminating the cost for an outside coater and further increasing earnings.

TEDLAR® PVF FILM - LOW HF AIRCRAFT FILM..... 18

To meet an aircraft industry request for a 50% reduction in HF evolution from Tedlar® PVF Film during combustion, a modification was developed incorporating 14% by weight of finely divided CaCO3, while maintaining other desired properties and enhancing thermal stability. Ten colors have been so modified with the balance to be converted as customer orders are received.

COATINGS FOR XEROX ELECTRORECEIVERS..... 19

The first lot of 30 cylinders for Xerox for use in a new high speed printer, were sprayed on a laboratory unit with Imron® urethane coating. These units will be used in prototype printers. Projected business is 20,000 gallons/year and $3MM in earnings by 1989.

PROCESS DEVELOPMENT FOR CORIAN® GRANITE..... 20

Two granite-like compositions, a light and dark shade have been developed by adding ground particles of black and white Corian® to the mix and casting into sheet. Patent protection is being sought for this novel process, and a $2.7MM project for granite manufacturing facilities is proceeding with start-up planned for April to meet sales projections of $10MM within three years.

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REDUCED WARP IN CORIAN®.....20

One of the remaining Corian® quality problems is warp of sheet product. Laboratory studies show that the key process improvements needed in minimize warp are uniform polymerization in all three dimensions through the sheet, a peak temperature of 125-130°C and uniform cooling. A project to implement these process changes is being developed.

TEFLON® COMMERCIAL BAKEWARE.....20

A candidate offering for the commercial bakeware market to compete against silicone coatings has been identified. The system consists of an amide-imide bound Teflon® FEP based primer with a topcoat based on a low melt Teflon® FEP. Durability after one year of testing is excellent, with a goal of two years compared to weeks or months life expectancy of the silicone coating. The initial target accounts are high quality bakers.

TEFLON® FINISHES - AUTOMOTIVE WELD-NUT THREAD COATING..... 21

A non-conductive release coating has been demonstrated to GM Truck and Bus Division to coat weld nuts and studs to prevent subsequent deposition of primer on these parts during painting and assembly, to permit easy assembly with automated equipment. The product, 954-101, Teflon®S coating, and its application was demonstrated as a result of close cooperation with Spring Tool Company, and represents estimated 1989 sales of 20,000 gallons with an ATOI of $240M.

SPORTING GOODS, EXPLOSIVES AND ENGINEERED PRODUCTS

ENGINEERED PRODUCTS

KALREZ® - LP 7 COMMERCIALIZATION..... 22

Commercialization is proceeding, in Japan, with a new Kalrez® perfluoroelastomer product, LP 7, to respond to the first in-kind competitive offering from Daikin. As a result of the development of a new short hot molding cycle and a new mold release system, 2000 O-rings have been molded in proof testing of new molds, demonstrating a 90% yield compared to 70% for existing processes, and show the potential for higher quality at lower cost than the competitive offering.

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VESPEL® ST - SCALE-UP.....22

Scale-up of the ST resin for its first commercial application in a part for Toyota, has been achieved in our pilot plant in Circleville. Toyota's requirement of 2500 pounds will fully utilize our pilot plant capacity, so we are now addressing increasing capacity and subsequent installation of full scale production facilities.

EXPLOSIVE PRODUCTS

NEW MINE ROOF SUPPORT SYSTEM.....23

All patent claims have been allowed for a new mine roof support system using Fasloc® "Quick Cure" resin together with a special bolt design. A 1,000 bolt mine field test is under way.

NEW DETALINE® COMPONENT 'QUICKLOK".....23

Development of a new, patented plastic connector body for our Detaline® non-electric initiating system, offers a product that is easier to use and more reliable in the field, by elimination of a .22 caliber primer. It also increases manufacturing capacity by 40% and will provide a cost saving of $100,000 in 1987.

SPORTING GOODS

SHOTGUN BARREL STEEL MATERIALS RESEARCH.....24

In defense against a plaintiff's claims in a litigation claiming that Remington shotgun barrels fail by fatigue, a University consultant's results support the conclusion that fatigue failures do not occur. Court testimony will be taken in the Spring of 1987 to defend Remington's special 1140 modified steel.

SNIPER WEAPON SYSTEM.....24

Taking a more aggressive approach to military contracts, Remington has bid on the U.S. Army's M24 Sniper Weapon System. Research completed the final testing stage and eight rifles were submitted to the Army. The award of the initial contract will be decided upon in April 1987.

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DEPARTMENTAL STRATEGIC RESEARCH

FILM/FABRIC COMPOSITES FOR PROTECTIVE CLOTHING..... 25

An interdepartmental team is assessing the commercial viability of vapor permeable film structures developed by PPD. The New Business Development Group is investigating disposable garments to protect workers from pesticide overspray. Testing to date indicates good pesticide protection, but inconclusive differences in comfort versus competitive commercial products. Further testing is planned as well as evaluation by workers in spraying automotive paints.

COMB COPOLYMERS FROM GTP MACROMONOMERS..... 26

Improvements in ultra-violet light and oil resistance are being sought for "Kraton" styrene/butadiene/styrene ABA block copolymers by using comb copolymers prepared by free radical polymerization of macromonomers prepared by GTP. Copolymers of various acrylates have been prepared with PMMA macromonomers for characterization in applications for adhesives and elastomers.

EXTRUSION TESTING OF GTP PREPARED PMMA..... 27

500 pounds of PMMA were prepared in the 300-gallon semi-works GTP reactor for evaluation to identify potential advantages as an extrusion resin over conventional PMMA. Tests will be conducted by Du Pont and Mitsubishi Rayon to determine the desireability of a joint technical program on new products.

ISOLATION OF SOLUTION POLYMERS..... 27

The Luwa "Filmtruder" has been identified as the only commercially available equipment to meet the needs of isolating specialty resins made in solution. A semi-works unit will be installed at the Marshall Laboratory in 1987, with installation ultimately planned for a manufacturing site.

R&D TRAINING PROGRAM

ORGANIZATIONAL EFFECTIVENESS TRAINING..... 28

The R&D Division's Management Effectiveness Training program has completed 14 programs to date, with 250 people participating. An additional 5 programs are scheduled for 1987. Benefits derived include more effective meetings, and team development around goals and objectives. At major laboratory sites, on-site programs are being developed to involve all personnel to increase teamwork and motivation for excellence in work activities.

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FINISHES

LOW TEMPERATURE CURE FINISHES

Trends in the automotive industry continue to emphasize high glamour, low polluting finishes, and the increasing use of plastics as materials of construction. As many of these plastics are heat sensitive and deform at the 250°F bake temperature required with current finishes, we are developing topcoat systems which will cure at 180°F. These systems comprise a high glamour waterborne basecoat plus an isocyanate or non-isocyanate solvent borne clearcoat. The first identifiable commercial target is the Saturn Corporation car scheduled for the 1989-1990 model year. The full potential in sales at General Motors (U.S.) by the mid 1990's is $209MM with an ATOI of 11%.

The basecoat is a modification of licensed ICI technology, based on a low Tg (-34°C) acrylic latex blended with a waterborne polyesterurethane, and does not require further crosslinking.

The leading clearcoat candidates are:

1. Isocyanate Rigid Clear - an acrylic polyol, crosslinked with an aliphatic isocyanate.

2. Isocyanate Uniclear - an acrylic polyol/polyester urethane blend crosslinked with an aliphatic isocyanate.

3. Non-Isocyanate Rigid Clear - an acrylic anhydride polymer, crosslinked with a glycidyl ester epoxy.

As part of a test program to demonstrate our new low temperature finishes, a series of six Du Pont automobiles were painted with these systems in the Detroit area, with each clear being applied to two of the automobiles. They were cured at 160-180°F. Results of this program were very encouraging. The finishes displayed excellent appearance, application latitude, and cure properties. All six cars are in service and we plan to obtain in car use data on these finishes.

The overall technical program on these finishes continues to show progress. The laboratory work is concentrating on polymer development, crosslinker and catalysis studies, and durability definition. Joint programs are in progress with various vendors (Ciba-Geigy in particular) to help meet our objectives.

LOW COST/NON-AQUEOUS DISPERSION FOR RIGID CLEAR COATS

Non Aqueous Dispersions (NAD's), lightly crosslinked acrylic particles stabilized with grafted linear acrylic side

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chains, are used in automotive rigid clear coats as toughenerS. The new NAD, was developed as a lower cost, improved clarity replacement for the effective, but more expensive dispersion, which is currently utilized in our acrylic-melamine automotive clear coat. The lower cost results both from the greater use of styrene as a low cost raw material and by employing a more efficient polymerization process. Extensive testing of the reformulated clear coat has been completed at the Troy Laboratory. Distinctness of Image* is, on the average, better than the control. Other properties, such as MVSS**, abuse cracking, humidity resistance, etc., are equal to the control. Premanufacturing notifications have been filed with EPA, and we expect to be free to manufacture by January 29, 1987.

We are working with the Troy laboratory to improve the solvent pop resistance of the rigid clear, the most probable route being the partial replacement of heptane with higher boiling solvents.

Forecast for NAD use in 1987 is 250M gallons which would result in a potential $400M/year cost reduction if this replacement is effected.

* Distinctness of Image (DOI) is a measure of the mirror-like quality of an automotive finish.
** MVSS refers to the ability of windshield sealant to adhere to the finish so as to meet "Motor Vehicle Safety Standards".

AUTOMOTIVE PRIMERS FOR PLASTIC SUBSTRATES

Currently, U. S. cars on the average contain 8% exterior plastic body parts, projected to at least double by 1990. Primers for painting such parts must provide adhesion, improve the surface characteristics to provide a Class A surface, and impart dry film conductivity to improve the transfer efficiency of electrostatically applied topcoats. Corrosion resistance is of little consequence on plastic parts.

As we have broadened our business focus away from total concentration on topcoats, we have been developing a series of primer candidates similar to competitive offerings to establish our presence in the primer market. Our candidate for flexible fascia fabricated from either RIM (Reaction Injection Molded) polyurethane, or TPO (ThermoPlastic Olefin), is 764-140. This primer, based on a pigmented polyester-melamine combination, has been given technical approval from the CPC Division of General Motors in Canada. If process approval is obtained, (based on on line painting of parts) sales will commence at several Canadian sub-contractor accounts in the first quarter of 1987. Domestic business is also being sought at General Motors' Guide Division.

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For rigid plastic parts, we have developed an electrically conductive primer coded 764-169, consisting of a pigmented polyester, vegetable oil, and melamine. Based on initial positive performance reviews with G. M. Truck and Bus Division, we have been requested to develop a complete submission for this product. Our initial commercial target will be for fender extensions and step boxes made of SMC (Sheet Molding Compound) at the Pontiac East and Fort Wayne Truck Plants. A primer for use with thermoplastic substrates, 764-2450, has recently been submitted to G. M by the Troy Laboratory. It has excellent adhesion over "Bexloy C" amorphous nylon.

Longer range, a successful primer should be proprietary, capable of coating a broad range of plastics and metal substrates, and have low VOC (Volatile Organic Content). The latter is especially significant, as none of the current commercial primers for flexible substrates meet 1987 year-end requirements for VOC as mandated by the EPA. We have developed a prototype product, which on preliminary screening meets all requirements. The vehicle system is based on a combination of a high solids polyester (currently used in our rigid primers) and polycaprolactone, crosslinked with a monomeric melamine. The polycaprolactone acts as a reactive diluent to give high solids, provides good flexibility, and imparts adhesion to a broad range of plastic substrates. Performance verification is underway, and if confirmed, we will begin an extensive broadened evaluation program and a submission to General Motors in January, 1987.

HIGH SOLIDS TOPCOATS FOR REFINISH

High solids Imron® urethane topcoats (3.5 lb./gallon VOC*) are being developed to combat legislative and competitive pressures which currently threaten our $50MM Refinish "A" Accounts Business. Imron® is the preferred refinish topcoat for many fleets, truck body builders, and heavy duty truck manufacturers (collectively called "A" accounts). It is supplied in two different mixing machine qualities (versions), TAE** and Imron®, which have different resin compositions and different pigment dispersions. High solids formulations are being developed for both qualities.

In the TAE quality, used by large customers who mix their own colors, high solids is achieved by addition of a clear resin additive which is used with existing tints. The finished product has been successfully tested in several line trials over the past several months, and it is now available for commercial sale. Development of the complete color line is continuing.

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For the Imron® mixing machine quality, used primarily by jobbers who mix and distribute fully formulated paint, high solids cannot be achieved without modifying existing pigment dispersions. Nine new high solids tints, representing the critical high volume colors, are being added to the line. They will be used in conjunction with the old tints to formulate 500 new high solids colors for nationwide commercialization in the third quarter of 1987. The new tints are based on existing automotive OEM high solids dispersion technology.

* VOC refers to "volatile organic content".
** TAE refers to "thermosetting acrylic enamel".

Application parameters for the Imron® coatings have been developed and tested successfully with a few customers, and extensive field testing will continue over the next six months. An additional nine high solids tints are being developed to provide basecoat/clearcoat capability for both TAE and Imron® qualities. The commercial target for this project is the third quarter of 1987.

The first major order, approximately $100M, for high solids Imron® topcoat (along with a previously developed high solids primer) was obtained during the last quarter of 1986. Current 1987 sales forecast for these high solids refinish products is 10M-20M gallons, representing $0.5-$1MM sales.

REFINISH CRONAR® PROGRAM

Commercialization of Cronar®, our new non-isocyanate automotive refinish enamel system, began during December, 1986, with jobber customer conferences held at the Troy, Michigan site. A selected number of customers are being stocked with the various products after appropriate training. Extension of the system to all customers will be staged because of the large number of products involved and the logistics of supplying and servicing. The commercialization will involve 37 products, a "pipeline fill"* in excess of 400M gallons and the development of over 2000 color formulas. The development program in early 1987 will focus on continued product improvements, dictated by the national field feedback, plus the development of additional colors. It is expected that the commercialization will generate about $3.8MM ATOI in 1987.

* "Pipeline fill" means stocking all the jobbers and suppliers in the Refinish network.

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COLOR QUALITY TOLERANCES

Visual judgment of color match acceptability has a very high immediate impact on a customer's perception of the quality of a finish, but we lack a robust numeric color tolerance model which more fully agrees with human color quality decisions. This forces us to rely internally on subjective judgments for commercial acceptability decisions. Last year a joint research program was initiated with the Rochester Institute of Technology, aimed at developing numeric color tolerances from experimental determinations of human color difference perception. To date we have determined 45 color tolerances based on over 16,000 color difference judgments. Over the next two years, we plan to determine another 106 tolerances. In later stages, we will develop improved numeric tolerance models and promote adoption by international color standards organizations (CIE). Eventually, this research could impact other Du Pont businesses where color acceptability is important, e.g., C&P Pigments, and Textile Fibers.

FURTHER IMPLEMENTATION OF "CATS" - QUALITY TESTING

Production of quality products in our plants requires the use of quality raw materials in the proper proportions, that transformations are carried out properly, and finally, that the isolated products are correctly identified and labeled before shipment. We have previously reported on an instrumented infrared monitoring system (MTAIRS)* that permitted us to routinely test raw materials and certain intermediates so as to ascertain that they were correctly identified and uncontaminated. This system has been estimated to save a total of $843M in four plants during the second and third quarters of 1986.

Although the MTAIRS system provided a marked improvement, it had certain disadvantages which limited its utility in many phases of quality control. Because it used conventional salt-plate infrared cells with transmitted light, it was limited to clear, non-aqueous, materials and required extensive operator training in order to obtain reliable results. At the beginning of this year we undertook a project to develop a new instrumental approach which would be independent of sample preparation skill and could be used with pigmented and aqueous products. The system which evolved is based on a unique attentated total reflectance (ATR) attachment, a Fourier transform infrared spectrometer, and our own proprietary software. This system, called CATS**, has been so successful, that all domestic Finishes sites will have been equipped with this system by the end of 1986. When fully implemented, it is expected to more than double our savings, while simultaneously leading to better and more consistent products.

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The acceptance of this system has been driven by the plant operators and testers themselves, who find the system easy and satisfying to operate, and by production management, who appreciate the rapid visual demonstration of potential problems at a stage where corrective action is readily taken. Early successes with this system have encouraged its expansion to a wider range of products.

The Infra Red Steering Committee has recommended that each plant begin immediate testing of all large volume (tank wagon and tank car) shipments by this technique, and that formulations with the greatest liability be added to the testing program as soon as possible. A revision of the Divisional Resin Formulas to show TM-229-CATS is underway, and the fifty largest volume formulas, accounting for about 97% of our resin output, are expected to be converted by the begining of 1987.

We have communicated our experience to the Instrument Products Group with the objective of making this unique technology more widely available, both within the company, and for sale outside the company.

* MTAIRS is an acronym for "Materials Testing by Automated Infrared Spectrometry".
** CATS is an acronym for "Compositional Assurance Testing Spectrometry".

IMPACT TESTING OF COATED PLASTIC SUBSTRATES

Polymeric substrates are forcast to have a very bright future as replacements for steel in automotive construction. We have been developing expertise in the impact testing of coated polymer systems in order to deal with the system rather than the individual components. We have previously reported the startling, but not completely novel, finding that a brittle coating such as a conventional automotive enamel, can cause an otherwise tough and ductile plastic substrate to fail catastrophically on impact.

Further studies with our "state-of-the-art" Rosand Instrumented Impact Tester, have led us to the observation of the converse of the above finding, that is the toughening of a brittle substrate by use of a tough, flexible coating. In particular, samples of rigid RRIM**, painted with a competitor's coating system have shown significantly improved impact resistance when tested with our equipment. Although all samples broke at each temperature tested, the painted samples required a higher peak force and gave a higher energy to break than the unpainted controls.

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Several factors make this phenomenon appear reasonable. The substrate, rigid RRIM, comprises a brittle glass reinforced core sandwiched between two relatively thin layers of unfilled RIM*. The tough, flexible coating effectively increased the thickness of this outer layer and accordingly improves the overall impact strength of the compsite. Our basic conclusion from this work at this time is that it has become increasingly important to deal with coated polymers as systems, and to expand our expertise in the area of physical testing of such materials.

* RIM stands for "Reaction Injection Molded" (usually polyurethane) parts for automotive and other applications.
** RRIM stands for "Reenforced RIM" (usually with glass fibers).

ELECTROCOATING PRIMER RESINS

With the acquisition of the Ford Mount Clemens facility, we have acquired the PPG electrocoating technology for applications involving Ford. We have completed a study of the process, aimed at learning the mechanics of the process and developing a back-up plan to ensure continuity of electrocoating resin supply to Ford.

The study concluded that it would be uneconomical to completely duplicate the capabilities now existing at Mount Clemens. Our strategy will be to identify equipment and process risk elements which could interrupt supply and to provide resources so as to minimize these risks.

NEW DISPERSION PROCESS STUDIES

The objective of this program is to develop and apply a fundamental understanding of the impact of media mill* process and equipment variables on the ultimate quality of a pigment dispersion and the rate of quality (or dispersion) development. The effective application of these parameters could substantially reduce current ingredient costs ($88MM/year) and direct conversion cost ($8MM/year) while upgrading manufacturing reproducibility, product quality, and pigment utilization.

Substantial progress has been made in defining the conditions for optimum media fluidization in laboratory vertical and horizontal mills. We have developed an instrument package which allows measurement of fluidization conditions in vertical media mills. A predictive mathematical model is in preparation which, when verified in commercial scale equipment, will allow definition of specific mill base throughput rates required to achieve optimum media fluidization ofr developing product quality and mimimizing equipment wear.

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Definition of the impact of a range of process and equipment variables for horizontal media mills has allowed development of a preliminary mathematical model based on laboratory derived data. Based on data developed for a limited number of different dispersion formulas, it has been determined that media size, media load, disk area, and disk speed are the variables having the most impact on product quality and the rate of dispersion development. The two variable exponential equation model has accurately predicted the residence time-product quality relationship for these dispersions over a range of laboratory operating conditions. Expansion of the model to vertical media milling has been initiated with the receipt and installation of the suitable vertical laboratory mill.

Coincident with the above process modeling program, we have been developing a new dispersion technique, known as "multimedia tandem milling". This technique uses two or more horizontal media mills in series, the first using coarse media to provide a suitable predispersed feed to the subsequent mills which contain substantially finer media and do most of the dispersing. Multimedia tandem milling has demonstrated the capability of processing pigments or mill bases currently dispersed via ball mills to equal or higher quality.

A small (2 x 15 liter) commercial scale multimedia tandem mill has been designed and installed, using surplus horizontal "Supermills", with the encouragement and cooperation of the Toledo Plant. Earlier runs of this installation demonstrated the capability of producing ball mill type primer dispersions in this installation. During this quarter, after some modification, a highly successful run of a transparent pigment dispersion (974-573) was produced. Equally significant was the use of the above dispersion model to predict the product quality achieved at a variety of throughput rates to within two percent of the measured quality.

Based on this run and assuming the validity of the dispersion model, we have planned a series of additional runs, using revised equipment parameters. These runs will serve as a further test of our model validity and, if successful, will result in substantial increases in the dispersion rate and ultimate product quality achievable with the tandem mill installation.

* A media mill is a type of mill for grinding (dispersing) solids in which a mechanically agitated media such as steel shot is the grinding agent.

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SPECIALTY PRODUCTS AND SERVICES

MOLECULAR WEIGHT CONTROL OF METHACRYLATE BEAD RESINS

The preparation of methacrylate bead resins represents the largest segment of our Specialty Resins business, and our most competitive offerings. The Special Chain Transfer catalyst, bis(borondifluoro diphenylglyoximato) Cobaltate II (SCT), developed in CR&D, has been found to be an extremely active chain transfer agent in bead polymerizations, offering the exciting possibility of eliminating mercaptans from bead resin production, both eliminating sulfur from the polymer, meeting some customer needs, and reducing raw material costs. In semiworks trials, with conditions which parallel the plant reactors, excellent, reproducible molecular weight control has been demonstrated with 25-200 ppm SCT. In continuing development work we discovered that the addition of disodium phosphate markedly enhances the activity of the cobalt complex, in one case requiring as little as one-fifth the amount to get the desired molecular weight. This finding has additional cost savings implications, but more importantly, it reduces the residual cobalt content and the accompanying color of the resin. Samples of these sulfur-free products to customers have resulted in considerable interest and one or more commercial introductions are expected in 1987.

ELVERON 300® HYDROXYLATED POLYESTER RESIN

Elveron 300® is a low molecular weight hydroxylated polyester developed at the Experimental Station for the Specialty Resins Business. It is comprised of neopentyl glycol, trimethylol propane, isophthalic acid, and adipic acid. This resin demonstrates an excellent balance of flexibility and hardness as a film. The objective of this program was to demonstrate our ability to produce the resin in the semiworks, to provide sample materials for customer evaluation, and to characterize production parameters for full scale plant production.

A twenty-five gallon batch of the resin, meeting all product specifications was produced in the semiworks thirty gallon polyester reactor. Sample requests generated at the Atlanta Paint Show in November were filled from this batch. The resin was produced with the "Solvent/Water" or "Solvent III" process for making hydroxylated polyesters. Production in the Fort Madison Reactor No.4 (4500 gallon volume) will be initiated at the request of the Specialty Resins Business.

The value of Elverson 300® lies in expansion of our product base in the Specialty Resins Business, enhancing the overall competitive position of Du Pont as a supplier of quality resins. Customers are now evaluating this product and we are awaiting further developments.

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METHACRYLIC ACID COST REDUCTION PROGRAM

The methacrylic acid (MAA) manufacturing process has *not* experienced the yield improvement seen in the related methyl methacrylate (MMA) process. Year to date MAA yield from acetone is 81% versus 88% for MMA. Research effort is being increased to raise the MAA process yield by 5%, worth $1MM per year in ingredient savings.

A computer model has been developed using kinetic data on the rates of methacrylamide hydrolysis and by-product formation and plant data on physical losses of methacrylic acid. Based on the computer model and laboratory experiments, we have defined a series of changes in equipment and process conditions to increase yields to 84% by 1988 and 86% ultimately. A task team of Memphis Research and Belle Technical personnel are developing a low investment (ca. $750M) yield improvement project for authorization by mid 1987.

METHYLMETHACRYLATE PROCESS - YIELD IMPROVEMENT

Approximately 4% of the overall acetone yield loss for the methyl methacrylate process occurs in the methacrylamide conversion step. As part of an integrated effort to improve yield, worth $500M/year for each 1%, one research approach has been aimed at identifying cost-effective engineering modifications in the conversion step. Over several years, these efforts have been directed towards increasing plug flow behavior of the material passing through the converter system. An increase from the normal 80-85% plug flow (with three reactions in series) to 95% was predicted to be worth approx. 0.3% in yield.

Last year in a plant test, we packed one reactor (of three available) with packing and installed an efficient liquid distributor and have used this reactor exclusively for the last year. Tests show that plug flow performance exceeds the 95% goal, process operability is markedly improved, and the conversion step has been eliminated as a bottleneck in high capacity production. Direct cost of the modifications has been only $75M.

FILAMENTS - NEW HEXAGONAL SHAPED TOOTHBRUSH BRISTLES

During the past year, we showed that there is an optimum number of strands in a tuft in a toothbrush; wear improves with number of strands until over packing causes premature splay. As an extension of the theory we looked at using hexagonal filaments, each having identical stiffness to the round control, and found that a much neater brush resulted. In the past quarter all major toothbrush customers have evaluated our product and interest is high. Most customers have reported advantages of some type but the most important is that 10-20% additional strands can be used without increasing brush stiffness. Improved cleaning of teeth at the same

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comfort level might result. A process for preparing the hexagonal monofilament in the plant is in place and commercialization awaits customer orders. At the early stage we speculate that a 5-10% price premium or a 10-20% volume increase could result from this development.

DYMETROL® FABRIC - SCALE-UP OF NEW COEXTRUDED MONOFILAMENT

Dymetrol® fabric is a developmental product used as seating suspensions in automotive and furniture applications. Goal sales of $10-15MM at attractive returns are expected by 1992. The fabric requires a coextruded monofilament of Hytrel® which has been supplied in the past on semiworks equipment. A successful demonstration at 1000 lbs/day was made on the No. 19 Prime® spinner at Washington Works this quarter. Operation became routine after startup and a route to increase production rates to 3000-4000 lbs/day was developed. We expect to produce these monofilaments at 4.00/lb. and sell fabric at $.30/ft^2 after weaving and heat setting at outside vendors. At $0.30/ft^2 the monofilaments represent $27.00/lb revenue including the additional costs of weaving, materials, and processing. This demonstration of a new product in the Prime® spinner is a model for planned tests of other coextruded monofilamant product at early stages of development, including tennis strings, round cables for energy transmission and large diameter fish lines.

DYMETROL® TAPE - NEW PASSIVE RESTRAINT PRODUCT

In September Ford announced that Escort and Lynx automobiles will be equipped with automatic seat belt systems using our Dymetrol® tape product. This development, accomplished by a team from Marketing, Manufactureing, and R&D, enables us to sell parts cut-to-length and Teflon® coated, a considerably more fabricated part than the usual tape. Both sales and earnings will be more than double compared to selling tape alone. By 1989, Ford applications (Escort, Lynx, Tempo, Topaz, Cougar, T-Bird) should reach 3MM sales at 40% margin. This quarter, Washington Lab in cooperation with Marshall Lab, developed a new Teflon® coating which can be applied in-house, eliminating the cost of an outside coater and further increasing earnings.

TEDLAR® PVF FILM -LOW HF AIRCRAFT FILM

The aircraft industry is an important market for Tedlar® PVF film; in fact, it is our most profitable market segment. The primary use is for interior surfaces (walls, ceilings, cargo compartments) where Tedlar's appearance, inertness, stain resistance and cleanability combined with its low weight are desired properties. Sales of Tedlar® to this market in 1986 were over $9MM which represents about 20% of total Tedlar® sales.

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To meet increasing demand for reduction in all toxic components, the aircraft industry requested a 50% reduction in HF evolution from Tedlar® during combustion. We have met this target by incorporating finely divided CaC03 at a loading of 14%, by weight, and have now converted ten of the pigmented aircraft films to the new formulation. The remaining films will be converted when orders are received for them.

When a major change is made in a product, there are inevitably trade-offs in other properties which we were concerned about, film strength, surface texture and stain resistance, have been maintained at acceptable levels by careful control of pigment and deglosser. And we found that the new compositions provided a very desirable benefit: films had higher thermal stability which permitted embossing at higher temperatures which, in turn, gave improved pattern definition and reduced "wash-out" during subsequent forming steps.

COATINGS FOR XEROX ELECTRORECEIVERS

Xerox Company is developing a new type of a printer which combines high speed, high resolution and graphics capabilities of a laser printer with a low price comparable to that of dot-matrix or inkjet printers. We have been working with them closely to provide coated cylinders with a high degree of film uniformity (+_2.5%) and unique electrical properties. While our effort with Tedlar® was not successful due to high discharge rates and variations of electrical properties, we succeeded by applying good quality urethane coatings. After evaluation of several candidates Xerox approved our Imron 580S/582S coating for advanced prototype testing along with a competitive film coated candidate.

We have produced the first lot of 30 cylinders sprayed on a laboratory unit to be used in prototype printer machines. Refinish and Specialty Services Groups are evaluating a commercial Binks spraying unit with the first trial scheduled in 1Q87. Based on volumes forecast by Xerox, we estimate that this opportunity would generate approximately 20,000 gal/year additional Imron® sales and approximately $3MM new earnings opportunity by 1989, based on a negotiated price of $3.00-5.00/cylinder (depending on volume) and projected 0.75-$1.00 cost of raw materials and coating process for Imron® coated cylinders.

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PROCESS DEVELOPMENT FOR CORIAN® GRANITE

Marketing studies suggest that Corian® with granite-like appearance represents a significant growth opportunity. Two granite-like compositions, a light and a dark shade have been developed by adding ground particles of black and white Corian® sheet to the Corian® mix and casting into sheet. Sales of $10MM are expected within three years with good margins. A continuous, short holdup time process, necessary to prevent monomer absorption by the preformed Corian® from being a problem, has been developed. Controlled monomer penetration of the particles results in formation of an interpenetrating network (IPN) between the matrix and particles when the mix is cured and a 20% increase in impact strength over standard product results. Patent protection for this novel process is being sought.

A $2.7MM project for granite manufacturing facilities was authorized in October 1986 with start-up planned for April and initial sales expected in June.

REDUCED WARP IN CORIAN®

One of the remaining Corian® quality problems is warp of sheet product. Warp causes problems in the field in fabrication and its solution will facilitate the introductin of the new granite products and of a more crack resistant formulation. Laboratory scale studies have shown that the key process improvements needed to minimize warp are uniform polymerization in all three dimensions through the sheet, achievement of a peak temperature of 125-130°C and uniform cooling. A project to achieve these by process improvements is being developed.

In late October the plant encountered an unusually severe problem with warp. On an interim basis, as many of the project recommendations as possible were implemented, and a three-fold reduction in warp resulted. Two more recent runs have confirmed the improved warp. Implementation of all the improvements on a permanent basis is expected to further reduce warp.

TEFLON® COMMERCIAL BAKEWARE

Teflon® Silverstone® finishes have had great success over the years in the consumer market, but have been slower to penetrate industrial markets such as commercial bakeware. The recoating process requires use of solvents and EPA regulations are providing impetus for increased sales in the market with $10MM potential is a goal. In this highly automated industry, manufacturers presently utilize a silicone coating as the anti-stick component. This coating has low initial cost, but pans must be frequently recoated and coating must be supplemented by greasing.

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Our strategy has been to introduce a product from existing FDA-approved candidates. This would permit most rapid entry into the market, and could be followed by a "Next Generation" product tailored specifically for this application. The coating system of choice has been found to be an amide-imide bound Teflon® FEP-based primer with a topcoat based on a low melt Teflon® FEP*. This system, which has the best cost/performance balance of properties, has shown excellent release. The important durability tests have been underway for a year and will be continued towards a goal of two years, versus the weeks or months life expectancy of the silicon coating. Performance so far is excellent.

Testing has focused on high quality bakers (e.g. for Mac Donalds) where large numbers of hamburger buns are baked to exacting standards. Success in this area will provide incentive for the rest of the baking industry to follow, especially in view of the increasingly stringent EPA regulations. The total market potential represented is 20M to 100M gallons, or $2MM to $10MM sales annually, with an ATOI of $240M to 1200M.

* Teflon® FEP is a copolymer of tetrafluoroethylene and hexafluoropropylene.

TEFLON® FINISHES-AUTOMOTIVE WELD-NUT THREAD COATING

An important part of automotive assembly involves the use of "weld nuts" and studs. These are nuts and bolts respectively, which are welded to the chassis of an automobile and are used for the attachment of engine components, accessories, and large body panels. Unless the threads of these components are protected during the priming step, primer is electrodeposited in or on the threads, preventing automatic machines from operating well. General Motors spends about $20 per vehicle manually protecting and cleaning the threads of weld nuts and studs.

At the request of GM Truck and Bus Division, we have worked closely with the Spring Tool Company, which has designed a machine that coats only the threads of the weld nuts and studs with a Teflon® coating. This non-conductive, release coating minimizes deposition of primer on the threads, permitting easy assembly with automatic equipment. General Motors recently validated both the application equipment and our Teflon® S coating, 954-101 (based on a low-melt Teflon® FEP fluoropolymer made only for us by PPD). Extensive training of the applicators and interactions with GM Truck and Bus were required to attain satisfactory performance.

The potential opportunity with General Motors is estimated to be 50 to 75 thousand gallons of Teflon® S coating world-wide. Sales for 1989 are estimated at 20M gallons, with an ATOI of $240M. General Motors' interest in the project stems from a cost savings of about $13 per vehicle.

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SPORTING GOODS, EXPLOSIVES AND ENGINEERED PRODUCTS

ENGINEERED PRODUCTS

KALREZ® - LP 7 COMMERCIALIZATION

We are on schedule with the commercialization in Japan of our new Kalrez® product, LP 7, to respond to the introduction of the first in-kind perfluoroelastomer competitive offering from Daikin, a major fluoroelastomer manufacturer. As reported in the previous quarterly report, the base polymer K9000, a terpolymer which can be used by free radical chemistry, was produced in a scaled-up run at the Chambers Works in July. Since then, technical effort has been focused on molding process development at our parts manufacturing facility at Tralee Park. A new short, hot-molding cycle has been developed that has reduced cycle time from one and a half hours to fifteen minutes. With the development of an improved mold release system and the high state of cure obtainable in the K9000 radical cure system, we expect to be able to eliminate a costly hand finishing step as well. About 2000 O-rings have been molded so far in the proof testing of new molds. Most recent results indicate that molding yields of 90% are reasonable, compared to 70% for the existing process and compositions. All of these improvements, combined, place us in an excellent competitive cost position.

We have recently obtained a small number of O-rings produced in Japan from the Daikin material. None of these rings passed our standard quality control inspection. For the present, at least, we can maintain a higher quality standard than competition, with the prospect of reducing costs further as needed.

Our ability to respond promptly to this competitive offering, combined with our soon-to-be completed parts production unit in Japan, places us in a strong position to sustain the growth of the Kalrez® business.

VESPEL® ST - SCALE-UP

Scale-up of the ST resin process, our new "super-tough" polyimide molding resin, has been achieved in our Circleville pilot plant and repeated batches of resin are now being produced just in time to meet a stepped-up commitment to Toyota for a new part. The application is a poppet valve in a new design automobile air conditioning unit. The improved impact resistance of our new resin is the key to its selection for this part. Toyota's tests have shown that our current SP product cannot meet its needs.

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The first 50 pounds of resin produced were used to produce 13,000 part blanks for shipment to our Utsonomiya plant for final finishing. We have accumulated about another 100 pounds of resin for use in molding process development and parts production at our Pencader parts operation. The Toyota part represents $300,000 in new business in 1987 and will require 2500 pounds of resin, the current demonstrated capacity of our pilot unit. Our attention is now focused on increasing the capacity of the equipment via the demonstration of higher solids throughput, and these experiments will provide basic data at the higher operating levels to support a full scale plant trial now planned for the end of the 1st quarter 1987. This plant trial, if successful, will provide the basis for a project to install facilities in the plant for ST and at the same time provide relief from our tight resin supply so that we can pursue new applications.

EXPLOSIVES PRODUCTS

NEW MINE ROOF SUPPORT SYSTEM

Final stages of development are in progress for a new mine roof support system which promises to compete with mechanical bolts (using no resin) which now hold 60% of the roof support market.

The new system uses Fasloc® "Quick Cure" resin together with a specially designed bolt to produce an anchorage which competes with mechanical bolts on cost and installation time while offering increased anchorage strength, and no need for follow-up maintenance to maintain bolt tension.

All claims have been allowed in our patent application and an extensive (1,000 bolt) mine test is underway. A Marketing-Technical Task Force is developing a market introduction plan pending final testing and an agreement with the bolt company manufacturer. Development is on schedule to meet the 1987 financial forecast commitment of $900M in sales out of a total long-term mechanical bolt market opportunity of $20MM.

NEW DETALINE® COMPONENT "QUICKLOK"

The DuPont Detaline® non electric initiating system incorporates a .22 caliber primer to transfer the initiation signal from the blaster to the explosive detonator thru the low energy detonating cord. Development of a new, patented plastic connector body which incorporates a sealing membrane and easy-to-connect snap-in feature has made possible the elimination of the .22 caliber primer.

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Elimination of the .22 primer reduces the number of manufacturing steps and results in a saving in cost of manufacture of approximately $100M in 1987. A process bottleneck is also eliminated increasing manufacturing capacity by 40%. This modification provides a product that is easier to use and has increased reliability; a primary concern in field blasting.

Laboratory reliability testing is currently in progress with field testing to begin in January and product introduction in February.

SPORTING GOODS

SHOTGUN BARREL STEEL MATERIALS RESEARCH

After more than 20 years of performance in the field, Remington's special 1140 modified steel is being challenged via litigation.

Frederick Schmidt (Metallurgist-Engr. R&D) and James Hutton (Remington R&D) requested in April, 1986, that Professor R. W. Hertzberg, (Lehigh University) author of "Deformation & Fracture Mechanics of Engineering Materials", make an intensive and independent analysis as our consultant. Over 50 shotgun barrels were evaluated after 1, 10, and 100 high pressure proof loads to determine a quantitative fatigue plot of stress vs. cycles shown below:

Professor Hertzberg has also analyzed failed barrels using the electron microscope under adverse and controlled conditions. He concludes, contrary to plaintiff's experts, that fatigue failures do not occur. Hertzberg also concluded that Remington's material exhibits a very desirable engineering design feature called "damage control". In the event an overload shell fails the barrel, no fragments are produced.

Hertzberg, Hutton and Schmidt have been deposed and will testify in court this spring regarding the engineering properties of Remington Arm's special 1140 modified steel.

SNIPER WEAPON SYSTEM

The Firearms Business Team has elected to take a more aggressive approach to military contracts. The M24 Sniper Weapon System is a new rifle/optics system for the United States Army (with marketing potential to the other military services, civilian law enforcement agencies, and competitive long-range shooters). It is designed to give pinpoint accuracy out to 800 meters. Remington's response to the Army's Request for Proposal was submitted on the due date of November 14.

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Research completed the final testing stage of the rifle. It will be a Model 700 action with a Mike Rock barrel, H&S synthetic stock, and Leupold telescopic sight. Accuracy is well within requirements. Endurance testing to 5M rounds without going out of specification on accuracy and 10M rounds for the remainder of the rifle continue. Eight rifles were submitted to the Army on November 14.

The Army contract calls for 2M rifles over three years at an estimated (preliminary) selling price per rifle of $2.5M for a sales potential of $5MM. We believe we can manufacture in existing facilities.

Orientation courses for the Army have been conducted at Aberdeen, MD, and Fort Benning, GA. A Pre-Award Survey of the Ilion site is scheduled for January 7, 1987.

Steyr of Australia is the only other bidder. The award of the initial contract for 500 systems should be let in April.

DEPARTMENTAL STRATEGIC RESEARCH

FILM/FABRIC COMPOSITES FOR PROTECTIVE CLOTHING

An interdepartmental team (F&FP, T.F., PPD, C&P) has been working to assess the commercial viability of vapor permeable film structures developed by PPD for apparel and non-apparel end uses. The advantage of these nonporous film structures are permeability to water vapor (perspiration) and non transmissivity to liquid water (rain), and significantly lower mill cost than commercially available materials. The "Hyperm" film structure consists of coextruded hydrophobic and hydrophilic elastomer layers. The hydrophilic polymer is a new Hytrel® type; the hydrophobic polymer is a commercially produced Hytrel® polymer. The film is laminated on a fabric to provide breathable structures.

The New Business Development Group has identified a potential business in the area of disposable garments which protect workers from pesticide overspray. Their estimated potential is 1990 sales of $14MM with $1.5MM ATOI. A laminated structure of the breathable "Hyperm" polyether-polyester film bonded to Sontara® polyester nonwoven has been made as a comfortable, breathable compromise to current barrier suits which are either inexpensive and uncomfortable (coated Tyvek®) or expensive and more comfortable (Gore-Tex). Testing at Haskell Laboratory had shown that this structure is impervious to Guthion, a common pesticide.

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Utah State University conducted a test in July and August to assess performance during pesticide application in fruit orchards using garments made from our structure compared to standard work clothing and Saranex coated Tyvek®. Results indicate our prototype holds out pesticides effectively, but the difference in comfort was inconclusive. Further testing is planned, and prototype suits are also under test at Troy to see if they offer comfort advantages to workers spray applying automotive finishes.

COMB COPOLYMERS FROM GTP MACROMONOMERS

"Kraton" styrene/butadiene/styrene ABA block copolymers (over $100MM in total sales) are widely used in adhesives and thermoplastic elastomer applications. In many of these applications there is need for better UV or oil resistance and these are specific needs expressed in our contacts with several customers. Our initial approach using methacrylate ABA triblocks has given some promising results, but it is being delayed by lack of an available low Tg monomer of sufficient purity. A more promising approach uses comb copolymers prepared by free radical polymerization using macromonomers prepared by GTP.

Several copolymers of butyl acrylate, 2-ethylhexyl-acrylate or mixtures thereof with a PMMA macromonomer were prepared, and are being tested. As an example, a copolymer of butyl acrylate and PMMA macromonomer with an overall composition of BA/MMA (92/8) gives higher holding power than "Kraton" 1107, good rolling ball tack, and slightly lower Polyken probe tack in evaluations as a pressure sensitive adhesive. Variations in composition are being prepared for more complete evaluation.

Copolymers of butyl acrylate with larger amounts of a PMMA macromonomer have been prepared for characterization of physical properties as thermoplastic elastomer candidates. Initial observations are that stress/strain curves look like well behaved elastomer vulcanizates; permanent set is outstandingly low, even compared to Alcryn®; tensile strength of our best composition (28% MMA) is a little lower than unreinforced Alcryn® but easily exceeds unreinforced polyacrylate. Work will continue as these encouraging results indicate that these comb polymers could make an acceptable elastomer with excellent outdoor durability.

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EXTRUSION TESTING OF GTP PREPARED PMMA

The use of methacrylates in injection molding and extrusion has been limited because of a relatively narrow processing window. Polymers made by GTP have lower polydispersities and therefore lower melt viscosity at a given molecular weight. In addition, these polymers have good thermal stability because of absence of residual double bonds. To determine any practical advantage of these differences, we have prepared 500 pounds of solid polymer for two planned extrusion tests. One of these will be conducted in PPD equipment at the Experimental Station, and the other Mitsubishi Rayon will conduct as part of the exploratory efforts underway to determine the desirability of a joint technical development program on new products.

Two 300 gallon semi-works batches of PMMA were blended together to provide the required amount of material. Number average molecular weight is 55M and polydispersity is 1.4. The polymer was isolated as pellets at Luwa in their Filmtruder, an important demonstration of our ability to provide bulk polymers.

ISOLATION OF SOLUTION POLYMERS

Cost effective isolation of specialty resins made in solution by conventional or by GTP processes is essential for many proposed commercial applications, and attractive for solution resins where unconventional solvents are required. It is necessary to be able to handle a wide range of polymer compositions, molecular weights, and functionality, in a variety of solvents, without impairing the quality of the (relatively) thermally sensitive methacrylate polymers. After considerable investigation by the Process Engineering Group, we have settled on the Luwa "Filmtruder" as the only commercially available equipment capable of meeting our needs.

Successful isolation tests at Luwa on a "worst case" solution type resin, EP-2540 in MEK, on Elvacite® AB-1010 dispersant resin, and on 50M molecular weight methyl methacrylate made by GTP, have supported our original projections, and have permitted us to define the critical auxiliary equipment needed. We have forecast purchase and installation of a skid mounted 5-square foot "Filmtruder" at the Marshall Laboratory semiworks for 1987. Our ability to use existing space and to tie in with our PG&S utilities will reduce the installation cost significantly. Operation at the Marshall Laboratory will permit us to work out conditions and develop experience with the equipment as well as to manufacture development and early commercial quantities of isolated polymer. Our long range plan is to move to this unit to Parlin as the business volume grows.

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R&D TRAINING

ORGANIZATION EFFECTIVENESS TRAINING

The R&D Division's Management Effectiveness Training (MET) program continues with fourteen programs completed and five more scheduled for 1987. To date, over 250 people, including 15 non-exempts, have participated in this process which is largely based on the Organizational Effectiveness (OE) technology developed within Du Pont. Each program has typically included a cross section of personnel from all sites, a major factor in the teambuilding process. Further, present and all future programs will include several members of the Mt. Clemens Coatings, Inc. technical organization.

The content/process of the program has continually evolved. Particular attention has been placed on alignment of our program with other Departmental/Corporate activities, including the Leadership (OE) Series (previously called the Senior Manufacturing Management Workshop Series - SMMW), the Marketing Management Series (with a strong focus on "customers"), as well as various Quality and Excellence thrusts presently underway.

Based on feedback and other observations, successful application of this training has been considerable and varied. A sampling includes more efficient/productive meetings of all kinds, better development and buy-in of program objectives, significantly better alignment of personal/technical goals and objectives with those of the business, greater delegation and involvement of people at the lowest possible levels)e.g. design of the new maintenance facility at MRL), and in general, better inter-personal relations throughout the Division.

With MET as a foundation, a variety of additional OE thrusts have been generated and are in various stages of development. Several worth noting are:

- a MRL "site" training program which will involve all personnel in order to further build teamwork and increase motivation for excellence in all phases of daily work activities. A pilot is planned for 1Q, 1987. Similarly, a training program aimed primarily for non-exempts at Troy Lab is planned for 1987. Non-exempt "Core Team" members are receiving their training in MET.

- development of a Resource Team whose major thrust will be to provide OE resource assistance to Strategic and Leadership efforts.

- the use of the OE process in R&D Staff meetings with emphasis on Strategic activities such as the recently completed effort on Quality which resulted in an agreed upon definition for R&D as well as comprehensive objectives for the Division.

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D. BETLEM, B-1232
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T. U. YOUNG, TROY ADC
J. R. GREGORY, B-4258
R. R. CARRYER)CONCORD PLAZA
J. R. SMALL)IN TURN
R. F. ULAK, B-3370
E. F. KREUZBERGER, P191290)
G. F. SCHREIBER , P192164) IN TURN
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J. R. LEWIS , B-11266)
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R. G. SHEPPARD, MEMPHIS

RD-69-8

REMINGTON ARMS COMPANY, INC.

INTER-DEPARTMENTAL CORRESPONDENCE

Remington (DUPONT) PETERS (DUPONT)

"CONFINE YOUR LETTER TO ONE SUBJECT ONLY"

xc: R. A. Darby
R. F. Ulak
T. C. Douglas
J. R. Snedeker
File

Ilion, New York
May 5, 1987

TO: W. H. COLEMAN, II

FROM: T. C. DOUGLAS TCD

NEW PRODUCTS DEVELOPMENT MONTHLY REPORT - APRIL

SYNTHETIC LONG STOCK - MODEL 700 RS

One hundred Trial and Pilot stocks were received the week of April 6th, fifty Grey and fifty Camouflage. The "Matte" metal finish changes to the rifles have delayed the metal components of the rifles. It is anticipated that the Trial and Pilot guns will be available the first week in May.

SNIPER WEAPON SYSTEM

Technical negotiations for the SWS were conducted at Dover, New Jersey on March 26th and 27th. Remington was notified on April 24th to submit our "Firm and Final" offer. The final offer is being hand-delivered on May 5th.

GOVERNMENT M12 RIMFIRE MATCH RIFLE

A quotation for 12,607 U. S. Army M12 .22 caliber match rifles was submitted on May 4th. This rifle would be a 540X rifle with design modifications to the stock, safety, and barrel contour to meet the Army specifications.

PARKER

A theoretical analysis of the original Parker barrel configuration using our current barrel steel indicates stress levels significantly higher than a standard LT-20 barrel. Our Du Pont consultant, Fred Schmidt, has recommended two types of heat treatments to try to eliminate this problem. Heat treated samples will be available for testing by mid-May.

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NEW CONCEPT SHOTGUN

The computer simulation program has been completed and debugged. The program indicates that an inertia operated action system works better as gun weight decreases. This could be in contradiction with the recoil reduction program due to a lighter gun generating more recoil forces to tame.

The Super X-1 prototype is complete except for a prototype spring. It is anticipated that the gun will be ready for test prior to June.

The Benelli alteration for gas operated recoil reduction will be complete by May 15th.

Scott Franz met with Henry Replin(inventor) for evaluation of a recoil reduction device. The device was tested with the results showing very little promise of acceptable results.

SYNTHETIC SHORT STOCK AND FORE END

Prototype M/870 textured fore ends and stocks have been molded and delivered. They are currently being prepared for assembly to guns for development testing.

Quotations for production tooling have been received and will be worked into the program economics for viability.

MAG 10 PROGRAM

Legal has requested that the fire control be redesigned to include the Remington common hammer/sear/trigger arrangement. The redesign is approximately 90% complete, using the CAD/CAM system. Firm portions of the design are currently being built.

Legal has also requested that the fire control, barrel, and breech bolt of Remington manufacture not be interchangeable with Ithaca manufactured parts and vice versa, without modifications to the parts that could be easily detected.

Approximately 75% of the Ithaca drawings have been redrawn to Remington format.

The Test Lab has developed the capabilities for dry cycling and taking bolt velocities on the Mag 10.

MODEL 700 CLASSIC .35 WHELAN

This offering for 1988 catalog introduction is a synergistic program between Ilion and Lonoke. Four prototype rifles have been built at Ilion, with one prototype being sent to Lonoke for use in testing of their new .35 Whelan ammunition.

Ammunition for testing has been received, and the Design Acceptance Test is currently underway.

MODEL 700 MOUNTAIN RIFLE CALIBER ADDITIONS

In 1988, the Mountain Rifle will be produced in .308, .243 and 7mm-08 as the first short action calibers in this rifle. The long action stock contour will be utilized versus having to make a new stock former for a new stock contour. Prototypes of all three calibers have been built and have successfully passed Design Acceptance Testing. Transmittal to the Plant will be accomplished by May 15th.

REMINGTON RESEARCH
ORGANIZATION CHART
MAY 1, 1987

DIRECTOR - F&FP RESEARCH & DEVELOPMENT DIVISION	R A DARBY
—	MARY RYAN
LABORATORY DIRECTOR - REMINGTON	W H COLEMAN, II
	+ CAROL POHLEVEN
	+ SUSAN SAUNDERS
SUPERVISOR	T C DOUGLAS
RESEARCH ENGINEER	K C ROWLANDS
ENGINEER	S R FRANZ
ENGINEER	R S MURPHY
ENGINEER	T P POWERS
ENGINEER	W A WARREN
DESIGNER	T G BAUMAN
DESIGNER	F E MARTIN
DESIGNER	E R OWENS
DRAFTSMAN	* R SMITHSON
SR. DESIGNER (PROCESS DEV)	A BASZCZUK
CONSULTANT - LITIGATION	W L ERICSON
SR. RESEARCH ENGINEER	J C HUTTON
DESIGNER	J H HENNINGS

* Non/Exempt + Non/Exempt-Excludable (W) Wage Roll

Remington Arms Company, Inc.

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REMINGTON RESEARCH
ORGANIZATION CHART
MAY 1, 1987

LABORATORY DIRECTOR - REMINGTON — W H COLEMAN, II

SUPERVISOR — J R SNEDEKER

TECHNICIANS — * F SUPRY
- * C J STEPHENS
- * D R THOMAS
- * D J URTZ
- (W) R W HOWE
- (W) J E SELAN

MODEL MAKERS — (W) C WILLIAMS
- (W) R BUTLER
- (W) D FIORENTINO
- (W) I TRUAX
- (W) G STARKS

RESEARCH PROGRAMMER — R J SANZO

PROGRAMMER (N/C) — E D RANKINS (PMS)

PROGRAMMER (N/C) — E L SAUNDERS

JR. PROGRAMMER — * R A JONES

JR. PROGRAMMER (N/C) — (W) R KOZAKOWSKI

PROGRAMMER — C J HAND

RESEARCH ENGINEER (CAD & STYLING) — D S FINDLAY

DESIGNER — T J PLUNKETT

ASSOC. DESIGNER — F H SMITH

DRAFTSMAN — * W F PICKETT

DRAFTSMAN — * R A WEBSTER

5/1/87

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5-28-87

QUESTIONS TO ASK FOR MARKET NITCHE

- HOW BIG IS THE MARKET
- WHO ARE PLAYERS
- MARKET PRICE FOR PRODUCT
- WHAT KIND OF SHARE
- WHAT PRODUCT FEATURES ARE REQUIRED
- RESOURCES NEEDED
  - PEOPLE PER INDIVIDUAL OPERATIONS
  - DEVELOPMENT OUTSIDE RESOURCES
- PRODUCT LIFE CYCLE
- DO YOU WANT TO DO IN-HOUSE OR OUT
- WHAT IMPACT ON REMINGTON IMAGE
- PROBABLE PRODUCTION COST
- RISK
- PROBABILITY OF SUCCESS
- FUTURE DIRECTION OF MARKET
- TIMING OF INTRODUCTION
- COMPETITIVE REACTION
- RELATIONSHIP TO PRODUCTION CAPACITY - FMS/TRADITIONAL
- PRODUCT FAMILIES (NITCHES)

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GEORGE CATO
Sales Representative
Engineering Polymers Division
E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Polymer Products Department
Bldg. 600-1
331 Treble Cove Road
N. Billerica, MA 01862
716-381-4325
(617) 671-8048

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NIBAS

6/3/87

RANDY MURPHY - STOCK INSERT -

NEW DESIGN - NOT TO GO FAR

MOLDING RYNITE

TEMP: - 350° - 410°

(1)

TO: TERRY DOUGLAS

FROM: BILL WARREN 6-23-87

QUARTERLY PROGRESS REPORT

ACTIVITY	% OF QUARTERLY TIME
M12 RIMFIRE CONTRACT ACTIVITY AND THE IMPROVEMENT OPPORTUNITIES TO CURRENT MODELS RESULTING FROM IT.	45
INVESTIGATE QUALIFYING M870 TO MIL. SPEC. MIL-S-3443E	7
DATA COLLECTION FOR M700 SAFETY OPERATING FORCE ANALYSIS	7
M11 CUSHION REPLACEMENT	0
M7400 GALLERY PERFORMANCE DATA	0
SINGLE SHOT SHOTGUN	0
(THESE 3 FOR INFO. ONLY)	

M12 MATCH/CURRENT MODEL IMPROVEMENT

M12 ACTIVITY, PER SE, STOPPED WHEN GOVT. AWARDED BID TO KIMBER. IF THIS ITEM/PROGRAM IS CONSIDERED IN THE FUTURE, TWO ITEMS WILL REQUIRE MAJOR DRAWING TIME: STOCK AND ADJUSTABLE BUTT PLATE ASS'Y. MOST OTHER COMPONENTS CAN BE DESCRIBED BY TABULATION ON AN EXISTING DRAWING. THE STOCK HAS BEEN FINISHED @ S&K. IT IS BEING PUT IN R&D GUN LIBRARY. S.N. A1048072

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DURING THIS ACTIVITY, OPPORTUNITIES FOR IMPROVEMENT WERE DEVELOPED/IDENTIFIED. THESE CAN BE APPLIED TO CURRENT PRODUCT. THERE ARE THREE TYPES OF THESE:

(1) CHANGES TO IMPROVE PERFORMANCE
(2) " " REDUCE AMOUNT OF EFFORT OR SUB-ASSEMBLY OPERATIONS NEEDED.
(3) RECORDS/PRACTICE . TO BE RECONCILED

A REVIEW MEETING WAS HELD 6-22-87; AT WHICH IT WAS DECIDED TO PROCEED WITH THESE IMPROVEMENTS.
THE PROGRAM HAS BEEN REVIEWED WITH THE TEST LAB. THEY HAVE A WORK REQUEST AND SAMPLE PARTS TO BEGIN COMPREHENSIVE TESTING.

M 870 MIL-S-3443E

ACTIVITY CONSISTED OF REVIEWING LATEST MIL. SPEC. AND OUR EXISTING/HISTORICAL 870 MIL. MODIFICATIONS/ACCESSORIES.

SUMMARY

WITH ONLY MINOR DESIGN AND/OR MATERIAL AND/OR ACCESSORY CHANGES, THE 870 CAN BE MADE TO MEET SPECIFICATIONS FOR TWO OF THREE TYPES OF SHOTGUNS IN MIL-S-3443E.

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QUARTERLY PROGRESS REPORT BILL WARREN 6-23-87

WE WILL REQUIRE SIGNIFICANT DESIGN ACTIVITY TO COMPLY WITH,

"TYPE I CLASS 1 ... WITH BAYONET ADAPTER, HEAT SHIELD, AND SLING ... TAKE-DOWN RECEIVER"

I THINK WE DO NOT NOW QUALIFY BECAUSE OF THE REQUIREMENT THAT, "... the barrel can be easily removed from the receiver without the use of tools..." (3.2.1.4). THE PRESENT BAYONET ADAPTER CLAMPS TO BOTH THE BARREL AND MAGAZINE TUBE EXTENSION. THIS REQUIRES A TOOL TO LOOSEN 3 SCREWS TO REMOVE THE BARREL.

JUDGING FROM CATALOG ILLUSTRATIONS, THE MOSSBERG PRODUCT MOUNTS THE BAYONET COMPLETELY ON THE BARREL ASSEMBLY. IF SO, THIS MEETS THE REQUIREMENT OF THIS SECTION.

TWO QUESTIONS NEED TO BE ADDRESSED BEFORE IN-DEPTH DESIGN ACTIVITY BEGINS TO QUALIFY THE 820:

- IN WHAT TYPE AND CLASS IS THE MAJORITY OF THE GOVT/CIVILIAN MARKET LIKELY TO BE?
- WHAT EXACTLY DOES THE SPEC. MEAN BY, "barrel ... easily removed ... without tools

→

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MY OPINION IS THAT WE SHOULD QUALIFY THE 870, BY DESIGN, FOR CLASS 1 AND ALL THREE TYPES, EVEN IF THIS DELAYS OFFERING TYPE I CLASS 1 - TO PERMIT DESIGN/TEST TIME FOR A SUPERIOR DESIGN.

M 700 SAFETY OPERATING FORCE ANALYSIS DATA AND SAMPLE COLLECTION HAVE BEEN ONGOING FOR SIX MONTHS. THESE ARE NOW AMPLE TO BEGIN A SYSTEMATIC PLANNED APPROACH TO DETERMINE MAJOR CAUSE(S).

THERE ARE APPROX. 100 RIFLES DOCUMENTED BY FINAL INSPECTION DATE AND APPROX. 60 TRIGGER ASSEMBLY EXAMPLES FULLY DOCUMENTED.

TRIGGER ASSEMBLIES BUILT IN FOUR DIFFERENT YEARS HAVE BEEN FOUND WITH THE S.W.H./S.W.W. CONDITION. (SEE ATTACHED HISTOGRAM)

THERE ARE AT LEAST TWO OTHER SITUATIONS TO BE CONSIDERED IN A COMPREHENSIVE CONSISTENT SOLUTION:

- THE LUBRICANT USED ON PRODUCTION IS DIFFERENT FROM THE ONE RECOMMENDED

QUARTERLY PROGRESS REPORT BILL WARREN
6-25-87

IN THE OWNER'S MANUAL.

- FIELD SERVICE PERSONNEL HAVE BEEN TELLING GUNSMITHS NOT TO ALTER OR ADJUST TRIGGER ASSEMBLIES. BUT WE PAY NEW GUN REPAIR STATIONS CLAIMS FOR ALTERING M200 TRIGGER ASSEMBLY'S TO CORRECT FOR SWW/SWH.

M11 CUSHION REPLACEMENT

ENGINEERING ACTIVITY ON THIS HAS BEEN DEFERRED SINCE MARCH FAVORING REMINGTON'S BID RESPONSE FOR THE M12 MATCH RIFLE (BECAUSE OF RESPONSE DEADLINE AND DOLLAR VOLUME OF POTENTIAL GOVT BUSINESS).

CURRENT STATUS

DRY CYCLE TEST DEVICE HAS BEGUN TESTING ORIGINAL AND FIRST RUN CUSHIONS TO ESTABLISH BENCHMARK LEVEL OF PERFORMANCE. THIS HAS NOT CONTINUED IN THE LAB. SAMPLES FROM THE (DAMAGED) TEMPORARY SPRAY UP TOOLING USING THE SELECTED ST 801 WS MATERIAL HAVE BEEN RUN. THEY REQUIRE SOME ALTERATION IN MODEL SHOP TO CORRECT DIMENSIONAL PROBLEMS WITH THE TOOLING. THEY CAN THEN BE TESTED.

A SECOND, NEARLY NEW, M11 HAS BEEN MODIFIED TO PROVIDE FOR SHOOTING TESTS ON BUFFERS (BUFFER IS EASILY REPLACEABLE) SHOOTING SHOULD FOLLOW DRY CYCLE TESTING.

FUTURE TO BE DONE

RESUME DRY CYCLE TESTING

DEVELOP AGREEMENT WITH ALL INTERESTED PARTIES ON THE NATURE AND EXTENT OF TESTING CONSIDERED APPROPRIATE.

INSIGHTS

THE PART DESIGN SHOULD BE BASED ON THE ASSUMPTION THAT A MALE MASTER PART WILL BE MADE AS AN ELECTRODE TO SINK A MOLD CAVITY. OTHERWISE THERE ARE TOO MANY SHAPE COMPROMISES NECESSARY IF THE DIE CAVITY IS MACHINED DIRECTLY.

FINAL DESIGN CAN BE OPTIMIZED BASED ON DRY CYCLE TEST RESULTS.

THE 3T 80 HS MATERIAL LOOKS VERY GOOD THRU BLACK OXIDE. SOLVENT RESISTANCE TESTS CAN BE BASED ON TABULATED (DUPONT) TEST RESULTS AND FIELD

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QUARTERLY PROGRESS REPORT BILL WARREN

6-26-87

PERFORMANCE OF THE NYLON 66 STOCK.

R&D WILL NOT DEVELOP OR INVESTIGATE SOURCES FOR PERMANENT TOOLING, OR THE "GUNSMITHING" END OF FIELD REPLACEMENT INSTALLATIONS.

ALL TO-DATE ACTIVITY HAS CENTERED ON THE 12 GAUGE. A COMBINATION 16-20 GAUGE IS ALSO REQUIRED.

ILL BE HAPPY TO BRIEF THOSE WHO WILL BE TAKING OVER FOR ME ON THESE ACTIVITIES. THIS COULD ASSURE MAXIMUM KNOWLEDGE TRANSFER AND MINIMUM LOST EFFORT.

Bill Warren

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File - SAAMI

STURM, RUGER & Company, Inc.
Southport, Connecticut 06490 U.S.A.
ALL RUGER FIREARMS ARE DESIGNED AND MANUFACTURED IN OUR OWN FACTORIES IN THE UNITED STATES OF AMERICA

RECEIVED

cc: R B SPERLING, LEGL
K D GREEN, ILION
J E PREISER, FPL
D M CONDON, FPL
W H COLEMAN, ILIC

MEMO TO: All Members of SAAMI Legislative & Legal Affairs Committee

FROM: Stephen L. Sanetti, General Counsel

DATE: August 10, 1987

RE: Final Revision -- SAAMI Firearms Safety Rules

Ladies & Gentlemen:

Enclosed please find what is hopefully the final version of the above. I specifically considered comments from member companies submitted to me since our last meeting.

As we discussed at the last meeting, this will be the version submitted to the Executive Committee for approval. If you have any dire objections to any of the language contained herein, please submit these immediately to Dick Bachmann. Hopefully, these rules will be approved at the next Executive Committee meeting and will be ready for printing by NSSF/SAAMI after that time.

I would like to personally thank all of you for your suggestions and assistance with this project. Combined with the individual instruction manuals that the member companies each put out, these generalized rules of firearms safety should greatly assist in our goal of encouraging the safe, responsible use of firearms.

Thank you.

Stephen L. Sanetti
General Counsel

SLS:sab

Enclosure

cc: Doug Painter, NSSF
Bob Delfay, NSSF

P.S. The art work, etc. will be strictly up to you fellows. SLS

REMINGTON ARMS CO.
RECEIVED
AUG 28 1987
FIREARMS RESEARCH DIVISION

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

INTRODUCTION

From the time he picks up a firearm, the shooter becomes a part of a system over which he has complete control. He is the only part of the system that can make a gun safe - or unsafe.

Hunting and target shooting are among the safest of all sports. This booklet is intended to make them even safer - by re-emphasizing and reaffirming the basics of safe gun handling and storage and by reminding each individual shooter that he or she is the key to firearms safety.

You can help meet this responsibility by enrolling in hunter safety or shooting safety courses. You must constantly stress safety when handling firearms, especially to children and non-shooters. Newcomers in particular must be closely supervised when handling firearms with which they may not be acquainted. Don't be timid when it comes to gun safety. If you observe anyone violating any safety precautions, you have an obligation to suggest safer handling practices, such as those in this booklet.

Please read this booklet carefully and follow the safety procedures outlined. Firearms safety is up to you. Make no mistake about it.

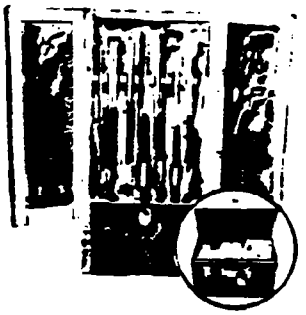
ALCOHOL, DRUGS AND GUNPOWDER DON'T MIX!

1. ALWAYS KEEP THE MUZZLE POINTED IN A SAFE DIRECTION. This is the most basic gun safety rule. If everyone handled his firearm so carefully that the muzzle never pointed at something he didn't intend to shoot, there would be virtually no firearms accidents. It's as simple as that, and it's up to you.

Never point your gun at anything you do not intend to shoot. This is particularly important when loading or unloading a firearm. In the event of an accidental discharge, no injury can occur as long as the muzzle is pointing in a safe direction.

A safe direction means a direction in which a bullet cannot possibly strike anyone, taking into account possible ricochets, and the fact that bullets can penetrate walls and ceilings. The safe direction may be "up" on some occasions or "down" on others, but never at anyone or anything not intended as a target. Even when "dry firing" with an unloaded gun, you should never point the gun at an unsafe target. Develop safe shooting habits.

Make it a habit to know exactly where the muzzle of your gun is pointing at all times, and be sure that you are in control of the direction in which the muzzle is pointing, even if you fall or stumble. This is your responsibility, and only you can control it.

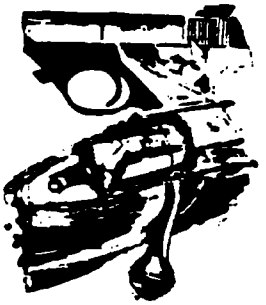


2. FIREARMS SHOULD BE UNLOADED WHEN NOT ACTUALLY IN USE. Firearms should be loaded only when you are in the field or on the target range or shooting area, ready to shoot. Firearms and ammunition should be securely locked in a safe place, separate from each other, when not in use. It is your responsibility to prevent children and careless adults from gaining access to firearms or ammunition. Unload your gun as soon as you are through. A loaded gun has no place in or near a car, truck, or building. Unload your gun immediately when you have finished shooting, well before you bring it into a car, camp, or home.

Whenever you handle a firearm, or hand it to someone, always open the action immediately, and visually check the chamber, receiver, and magazine to be certain they do not contain any ammunition. Never assume a gun is unloaded -- check for yourself! This is considered a mark of an experienced gun handler.

Never cross a fence, climb a tree, or perform any awkward actions with a loaded gun. There are other times during nearly all hunting trips when common sense and the basic rules of firearms safety will require you to unload your gun for maximum safety. Never pull or push a loaded firearm toward yourself or another person. There is never any excuse to carry a loaded gun in a scabbard, a holster not being worn, or a gun case. When in doubt, unload your gun!

Always Keep action open when not in use.

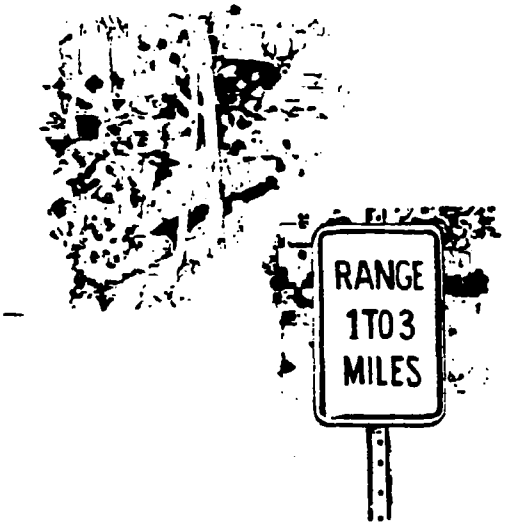


become inoperable

3. DON'T RELY ON YOUR GUN'S "SAFETY". Treat every gun as though it can fire at any time, regardless of pressure on the trigger. The "safety" on any gun is a mechanical device which, like any such device, can ~~fail~~ at the worst possible time. Besides, by mistake, the safety may be "off" when you think it is "on". The safety serves as a supplement to proper gun handling, but cannot possibly serve as a substitute for common sense. You should never handle a gun carelessly and assume that the gun won't fire just because the "safety is on".

Never touch the trigger on a firearm until you actually intend to shoot. Keep your fingers away from the trigger while loading or unloading. Never pull the trigger on any firearm with the safety on the "safe" position or anywhere in between "safe" and "fire". It is possible that the gun can fire at any time, or even later when you release the safety, without your ever touching the trigger again. Never place the safety in between positions, since half-safe is unsafe. Keep the safety "on" until you are absolutely ready to fire.

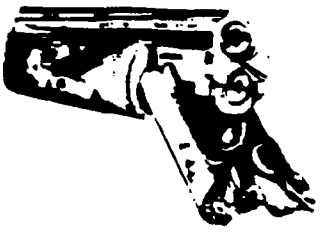
Regardless of the position of the safety, any blow or jar which is sufficient to actuate the firing mechanism of a gun can cause it to fire. This can happen even if the trigger is not touched, such as when a gun is dropped. Never rest a loaded gun against any object because there is always the possibility that it will be jarred or slide from its position and fall with sufficient force to discharge. The only safe gun is one in which the action is open and which is completely empty. You and the safe gun handling procedures you have learned are your gun's primary safeties.



4. BE SURE OF YOUR TARGET AND WHAT'S BEYOND IT. No one can call a shot back. Once a gun fires, you have given up all control over where the shot will go or what it will strike. Don't shoot unless you know exactly where your shot is going to strike. Be sure that your bullet will not injure anyone or anything beyond your target. Firing at a movement or a noise without being absolutely certain of what you are shooting at constitutes a criminal disregard for the safety of others. No target or animal is so important that you do not have the time before you pull the trigger to be absolutely certain of your target and where your shot will stop.

Be aware that even a .22 short bullet can travel over 1½ miles, and a high velocity cartridge such as a .30-06 can send its bullet more than three miles. Shotgun pellets can travel 500 yards, and shotgun slugs have a range of half a mile.

Shooters should keep in mind how far a bullet will travel if it misses its intended target or ricochets in another direction.



5. USE CORRECT AMMUNITION. You must assume the serious responsibility of using only the correct ammunition for your firearm. Read and heed all warnings including those that appear in the gun's instruction manual and on the ammunition boxes.

Improper or incorrect ammunition can destroy a gun and cause serious personal injury. It only takes one cartridge of improper caliber or gauge to wreck your gun, and only a second to check each one as you load it. Use only ammunition that exactly matches the caliber or gauge of your gun.

Firearms are designed, manufactured and proof tested to standards based upon factory loaded ammunition. Handloaded or reloaded ammunition deviating from pressures generated by factory loads or from component recommendations specified in reputable handloading manuals can be dangerous, and can cause severe damage to guns and serious injury to the shooter. Do not use improper reloads or ammunition made of unknown components.

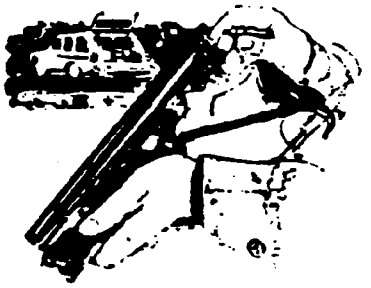
Form the habit of examining every cartridge you put into your gun. Never use damaged or substandard ammunition -- the money you save is not worth a ruined gun or very much worse.

6. IF YOUR GUN FAILS TO FIRE WHEN THE TRIGGER IS PULLED, HANDLE WITH CARE! Occasionally, a cartridge may not fire when the trigger is pulled. If this occurs, keep the muzzle pointed in a safe direction. Keep your face away from the breech. Then, carefully open the action, unload the firearm, and dispose of the cartridge in a safe way.

Any time there is a cartridge in the chamber, your gun is loaded and ready to fire -- even if you've tried to shoot and it did not go off. It could go off at any time, so you must always remember Rule #1 and watch that muzzle!

7. ALWAYS WEAR EYE AND EAR PROTECTION WHEN SHOOTING. All is a shooters should wear protective shooting glasses and some form of hearing protectors while shooting. Exposure to shooting noise can damage hearing, and adequate vision protection is essential. lasses ~~They~~ guard against twigs, falling shot, clay target chips, and the rare ruptured case or firearm malfunction. There ~~are~~ wide variety of eye and ear protectors available. No target shooter, plinker, or hunter should ever be without them. Wearing eye protection when disassembling and cleaning any gun will also help prevent the possibility of springs, spring tension parts, solvents, or other agents from contacting your eyes.

Most rules of shooting safety are intended to protect you and others around you, but this rule is for your protection alone. Futhermore, having your hearing and eyes protected will make your shooting easier, and will help improve your enjoyment of the shooting sports.

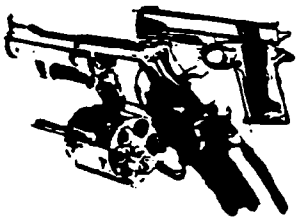


8. BE SURE THE BARREL IS CLEAR OF OBSTRUCTIONS BEFORE SHOOTING. Before you load your firearm, open the action and be certain that no ammunition is in the chamber or magazine. Then glance through the barrel to be sure it is clear of any obstruction. Even a small bit of mud, snow, excess lubricating oil, or grease in the bore can cause dangerously increased pressures, causing the barrel to bulge or even burst on firing, which can cause injury to the shooter and bystanders. Make it a habit to clean the bore with a cleaning rod and patch to wipe away anti-rust compounds in the gun each time immediately before you shoot it. If the noise or recoil on firing seems weak, or doesn't seem quite "right", cease firing immediately and be sure to check that no obstruction or projectile has become lodged in the barrel.

Placing a smaller gauge or caliber cartridge into a gun (such as a 20 gauge shell in a 12 gauge shotgun) can result in the smaller cartridge falling into the barrel and acting as a bore obstruction when a cartridge of proper size is fired. This can cause a burst barrel or worse. You can easily avoid this type of accident by paying close attention to each cartridge you insert into your firearm. This is really a case where "haste makes waste".

9. DON'T ALTER OR MODIFY YOUR GUN, AND HAVE GUNS SERVICED REGULARLY. Firearms are complicated mechanisms which are designed by experts to function properly in their original condition. Any alterations or changes made to firearms after manufacture can make the gun dangerous and usually void any factory warranties. Do not jeopardize your safety or the safety of others by altering the trigger, safety, or other mechanism of any firearm or allowing unqualified persons to repair or modify them. You'll usually ruin an expensive gun. Don't do it!

Your gun is a mechanical device which will not last forever and is subject to wear. As such, it requires periodic inspection, adjustment, and service. Check with the manufacturer of your firearm for recommended servicing.



10. LEARN THE MECHANICAL AND HANDLING CHARACTERISTICS OF THE FIREARM YOU ARE USING. Not all firearms are the same. The method of carrying and handling firearms varies in accordance with the mechanical characteristics of each gun. Since guns can be so different, no person should handle any firearm without first having thoroughly familiarized himself with the particular type of firearm he is using, and with safe gun handling rules for loading, unloading, carrying, handling that firearm, and with the rules of safe gun handling in general.

Just by way of one example, many handgun manufacturers recommend that their handguns always be carried with the hammer down on an empty chamber. This is particularly true for older single-action revolvers, but applies equally as well to some double-action revolvers or automatic pistols. You should always read and refer to the instruction manual you received with your gun, or if you have misplaced it, simply contact the manufacturer for a free copy.

The person with the gun in his possession has a full-time job. He cannot guess, he cannot forget. He must know how to use, handle, and store his firearm safely. Do not use any firearm without having a complete understanding of its particular characteristics and safe use. There is no such thing as a fool proof gun.

G 88

DON'T SAY IT—*WRITE IT*

To K.D. GREEN – for information Date 8/15/87

From J.A. STEIC

While researching some information requested by John Lacy, for his book, it was learned from Dick Ludwig that from 1/6 – 1/11/78 a special block of serial numbers from A7555472 — A7557972, were run out of sequence for the Model 700 rifle. Normally, the numbers run from 6,200,000 – 6,899,999 in any given block of numbers.

"ACCIDENTS HAPPEN IN SECONDS, THE RESULTS CAN LAST A LIFETIME!"

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

cc: S. Gregory, Legal

August 25, 1987

J. W. PREISER
FABRICATED PRODUCTS DEPARTMENT

TRADEMARK "XP-100"
FOR TARGET GUNS

Adoption of this trademark by your department for the goods stated has been approved; however, the approval is contingent on your providing us with the necessary documentation of use as described below within three months of the date of this letter. Failure to comply within this time limit will necessitate: (1) that a subsequent search of the trademark records be conducted, and (2) that the Legal Department render a favorable opinion based on the subsequent search report that the mark is still available for use.

To secure the benefit of use and registration of this trademark in the United States, it should be used with its assigned goods as outlined in the attached procedure. Upon receipt of the material described in the attached procedure, your department adviser in the General Legal Division will take the necessary steps to apply for registration, and will notify you when the trademark has been registered by the United States Patent and Trademark Office.

K. W. LANG

KWL023.070

Attachment

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

FT-3310 REV. 8-82

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
ESTABLISHED 1802

FINISHES & FABRICATED PRODUCTS DEPARTMENT

August 18, 1987

B. A. BEARDWOOD
FPD
B-3332

PROPOSED ADOPTION AND REGISTRATION
OF THE TRADEMARK "XP-100"

The Sporting Goods Group would like to register the trademark "XP-100" to be used on target guns. The XP-100 is the only handgun produced by Remington and has been in existence since the 1960's.

We have made the appropriate searches, and based on these results, have found no conflicting marks for this or a related class of service. Accordingly, "XP-100" appears to be registrable and protectible in the United States, the country in which usage is planned at the present time.

The Sporting Goods Group requests permission to proceed with its registration and use of the trademark "XP-100". Upon receipt of your approval, registration will be sought in the United States Patent and Trademark Office.

If you approve of this request, please so indicate by signing this letter and returning it to my attention.

J. E. PREISER

Approved:

RAP
Legal Department

B. A. Beardwood
Fabricated Products Department

SLG:pr
3.82

F & FP MEANS *Safety*—FIRST & FOREMOST, POSITIVELY

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

LG-4879 REV. 10-63

DUPONT
REG. U.S. PAT. & TM. OFF.
ESTABLISHED 1802

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

LEGAL DEPARTMENT

August 18, 1987

SLG

R. H. REA

PROPOSAL TO ADOPT AND REGISTER
THE TRADEMARK "XP-100"

Attached is a memorandum which seeks approval to register the trademark "XP-100" for a target gun. The XP-100 is the only handgun produced by Remington and has been in existence since the 1960's.

Kindly consider this request, and if it meets with your approval, please execute it on behalf of the Legal Department and return it to my attention. Thank you.

STEPHANIE L. GREGORY

SLG:pr
Attachment
3.80

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

L-G-48.9 REV. 10-63

DUPONT
ESTABLISHED 1802

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

LEGAL DEPARTMENT

CC: C. A. RILEY, FPD, B-6220

July 24, 1987

E. O. FINI
FPD
B-6242

PROPOSED TRADEMARK "XP-100"

Pursuant to your request, a full United States search of the trademark records was conducted to determine the availability of the above-identified proposed trademark to be used in connection with firearms. Set forth below are the more pertinent references cited during the course of the search:

TRADEMARK	GOODS	OWNER
XPERT	sporting and small arms ammunition and components thereof	Olin Corporation Stamford, CT
XPERT (2 registrations)	shot shells	Olin Corporation Stamford, CT
GP100	firearms	Sturm, Ruger & Co. Southport, CT
M-100 (2 registrations)	firearms and parts	Amerind, Inc. Cleveland, OH
MR-3100	rifle powder	Accurate Arms Co. Inc. Mc Ewen, TN
XPLO	explosives, firearms and projectiles	J.J. Charpentier New Orleans, LA

It appears the number "100" and the letter "X" are quite common in the firearms and ammunition fields. In addition to the above references, the search report also cited Remington's registered trademark "RXP", as well as its "XP-100" mark. In view of Remington's long use of "XP-100", plus its established "RXP" mark and the number of marks utilizing either the number "100" or the letter "X" as a part of a composite mark, we are of the opinion that your proposed "XP-100" mark is a viable candidate for registration.

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KINZER V. REMINGTON

Unless I hear from you to the contrary, I will attend to the preparation of the required authorization letter. Should you have any questions in the meanwhile, please do not hesitate to contact me at 773-3678.

STEPHANIE L. GREGORY
SENIOR LEGAL ASSISTANT

/SLG
2.73

Trademark Search Report

RECD
JUL 9 1987
TM & C.

Mark Searched: XP-100

Goods/Services: FIREARMS AND AMMUNITION

Thomson & Thomson

One Monarch Drive, North Quincy, MA 02171-2126 Telephone (617) 479-1600 (800) 692-8833
FAX (617) 786-8273 Telex 6971430 (Thomson)

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

Our File: 2661994
Your File: _____

Trademark Search Report

Client Name: E.I. DU PONT DE NEMOURS
KENNETH W. LANG
Date Received: JUNE 30, 1987 Received by: PHONE

Date Mailed: JUL 07 1987

Mark Searched: XP-100

Goods/Services: FIREARMS AND AMMUNITION

Type of Search: FULL SEARCH

Comments-Patent and Trademark Office Search:

PTO Analyst: A. SLATER

Pending Applications filed through 05/08/87 have been examined in preparing this report, except for a small number delayed by the PTO.

This report contains information from the OFFICIAL GAZETTE of 06/30/87.

Please Note: On those registrations which require an affidavit of use, and such affidavit has not been filed, the notation "Cancelled Sec. 8" appears. Conversely, the absence of this notation is indicative of the fact that the Sec. 8 affidavit has been filed.

We have taken all reasonable steps to ensure the completeness and accuracy of this Report; however, due to the highly subjective nature of trademark searching, we cannot otherwise guarantee these results. Any liability arising out of the preparation of this Report is limited to a refund of the search fee paid. Please note that this Report in no way constitutes a legal opinion.

Thomson & Thomson One Monarch Drive, North Quincy, MA 02171-2126 Telephone (617) 479-1600 (800) 692-8833
FAX (617) 786-8273 Telex 6971430 (Thomson)

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

Number of Copies: 01
Our File: 2661994
Your File:
Client Name: E.I. DU PONT DE NEMOURS
KENNETH W. LANG
Date Received: JUNE 30, 1987
Received by: PHONE
Mark Searched: XP-100
Goods/Services: FIREARMS AND AMMUNITION
Type of Search: FULL SEARCH
2735
PTO Analyst: A. SLATER
Filed Through: 05/08/87
O. G. Through: 06/30/87

	REG#	SERIES	CODE/#	TRADEMARK
1.	R0000000	3	638409	XP1
2.	R0958403	2	423191	RXP
3.	R0705414	2	096804	X XPERT
4.	R0199903	1	202472	XPERT
5.	R0500221	1	527846	XPERT
6.	R1431885	3	612322	GP100
7.	R1440547	3	625533	M-100
8.	R1441149	3	625618	M-100
9.	R1281479	3	397914	MR-3100

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

XP1

XP1

STATUS: PUBLISHED STATUS DATE: MAY 19, 1987.
U.S. CLASSES: 6-26 INT. CLASS: 1
GOODS: FILMS, DRY PLATES AND PAPER, ALL BEING SENSITIZED FOR PHOTOGRAPHIC PURPOSES AND CHEMICALS FOR USE IN PHOTOGRAPHY
SER. NUMBER: 638,409 FILED: JANUARY 5, 1987.
IN COMM: MAY 1, 1981.
FIRST USED: OCTOBER 1, 1980.
PUBLISHED FOR OPPOSITION: MAY 19, 1987.
APPLICANT: ILFORD LIMITED (UNITED KINGDOM COMPANY) : KNUTSFORD, CHESHIRE,ENGLAND

RXP

STATUS: REGISTERED STATUS DATE: MAY 8, 1973.
U.S. CLASS: 9 INT. CLASS: 13
GOODS: AMMUNITION NAMELY SHOTSHELLS
SER. NUMBER: 423,191 FILED: MAY 3, 1972.
IN COMM: JANUARY 17, 1972.
FIRST USED: JANUARY 17, 1972.
PUBLISHED FOR OPPOSITION: FEBRUARY 20, 1973.
REG. NUMBER: 958,403 REGISTERED: MAY 8, 1973.
REGISTRANT: REMINGTON ARMS COMPANY, INC., BRIDGEPORT, CONN.
ASSIGNEE: REMINGTON ARMS COMPANY, INC.
ASSIGNOR: REMINGTON ARMS COMPANY, INC. NEWREMCO, INC.
BRIEF: MERGER FEB 01, 1980 CHANGE OF NAME FEB 01, 1980
RECORDED: MAY 19, 1980.
ACKNOWLEDGED: APRIL 29, 1980.
REEL/FRAME: 368/648

X XPERT

STATUS: RENEWED STATUS DATE: OCTOBER 11, 1980.
U.S. CLASS: 9 INT. CLASS: 13
GOODS: SPORTING AND SMALL ARMS AMMUNITION AND COMPONENTS THEREOF
SER. NUMBER: 96,804 FILED: MAY 10, 1960.
IN COMM: MAY 2, 1960.
FIRST USED: MAY 2, 1960.
PUBLISHED FOR OPPOSITION: JULY 26, 1960.
REG. NUMBER: 705,414 REGISTERED: OCTOBER 11, 1960.
REGISTRANT: OLIN MATHIESON CHEMICAL CORPORATION, EAST ALTON, ILL.
RENEWED: OCTOBER 11, 1980.
RENEWED TO: OLIN CORP., STAMFORD, CONN.
ASSIGNEE: OLIN CORPORATION
ASSIGNOR: OLIN MATHIESON CHEMICAL CORPORATION
BRIEF: CHANGE OF NAME SEP 01, 1969
RECORDED: MARCH 9, 1970.
ACKNOWLEDGED: SEPTEMBER 1, 1969.
REEL/FRAME: 190/369
CLAIMS/DISCLAIMS: OWNER OF REG. NOS. 159,784 AND 500,221.

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON
R2540678

XPERT

STATUS: RENEWED STATUS DATE: JUNE 23, 1985.
U.S. CLASS: 9 INT. CLASS: 13
GOODS: SHOT SHELLS
SER. NUMBER: 202,472 FILED: SEPTEMBER 10, 1924.
IN COMM: JANUARY 16, 1924.
FIRST USED: JANUARY 16, 1924.
PUBLISHED FOR OPPOSITION: APRIL 14, 1925.
REG. NUMBER: 199,903 REGISTERED: JUNE 23, 1925.
REGISTRANT: WESTERN CARTRIDGE COMPANY, WILMINGTON, DELA., AND EAST ALTON, ILL.
RENEWED: JUNE 23, 1985.
RENEWED TO: OLIN CORPORATION (VA. CORPORATION); STAMFORD,CT
ASSIGNEE: OLIN CORPORATION
ASSIGNOR: OLIN MATHIESON CHEMICAL CORPORATION
BRIEF: CHANGE OF NAME SEP 01, 1969
RECORDED: MARCH 9, 1970.
ACKNOWLEDGED: SEPTEMBER 1, 1969.
REEL/FRAME: 190/369

XPERT

STATUS: RENEWED STATUS DATE: MAY 11, 1968.
U.S. CLASS: 9 INT. CLASS: 13
GOODS: SHOT SHELLS, RIFLE AND PISTOL CARTRIDGES
SER. NUMBER: 527,846 FILED: JULY 5, 1947.
IN COMM: JANUARY 16, 1924.
FIRST USED: JANUARY 16, 1924.
PUBLISHED FOR OPPOSITION: FEBRUARY 17, 1948.
REG. NUMBER: 500,221 REGISTERED: MAY 11, 1948.
REGISTRANT: OLIN INDUSTRIES, INC., EAST ALTON, IL
RENEWED: MAY 11, 1968.
RENEWED TO: OLIN MATHIESON CHEMICAL CORP., NEW YORK, N.Y.
U.S. REGISTRATIONS CLAIMED: 199,903

GP100

GP100

STATUS: REGISTERED STATUS DATE: MARCH 10, 1987.
U.S. CLASS: 9 INT. CLASS: 13
GOODS: FIREARMS
SER. NUMBER: 612,322 FILED: JULY 30, 1986.
IN COMM: FEBRUARY 5, 1986.
FIRST USED: FEBRUARY 5, 1986.
PUBLISHED FOR OPPOSITION: DECEMBER 16, 1986.
REG. NUMBER: 1,431,885 REGISTERED: MARCH 10, 1987.
REGISTRANT: STURM, RUGER & COMPANY, INC. (DEL. CORPORATION); SOUTHPORT,CT

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KINZER V. REMINGTON
R2540679

M-100

STATUS: REGISTERED STATUS DATE: MAY 26, 1987.
U.S. CLASS: 9 INT. CLASS: 13
GOODS: FIREARMS AND PARTS THEREOF
SER. NUMBER: 625,533 FILED: OCTOBER 16, 1986.
IN COMM: MARCH 1986.
FIRST USED: MARCH 1986.
PUBLISHED FOR OPPOSITION: MARCH 3, 1987.
REG. NUMBER: 1,440,547 REGISTERED: MAY 26, 1987.
REGISTRANT: AMERIND, INC. (CALIF. CORPORATION):
CLEVELAND,OH

M•100

M-100

STATUS: REGISTERED STATUS DATE: JUNE 2, 1987.
U.S. CLASS: 9 INT. CLASS: 13
GOODS: FIREARMS AND PARTS THEREOF
SER. NUMBER: 625,618 FILED: OCTOBER 16, 1986.
IN COMM: MARCH 1986.
FIRST USED: MARCH 1986.
PUBLISHED FOR OPPOSITION: MARCH 10, 1987.
REG. NUMBER: 1,441,149 REGISTERED: JUNE 2, 1987.
REGISTRANT: AMERIND, INC. (CALIF. CORPORATION):
CLEVELAND,OH

MR-3100

MR-3100

STATUS: REGISTERED STATUS DATE: JUNE 12, 1984.
U.S. CLASS: 9 INT. CLASS: 13
GOODS: RIFE POWER
SER. NUMBER: 397,914 FILED: SEPTEMBER 30, 1982.
IN COMM: 011978
FIRST USED: JANUARY 1978.
PUBLISHED FOR OPPOSITION: MARCH 20, 1984.
REG. NUMBER: 1,281,479 REGISTERED: JUNE 12, 1984.
REGISTRANT: ACCURATE ARMS CO. INC., MC EWEN, TENN.

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON
R2540680

Shepard's United States Citations

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*** No Pertinent Reference Found ***

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R2540681

State Trademark Report

Our report is based upon trademark registration information as maintained by the Secretaries of State of all 50 states and Puerto Rico. Every attempt has been made to assure its completeness and accuracy, however, total absence of error or omissions cannot be guaranteed.

Please note: Corporate, fictitious, assumed names and D.B.A.'s in each state are not included.

STATE UPDATES

EFFECTIVE DATE - 06/29/87

STATE NAME	LAST UPDATE	STATE NAME	LAST UPDATE
ALABAMA	05-25-87	NEBRASKA	03-31-87
ALASKA	10_01_86	NEVADA	05_29_87
ARIZONA	06-30-86	NEW HAMPSHIRE	05-04-87
ARKANSAS	05-04-87	NEW JERSEY	12-29-86
CALIFORNIA	05-29-87	NEW MEXICO	03-31-87
COLORADO	03-27-87	NEW YORK	02-12-87
CONNECTICUT	05-06-87	NORTH CAROLINA	05-29-87
DELAWARE	09-22-86	NORTH DAKOTA	03-31-87
FLORIDA	05-29-87	OHIO	05-29-87
GEORGIA	03-30-87	OKLAHOMA	03-31-87
HAWAII	12-29-86	OREGON	05-26-87
IDAHO	05-15-87	PENNSYLVANIA	05-30-87
ILLINOIS	05-29-87	PUERTO RICO	03-31-87
INDIANA	06-11-87	RHODE ISLAND	04-25-86
IOWA	04-30-87	SOUTH CAROLINA	05-19-87
KANSAS	04-30-87	SOUTH DAKOTA	03-30-87
KENTUCKY	02-21-87	TENNESSEE	03-31-87
LOUSIANA	02-03-87	TEXAS	02-24-87
MAINE	03-31-87	UTAH	02-27-87
MARYLAND	05-29-87	VERMONT	05-13-87
MASSACHUSETTS	03-12-87	VIRGINIA	06-30-86
MICHIGAN	03-03-87	WASHINGTON	04-07-87
MINNESOTA	03-31-87	WEST VIRGINIA	03-26-87
MISSISSIPPI	05-29-87	WISCONSIN	04-01-87
MISSOURI	03-31-87	WYOMING	03-31-87
MONTANA	05-29-87		

Every attempt has been made to secure timely updates from each state. We suggest that you contact the Secretary of State's office for any additional information.

Search : 2661994 LTE

XP

FOR: CLASS 26-MEASURING AND SCIENTIFIC APPLIANCE
OWNER: GOAL SYSTEMS INT'L INC COLUMBUS OH
STATE: OHIO
U.S. CLASS(ES): 26
REG NUMBER: 009921
STATUS: REGISTERED
DATE REGISTERED: JANUARY 21, 1983

EXP

FOR: CLASS 22-GAMES TOYS, AND SPORTING GOODS
OWNER: RICHARD H HARRIS JENKS OK
STATE: OKLAHOMA
U.S. CLASS(ES): 22
REG NUMBER: 014056
STATUS: REGISTERED
DATE REGISTERED: SEPTEMBER 23, 1975

PX

FOR: CLASS 26-MEASURING AND SCIENTIFIC APPLIANCE
OWNER: PHILA X-RAY CORP PENN FIELD DOWNS PA
STATE: PENNSYLVANIA
U.S. CLASS(ES): 26
STATUS: REGISTERED
DATE REGISTERED: APRIL 28, 1978

XPL

FOR: CLASS 1-RAW OR PARTLY PREPARED MATERIALS
OWNER: LANDMARK FARM BUR COOP ASSN COLUMBUS OH
STATE: OHIO
U.S. CLASS(ES): 1
REG NUMBER: 006265
STATUS: REGISTERED
DATE REGISTERED: MAY 05, 1980

XPLO

FOR: CLASS 9-EXPLOSIVES,FIREARMS AND PROJECTILES
OWNER: J J CHARPENTIER NEW ORLEANS LA
STATE: LOUISIANA
U.S. CLASS(ES): 9
STATUS: REGISTERED
DATE REGISTERED: OCTOBER 30, 1982

X-PLO-TONE

FOR: AN EXPLOSION PROOF, ELECTRONIC SIGNAL GENERATOR DESIGNED FOR USAGE IN HAZARDOUS LOCATIONS WITH PRIMARY USES AS A FIRE ALARM EMERGENCY AND EVACUATION SYSTEM, OPERATING IN A PRIORITY FASHION
OWNER: AUDIOSONE, INC., MONROE, CT
STATE: CONNECTICUT
U.S. CLASS(ES): 26
REG NUMBER: 005456
STATUS: REGISTERED
DATE REGISTERED: DECEMBER 20, 1982

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MCP-100

FOR: CLASS 6-CHEMICALS AND CHEMICAL COMPOSITIONS
OWNER: OWNER NOT LISTED
STATE: FLORIDA
U.S. CLASS(ES): 6
REG NUMBER: 923096
STATUS: REGISTERED
DATE REGISTERED: SEPTEMBER 25, 1980

CV 100

FOR: COMBUSTION ADDITIVE FOR LIQUID HYDROCARBON FUELS
OWNER: GLEN SHERWOOD KIRKLAND WA
STATE: WASHINGTON
U.S. CLASS(ES): 6
REG NUMBER: 008064
STATUS: REGISTERED
DATE REGISTERED: AUGUST 29, 1972

FORMULA 100

FOR: CLASS 6-CHEMICALS AND CHEMICAL COMPOSITIONS
OWNER: ALLIED ENTERPRISES INC NORFOLK VA
STATE: VIRGINIA
U.S. CLASS(ES): 6
STATUS: REGISTERED
DATE REGISTERED: MAY 24, 1978

OSDS 100

FOR: CLASS 6-CHEMICALS AND CHEMICAL COMPOSITIONS
OWNER: TAHOTE INDUSTRIES INC TAMPA FL
STATE: FLORIDA
U.S. CLASS(ES): 6
REG NUMBER: 016018
STATUS: REGISTERED
DATE REGISTERED: DECEMBER 29, 1975

GO-100

FOR: CLASS 26-MEASURING AND SCIENTIFIC APPLIANCE
OWNER: L F GAUBERT & COMPANY INC NEW ORLEANS LA
STATE: LOUISIANA
U.S. CLASS(ES): 26
STATUS: REGISTERED
DATE REGISTERED: DECEMBER 15, 1983

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Common Law Library Sources

Our trade directory sources are coded as follows for your references:

A1 Thomas Register of American Manufacturers
A2 MacRae's Industrial Directory
A3 U.S. Industrial Directory
A4 Standard Directory of Advertisers
A8 Thomas Grocery Register
A9 Trade Name Dictionary
C1 American Druggist Blue Book
C2 Drug Topics Red Book
C4 PDR - Physician's Desk Reference
C6 Trademarks Listed With The Pharmaceutical Mfrs. Assoc. (PMA)
C7 USAN and The USP Dictionary of Drug Names
C8 American Drug Index
C9 Physician's Desk Reference for Radiology and Nuclear Medicine
C10 Physician's Desk Reference for Nonprescription Drugs
C11 Unlisted Drugs
C12 American Hairdresser Green Book
C13 Veterinary Drug Index
C14 Clinical Laboratory Reference
C15 Drug & Cosmetic Catalog
C16 Medical Device Register
C17 Beauty Fashion
C18 Physician's Desk Reference for Ophthalmology
C20 Clinical Toxicology of Commercial Products
C21 Modern's Market Guide
C22 Pharmaceutical Trade Mark Directory - IMS
C23 Analytical Chemistry Lab Guide
C24 Modern Veterinary Practice Red Book
C25 The Merck Index
C26 Drug Facts & Comparisons
C27 Dental Products Report Annual Buyer's Guide
C28 Health Industry Buyer's Guide
C29 The Fragrance Foundation Reference Guide
C30 Pets Supplies Marketing
C31 Pet Dealer Purchasing Guide
C33 Dental Laboratory Review Buyer's Guide
D1 Chemical Week Buyer's Guide
D2 CEC - Chemical Engineering Catalog (Chemicals & Equipment)
D3 Paint Red Book
D4 Chemical Engineering Equipment Buyer's Guide
D5 Pesticide Handbook - Entoma
D6 Trademark Directory of the National Paint & Coating Assoc.
D7 Rubber Red Book
D8 Adhesives Red Book
D9 The Condensed Chemical Dictionary
D15 Farm Chemicals Handbook
D16 Farm Supplier Directory
D17 Metal Finishing Guidebook and Directory
D18 Home & Garden Supply Merchandiser Green Book
D19 Farm Store Merchandising Buyer's Guide
D20 McCutcheon's Emulsifiers and Detergents
E1 Pima Catalog - Pulp and Paper Mill Catalog and Engineering Handbook
E2 The Locksmith Ledger and Security Register
E3 A List of Massachusetts Solar Industries
E5 International Glass/Metal Catalog
E6 Directory of Forest Products Industry
E7 Wholesaler Product Directory - Plumbing, Heating, Air-Cond. & Refrig. Industry
E9 Hardware Age "Who Makes It Buyer's Guide"
E10 Building Supply Home Centers Buyer's Guide
E11 Heating, Piping, Air Conditioning HPAC Info-dex
E15 Product Directories of the Refractories Industry of the United States
E18 Fluid Power Handbook & Directory
E20 Trade Designation of Plastics & Related Materials - Plastics Technical Evaluation Center
E21 A Concise Guide to Plastics
E22 Modern Plastics Encyclopedia Directory of Trade Names
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E24 American Gas Assoc. Laboratory Directory of Certified Appliances & Accessories
E25 Packaging Machinery Directory
E27 Hitchcock's Assembly Engineering Master Catalog
E28 Best's Safety Directory
E29 Sanitary Maintenance Buyer's Guide
E30 Air Conditioning, Heating & Refrigeration News Directory
E31 Fence Industry Directory
E32 Construction Equipment Buyer's Guide
E33 Roofing/Siding/Insulation Trade Directory
E34 Manufactured Housing
E36 Welding & Fabricating Data Book
E37 Farm & Power Equipment
E38 Mechanical Products Catalog
E40 Directory of Machine Tools (NMTBA)
E42 Implement & Tractor Product File
F1 Datapro Directory/Software
F2 Design News Electrical/Electronic Directory
F3 ICP Software Directory
F4 Electronic Industries Association Trade Directory
F5 Electronic Design's Gold Book
F6 Annotated Directory of Parts and Services for Audiovisual Equipment
F10 Sound and Communications Blue Book
F11 E.E.M. - Electronic Engineers Master Catalog
F12 EITD - Electronic Industry Telephone Directory
F13 Computer Information Directory
F14 Audio-Visual Equipment Directory
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G2 China Glass & Tableware Redbook Directory
G5 MMR Musical Merchandise Review Supplier Directory
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G42 Sailboat & Equipment Directory
G43 Sailing Boats of the World

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G44a Mobile Home Blue Book - Official Market Report
G44b Recreational Vehicle Blue Book - Official Market Report
G44c Van Conversion Blue Book Official Market Report
G45 Motorcycle Dealer News Buyer's Guide
G46 Cruising World
G47 The Illustrated Encyclopedia of the World's Modern Military Aircraft
G51 Phonolog The All-In-One Record Reporter
H1 Cookware Manufacturers Assoc. Registered Trademarks & Brand Names
H2 Juvenile Merchandising
H3 Flotation Sleep Industry
H4 Small World Directory
H6 Wallcovering Directory
H7 American Furniture Manufacturers Assoc. Marketing Bulletin
H8 Sew Business - National Directory
H10 Flooring Directory and Buying Guide
H11 Trade Name Directory for Carpets & Rugs
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I4 Slogans in Print
I5 Slogans
I6 Editor & Publisher Yearbook
I6a Editor & Publisher Syndicate Directory
I7 Marking Products & Equipment Buyer's Guide
I8 Geyer's Who Makes It Office Supply Directory
I9 Walden's Paper Catalog
I10 Lockwoods Directory of Paper and Allied Trades
I11 International Motion Picture Almanac
I12 International Television Almanac
I13a Complete Encyclopedia of Television Programs: 1947 - 1976
I14 TV Feature Film Source Book
I14b Series, Serials and Packages
I15 The Effective Echo, A Dictionary of Advertising Slogans
I16a The Video Sourcebook
I16b The Video Tape & Disc Guide to Home Entertainment
I16c The Radio Programs Source Book
I17a Books in Print
I17b Paperbound Books in Print
I18 Children's Books in Print
I19 The Comic Book Price Guide (Overstreets)
I20 The International Licensing Directory
I21 Shepard's Citations (Copyrights)
I22 Ink Trademarks Filed With The National Association of Printing Ink Manufacturers
I23 Advertising Slogans of America
I24 Publishers, Distributors & Wholesalers of the U.S.
I25 The Standard Periodical Directory
I27 Gebbie Press - All-In-One Directory
I28 Ulrich's International Periodicals Directory
I29 Complete Directory to Prime Time Network Television Shows: 1946 - present
I32 Working Press Of The Nation/Magazine Directory
I33 Librarian's Handbook (EBSCO Subscription Services)
I34 American Book Publishing Record
I37 Library Journal Book Review
I38 Sources of Supply - Buyer's Guide
I39 Office Product Dealer Product Buying Guide
I40 The Videolog
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J1 Body Fashions - Intimate Apparel Directory
J3 Earnshaw's Infants, Girls, Boys, Wear Review Directory
J6 Register of Brand Names & Trade Marks of the Thread Industry
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J15 Shoe Factory Buyer's Guide
J16 Luggage & Travelware Directory and Market Guide
J17 Fashion Accessories Buyer's Bluebook
J21 Intimate Fashion News Directory Issue
J24a Knitting Times Yearbook
J24b Knitting Times Buyer's Guide Directory
J28a Leather Buyer's Guide
J28b Leather & Shoes - Chain Shoe Stores Directory
J29 Footwear News Magazine Directory Issue
J30 Hat Life Yearbook and Directory
J31 Fairchild's Textile & Apparel Financial Directory
J35 American Apparel Manufacturers Assoc. Inc. - Members
J38 Man-Made Fiber Fact Book
J38b Man-Made Fiber, A New Guide
J39 Industrial Fabric Products Review Buyer's Guide
K1 The Florida Fruit & Vegetable Directory
K2 Health Food Business Purchasing Guide
K5 Quick Frozen Foods Directory of Frozen Food Processors
K6 Candy Buyer's Directory
K9 Modern Brewery Age Blue Book
K10 The Beer Can Collectors Bible
K11 Connoisseur's Guide to Beer
K12 Tobacco Retailers' Almanac
K13 United States Tobacco and Candy Journal Supplier Directory
K18 Beverage Industry Annual Manual
K19 Universal Numeric Code Directory for Alcoholic Beverages
K19a Universal Numeric Code Directory for Wines
K20 The Brewer's Digest/Buyer's Guide & Directory
K22 The Directory of The Canning, Freezing, Preserving Industries
L1 Standard and Poors Register of Corporations
L3 Thomson & Thomson's List of U.S. Patent & Trademark Office Trademark Registrants and Applicants
L4 Directory of Corporate Affiliations "Who Owns Whom"
L5 Directory of Uniform Product Code Council (UPCC Members)
L6 Franchise Opportunities Handbook
L7 Shopping Center Directory
L8 Acronyms, Initialisms and Abbreviations Dictionary
L9 Reverse Acronyms, Initialisms and Abbreviations Dictionary
L10 World Guide to Abbreviations of Organizations
L11 Encyclopedia of Association - Vol. 1 - National Organizations
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Mark/Trade name: XP-100
Type of Search: Full Search

Mark/Trade Name	Goods/Services	Owner/Address	Source Code*/ Edition Date
EXP Series	Explosion-Proof HID ltg	Benjamin Div, Thomas Industries Inc. South, Sparta, TN	D-4/87
XP 100	Sporting Goods	Remington Arms Co, Inc. Bridgeport, CT.	E-9/87

Comments:

N/L=Not Listed
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*** No Pertinent References Found ***

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Trade Name Report

The attached report is the result of a computerized search of approximately nine million company names. The database has been supplied by Dun & Bradstreet and contains names from the Dun's Market Identifiers * (DMI) Database. Also included are two million Dun's support records which are usually assigned a Standard Industrial Classification (SIC) code of 8999. This represents records that do not contain complete marketing information; therefore, the type of business cannot be defined. A notation of "NEC" following the SIC Code description stands for "Not Elsewhere Classified", and an asterisk (*) following the name indicates that the company is incorporated.

Each record contains the name of the company, the secondary or "DBA" (Doing Business As) name if applicable, the city and state in which the company is located, Dun's number, up to six SIC codes, and an SIC code description of goods and services which represent categories of the company's business activity. (These descriptions may not always represent the exact product or service produced by the company).

While Dun & Bradstreet considers the database to be reliable, the accuracy, currency and completeness cannot be guaranteed.

PLEASE NOTE:
This report lists the records in the order of their closeness of similarity to your proposed mark. Identical or very similar marks are displayed first, followed by variations of the mark.

In cases where the name searched is common, the report has been limited by relevant descriptive terms; SIC Codes; or U.S. Classes.

*Dun's Market Identifiers is a registered trademark of Dun & Bradstreet Inc.

Search 2661994 TAD

COMPANY NAME SECONDARY NAME	CITY	ST	DUN #	SIC CODE/DESCRIPTION
B M X PARTS AND PIECES	LAWRENCEVILLE	GA	108643099	5941 SPORTING GOODS & BICYCLE STORES
T-SHIRTS X PRESS	MANY	LA	094080066	5999 MISCELLANEOUS RETAIL STORE, NEC 5941 SPORTING GOODS & BICYCLE STORES 2261 FINISHING PLANTS, COTTONS
H X P LIMTED INC HOWIG & ASSOCIATES	GRINNELL	IA	085373942	5041 SPORTING & AMUSEMENT GOODS
M X PORTERS	FORT WORTH	TX	121238638	5041 SPORTING & AMUSEMENT GOODS 5063 ELECTRICAL APPARATUS & EQUIPMENT 5199 NONDURABLE GOODS, NEC 5136 MEN'S CLOTHING & FURNISHINGS 5137 WOMEN'S & CHILDREN'S CLOTHING 5149 GROCERIES & ITS PRODUCTS, NEC
LARSON ERNEST RICHARD JRS PONY XPRESS	DIAMOND	MO	155240559	5541 GASOLINE SERVICE STATIONS 5331 VARIETY STORES 5699 APPAREL & ACCESSORIES, MISC. 0212 BEEF CATTLE EXCEPT FEEDLOTS
D X P EP S TOP DX PEP STOP	MT PLEASANT	IA	098721863	5541 GASOLINE SERVICE STATIONS
F X P INC	ATHERTON	CA	037866209	6552 SUBDIVIDERS, DEVELOPERS, EXCEPT CEMETERIES 3613 SWITCHGEAR & SWITCHBOARD APPARATUS
FORTESCUE FRANK X P C	BLOOMFLD HLS	MI	052471810	8111 LEGAL SERVICES
G X P TAVERN INC AY CAFE	STATEN ISLAND	NY	059352302	5812 RESTAURANTS, DINERS, EATING PLACES 5813 BARS, NIGHT CLUBS (DRINKING PLACES)
INTERCONT IMP & XP CO INC	CHICAGO	IL	138773387	8999 SERVICES, NEC
J P C PROPERTY MGT CONS* X P D MANAGEMENT	SMITHTOWN	NY	101201820	6512 BUILDING OPERATORS NONRESIDENTIAL
X P C O RECOURCES	PARKERSBURG	WV	143811719	8999 SERVICES, NEC
X P D COURIER & DELIVERY	COUNCIL BLF	IA	122113178	4212 TRUCKING WITHOUT STORAGE, LOCAL
X P EXPRESS INC	MASPETH	NY	150545408	4212 TRUCKING WITHOUT STORAGE, LOCAL
X P MGMT	LATHAM	NY	106169634	8999 SERVICES, NEC
X P O INC	NEW ORLEANS	LA	083550202	6792 INVESTORS, OIL & GAS ROYALTIES
X P O SOHO	NEW YORK	NY	143958502	8999 SERVICES, NEC
X-P FARMS	LYMAN	NE	145569224	8999 SERVICES, NEC

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Automotive Products Department

and

Fabricated Products Department

Research & Development

Quarterly Summary

July - September 1987

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ABSTRACTS

AUTOMOTIVE PRODUCTS DEPARTMENT

FINISHES

CONVERSION TO DUPONT FINISHES AT CORVETTE 8

All ten 1988 colors at the Corvette plant, Bowling Green, KY, have been converted from Inmont to Du Pont basecoat/clearcoat finishes, representing $5MM in sales. Additional significant opportunities exist for Bexloy® fascia to replace the currently used RIM, and for a two component isocyanate clearcoat for end of line repair.

HIGH SOLIDS BASECOAT/CLEARCOAT COST REDUCTION 8

A program aimed at reducing the raw material costs of high solid basecoat/clearcoat has resulted in estimated savings of over $2MM/year, primarily through reduction in pigmentation levels and lowering of volumetric solids, without sacrifice in performance.

LOW TEMPERATURE CURING AUTOMOTIVE TOPCOAT FINISHES 9

Development of a low bake, low solvent emissions automotive topcoat system has progressed to the submission stage at G. M. The system consists of a waterborne basecoat with either a solvent borne isocyanate or non-isocyanate two-component clearcoat. Potential sales to G.M.-U.S. by the mid 1990's is $209MM with an ATOI margin of 11%.

LEAD EDGE CHIP RESISTANT PRIMER.....10

With the introduction of aerodynamically designed automobiles, there has been a significant increase in the paint chipping on the lead edge of the hoods of these vehicles. A special chip resistant primer which can be applied wet-on-wet with a topcoat system is being readied for customer tests at Ford and General Motors.

GTP PIGMENT DISPERSANTS.....10

Pigment dispersants based on Group Transfer Polymerization showing improvements in viscosity stability and pigment utilization, have been approved for use at G.M.'s CPC Division and are also being offered to BOC. Across the board adoption of these dispersants has the potential to reduce dispersion costs by up to $2.5MM/year.

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REFINISH HIGH SOLIDS IMRON® COMMERCIALIZATION.....11

A new line of high solids urethane enamels, Imron® 5000, will be introduced to truck accounts, in response to EPA pressure to reduce solvent emissions. A companion line of glamour basecoat/clearcoat colors will follow. Current Imron® sales to this industry are $11MM annually with about $2MM ATOI.

CLOSED LOOP TECHNOLOGY.....11

A program has been initiated to demonstrate on-line color and appearance control during spray application in automotive plants. Designated, "Closed Loop Technology", this system will enhance service to our customers and also provide $100M/year cost savings in color standards preparation.

IMPROVED REFINISH CRONAR® CLEARCOAT.....12

In response to customers need for a more rapid cure clearcoat, a new Cronar® clear was developed and is undergoing field testing prior to commercialization. Cronar® is expected to contribute $4MM to Refinish ATOI in 1987.

REFINISH 1988 IMPORT NEW CAR COLOR PROGRAM.....12

The 1988 Factory Package color development program for new imported cars is the largest ever, with 120 colors to be developed. This is needed to provide a complete offering to our customers to prevent competitive inroads. Completion is expected in February 1988, with projected 1988 sales in excess of $100M.

REFINISH BUSINESS REQUIREMENTS PLANNING PROJECT.....13

A Technical Team was formed to improve formula accuracy as one route to attaining part of the cost reduction goal of $21MM in reduced inventories and $6.4MM in reduced raw material usage. Initially 130 formulas have been selected for revision. Additional savings of $300M ATOI in 1987 and $450M ATOI in 1988 were identified through related quality programs.

DISPERSION PROCESSES.....13

Estimated annual savings of $300M/year are expected as a result of switching to in-house manufacture of two red pigment dispersions used in Lucite® refinish lacquers, which resulted from improved dispersion capability developed in this program. Additional dispersions are now under study, to extend applications for the new capability.

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FABRICATED PRODUCTS

CONSUMER PRODUCTS AND SPECIALTY RESINS DIVISION

MACROMONOMERS AS DISPERSANT POLYMERS FOR NAD'S.....14

Macromonomers prepared by cobalt catalyzed chain transfer are the basis for a new class of Non-Aqueous Dispersions exhibiting improved rheology control in finishes and offering the possibility of acting as crosslinkers.

ACRYLIC PRESSURE SENSITIVE ADHESIVES.....15

High performance acrylic pressure sensitive adhesives have been formulated from comb and block copolymers made by Group Transfer Polymerization and cobalt catalyzed chain transfer processes. Characterization of these adhesives is continuing.

AQUEOUS DEVELOPMENT OF PHOTODEFINABLE FLEXOGRAPHIC PRINTING PLATES.....15

Acrylic microgel systems have been synthesized as a route to replace Kraton® copolymers in aqueous developable flexographic plates. FPD sales potential to Imaging Systems is in the range of $1.8MM to $5MM depending upon the market segment that can be addressed.

RESINS FOR XEROX TONER SYSTEMS.....16

As part of our program to increase resin sales to Xerox, a candidate styrene/acrylic bead resin was selected for further testing in one of their toner systems. Potential volume is 1.3MM pounds, with the economics to be defined. Approval of semi-works batches will lead to a December production run.

MICROWAVE OVEN RELEASE COATING.....16

A Silverstone® system was developed to meet the demanding requirements for a release coating for Lucky-Goldstar's microwave oven broiler. Sales potential is $2MM. Goldtstar is currently evaluating our candidate.

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PLASMA DEPOSITION AS A SUBSTRATE FOR FLUOROPOLYMER COATINGS.....17

Silverstone® was successfully applied to glass that was plasma coated with, in one case, a ceramic and, in another, with a coarse aluminum coating. Plasma deposition is being pursued as a low cost route for adhesion promotion of fluoropolymer coatings to a variety of substrates, to protect and expand our $30MM sales position.

ELECTROPHORETIC METHODOLOGY USED FOR DISPERSION APPLICATION PROBLEMS.....18

Electrophoretic studies helped identify the basis for better application properties of a competitive PTFE dispersion when compared to our own. This should enable us to improve roller coating application of existing and new PTFE products as the trade moves in this direction.

INCREASED METHYL METHACRYLATE CAPACITY VIA RECYCLE OF SPENT ACID.....18

A 15MM pound/year or 5 per cent increase in capacity of the Memphis methyl methacrylate plant has been achieved by recycling about 6% of the spent sulfuric acid directly to the process without conversion to 100% sulfuric acid in the acid recovery plant. This was instituted in response to record sales which has exceeded plant capacity.

INCREASED METHYL METHACRYLATE PRODUCTION BY METHACRYLIC ACID ESTERIFICATION.....19

A projected shortfall of methyl methacrylate in 1988 has led to developing the capability to esterify excess methacrylic acid from Belle in the Memphis MMA plant. Indications are that 28MM pounds per year could be obtained by this strategy with $2MM ATOI, if sales demand continues at capacity.

PRIME® PLUS INTRODUCTION.....19

A second generation cofilament fishline, Prime® Plus has been introduced. This line, which is limper for improved castability, and stronger for reduced breakage, retains Prime®'s unique sensitivity, and was developed in response to customer complaints regarding stiffness and line breakage with the original product.

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NEW CORIAN® SHAPE PROCESS.....20

A new closed-mold process for sinks, vanities, and other Corian® shapes is being designed. A Venture Guidance Appraisal indicates excellent economics and final technical evaluations are under way.

700 - M24 SNIPER WEAPONS SYSTEM.....20

Remington Arms was awarded the U.S. Army M24 Sniper Weapons Contract, because of superior functional quality of our offering. The initial contract is for 500 guns, representing $2.5MM in sales at 12% ATOI margin. The gun will be rollmarked Model 700-M24, which allows commercial tie-in with our Model 700 hunting rifle.

PARKER SHOTGUN.....21

A Parker shotgun prototype is being developed for introduction at the Shot Show in January. A key element is the strength of the shotgun barrel, which is under development. This specialty item will be available for order at the show for the production run of 50 shotguns to be sold for about $10,000 each.

SPECIALTY PRODUCTS AND SERVICES DIVISION

LOW HEAT RELEASE, EMBOSSED TEDLAR® SYSTEM FOR AIRCRAFT INTERIORS.....21

Three Tedlar® faced composities submitted to Boeing passed their demanding heat release test. Follow-up samples in Boeing's colors are being submitted for further evaluation. An acceptable product is required by the first quarter of 1988 to protect this market segment which accounts for 30 per cent of Tedlar®'s earnings.

IMPROVED TEDLAR® PACKAGING SYSTEM.....22

A new packaging system for Tedlar® film will replace the three existing packages, with improved product protection, and a cost savings of $350M. Packaging conversion has started with test quantities and will be completed by early 1988.

POLYVINYL FLUORIDE (PVF) DRUM COATINGS.....22

Testing of improved PVF based drum coatings is progressing at Natico, for uses involving difficult solvent challenges. Market potential is over $1MM for this specialty application.

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NEW VINYL FLUORIDE POLYMERS AND COPOLYMERS.....23

Encouraging initial results were obtained in scouting new polymers and copolymers of vinyl fluoride in terms of solubility, melt flow rheology, and lower modulus. In continuing work, higher glass transition temperature, greater hardness, and improved processing are being sought with the goal of providing new base resins for Tedlar® or other PVF-based films.

VESPEL® ST.....24

Eleven out of twelve Vespel® ST batches produced in the plant pilot unit have met specifications, significantly above preliminary performance specifications. A scale-up test in the commercial plant is underway. Full scale production is needed to meet customer orders in 1988.

KALREZ® 4000.....24

Modified end groups on Kalrez® 4000 perfluoroelastomer polymer appear to provide the desired reduction in durometer hardness while maintaining other property balances and offers the improved processing characteristics that are being sought. If the expected advantages prove out in continued testing, Kalrez® 4000 will be in an excellent cost and patent position to meet generic competition.

NEW FASTORQ® BOLT SYSTEM.....25

Delays in establishing a subcontractor and in obtaining regulatory approvals have slowed the commercialization of the new Fastorq® roof support system. Product performance and market acceptance remains good, but because of the delayed introduction, 1988 sales forecast is reduced to 1.5MM bolts, a break-even position.

DEPARTMENTAL STRATEGIC RESEARCH

MACROMONOMERS BY GROUP TRANSFER POLYMERIZATION (GTP).....26

Macromonomers, made by conversion of low molecular weight polymers produced by GTP, to polymers with polymerizable end groups, are finding potential applications in pressure sensitive adhesives, and as a dispersant in a fuel oil additive. In the adhesives market alone, potential for macromonomers is estimated at $10-15MM with a 30% ATOI margin.

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IONIC BLOCK COPOLYMERS FOR WATERBORNE FINISHES SYSTEMS BY GTP.....26

Hydrophobic/hydrophylic block copolymers prepared by GTP show promise as surfactants and pigment dispersants in automotive and refinish waterborne coatings. Acrylic emulsion polymers prepared with such surfactants appear to offer a better balance of paint stability and greater resistance to water sensitivity in the resultant films. Second stage testing is being conducted at Marshall and Troy Laboratories.

FUNCTIONAL STAR POLYMER APPLICATIONS AND SCALE-UP.....27

Star polymers containing reduced functionality and made at significantly reduced cost are the basis for new coatings candidates. A low VOC refinish flexible clear coating and a coil coating candidate are being tested.

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CONVERSION TO DU PONT FINISHES AT CORVETTE

All ten 1988 colors at the Bowling Green, KY, Corvette plant have been converted from Inmont to Du Pont basecoat/clearcoat finishes. Four new colors were formulated, tested and approved. There are two clears, a rigid and a flexible, used at the account. Also, a modified low gloss enamel blackout was introduced for painting the underbody.

During start-up some cratering was experienced. The cratering problems were overcome by re-cleaning two of the circulating systems and by formulation adjustments to the reducing solvent and surface tension additive.

The appearance of the car is currently limited by the physical properties of the substrate. The RIM fascia is being clearcoated and baked with an extra shift the night before in order to smooth out the inherent orange peel in the RIM. Marketing is addressing this opportunity by working with GM on the possible introduction of Bexloy® fascia. The SMC plastic body shows fiber readout and bond seam readout (a difference in smoothness of the paint along internal structural support lines) as the paint appearance and distinctness of image (DOI) improves. Marketing is about to propose a color keyed guidecoat to be sprayed over the competitor's "Polane" primer pending a Du Pont cost evaluation.

Corvette is planning to introduce a two component (2K) isocyanate clear for End Of Line repair in November and if successful, convert the main color booth next year. This represents an additional new business opportunity for Du Pont.

The current value of the Corvette business is estimated at $5MM annual sales but new plastic introductions at this account could increase this significantly and provide an inroad to plastic parts at other accounts.

HIGH SOLIDS BASECOAT/CLEARCOAT COST REDUCTION

Du Pont's high solids basecoat/clearcoat (BC/CC) technology has been successfully introduced and continues to be considered for use in many domestic automobile assembly plants. Throughout the development of this technology the major consideration was to provide a premium product with cost as a secondary consideration.

As sales volume increased and automotive companies profitability and market share decreased we recognized the need to identify and implement modifications to minimize the cost of our products while continuing to meet customers needs.

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Over the past year and a half a cost reduction program was manned, technically feasible alternatives identified , and many cost saving ideas implemented for over 30 GM passenger car colors supplied to 6 assembly plants. Initial work focused on the two largest potential cost reduction areas of product pigment to binder ratio (P/B), and product volume solids as supplied. APD's Marketing organization focused on the volume solids vs price issue while the technical community was charged with optimizing the P/B. Results to date show raw material cost reductions of up to $8.00/gallon (25 % reduction) have been achieved by dropping pigment levels with no known customer dissatisfaction. Additional changes have also been implemented to reduce the raw material costs of most high solids basecoats by over $1.00/gallon. Conservative estimates suggest that savings of over $2.0 MM/year are being realized in raw material savings alone through this program.

Future work will focus on implementing additional, currently identified, cost savings measures and to tracking this programs progress and assessing its contribution to profits.

LOW TEMPERATURE AUTOMOTIVE TOPCOAT FINISHES

The objective of this program is to develop high glamour, low pollution, low bake (200°F) topcoats for use on steel and on heat, sensitive plastics. Our topcoat system will include a high glamour waterborne basecoat (WBBC) with either an isocyanate or epoxy-anhydride two component (2K) clearcoat. Commercial targets are Corvette, Saturn, and Truck and Bus. Based on an expressed interest by the CPC Division of G.M. for a non-isocyanate clearcoat most of our effort has focused on the latter chemistry. Full potential sales at GM (U.S.) by mid 1990's is $209MM with ATOI margin of 11%

A submission of a WBBC/epoxy-anhydride clearcoat system to CPC was approved for film properties but was deficient in initial yellowing, high volatile content, and failed the test for paint/windshield compatibility (MVSS test). A reformulated product is being readied for re-submission. A prototype flexible clearcoat also based on epoxy-anhydride is under development to complete the low temperature curing topcoat package.

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LEAD EDGE CHIP RESISTANT PRIMER

Coincident with the introduction of aerodynamically designed automobiles presaged by Ford (Taurus and Sable) and more recently introduced by G. M. (Corsica and Beretta) the incidence of chipping on the lead edge of hoods has increased as has the manufacturers' needs for more chip resistant primer coatings. Our initial lead edge chip primer offerings, as well as our competitors, involved primer application followed by a bake cycle before topcoating. This process mode requires the addition of manpower for sanding primer overspray, otherwise, the overspray droplets will telegraph through the topcoat and detract from appearance. To provide for better customer value-in-use we have developed an alternative product wherein the topcoat is applied wet-on-wet over the primer, thus eliminating the primer bake and the costs associated with sanding.

Our candidate, coded 764-195, is based on an existing structured polyester, RC-3601, crosslinked with melamine. The technical challenge was to formulate this product so that it had an optimum balance of topcoat holdout to avoid strike-in, but with sufficient flow to avoid a rough topcoat appearance. This was achieved through judicious selection of a blend of melamines to match topcoat cure rate and a rheology package to provide high viscosity at low shear rates along with good flow under bake temperatures. Extender pigments were chosen to give optimum chip properties.

Laboratory evaluations of 764-195 show minimum detraction from topcoat appearance and a significant improvement in chip resistance. Customer tests are under way at Ford and planned at General Motors.

GTP PIGMENT DISPERSANTS

Applications for GTP dispersants in Performance Coatings continue to look promising. In the lab, we see significant improvements with use of GTP in several basecoat/clearcoat colors which have had chronic viscosity stability problems. Improvement of these colors is needed to protect our quality image and annual basecoat sales of more than $100MM (ATOI margin about 11%). CPC division of GM has already approved the use of GTP, and a presentation will be made to BOC. We are seeking a line trial at one of the BOC plants. If successful, we could be supplying commercially by year end.

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GTP also has potential beyond improving the quality of specific problem colors. Across the board use of GTP dispersions has the potential to reduce our dispersion manufacturing cost by up to $2.5MM/yr. To capitalize on this opportunity, we are developing a new line of dispersions, which we expect to have broad applicability in future Automotive product developments.

REFINISH HIGH SOLIDS IMRON® COMMERCIALIZATION

During the 4th Quarter, Refinish will introduce a new line of high solids urethane enamels, Imron® 5000, to major direct accounts, primarily heavy duty truck manufacturers, who are under increasing EPA pressure to reduce solvent emissions. Imron® 5000 colors will have emissions of less than 3.5 lbs./gal. Volatile Organic Compounds (VOC) versus current lower solids Imron® which has an average 5.2 lbs./gal. VOC. The higher solids product is achieved primarily from the development and use of higher solids pigmented tintings. Tests of the new line have been conducted at nine major truck accounts this year with positive results. Color development of approximately 400 popular fleet colors is under way in the new quality to support Fall commercialization.

Early in 1988, Refinish plans to introduce a companion line of glamour basecoat/clearcoat colors (Imron® 6000) utilizing the new tintings developed for the Imron® 5000 quality. Imron® has been the dominant coating used by the heavy duty truck industry for over a decade and the new high solids line is needed to maintain our leadership position in this market. Current color sales to this industry are $11MM annually with an approximate $2MM ATOI.

CLOSED LOOP TECHNOLOGY

We are developing the technology needed to control color and appearance of paint finishes during spray application. Our goal is to adjust, on-line, application and paint properties to yield finishes with uniform color with desired appearance levels. The concept of on-line measurement with feedback control is called "closed loop" technology. The incentive for this is to develop a competitive edge with OEM customers by enabling them to achieve "world class" appearance. An intermediate goal of "closed loop" technology is to improve the yield and quantity of OEM standards produced at Troy. Several hundred thousand panels are prepared annually for OEM customers. Major yield improvements can be obtained by providing rapid feedback of film build and color to a control system to adjust spray parameters. Implementation of this technology to OEM standards preparation is expected to produce $100M/year PTOI. An intangible benefit is better service to customers by providing quality and technology leadership.

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A research project is under way to implement this technology. Equipment has been purchased to control spray parameters, analyze the data and generate sequential control charts to provide anticipatory control. A modular system has been designed for use in the present Standards Preparation Area at Troy Lab. We have received the major equipment items such as the Unimate 562 Robot and Digital Equipment Corporation MicroVAX computer system. Installation of the equipment will be completed late 1987 with start-up in late first quarter 1988.

IMPROVED REFINISH CRONAR® CLEARCOAT

During the 1st Quarter of 1987, Cronar®, a new line of Refinish isocyanate-free enamels based on acrylic and epoxy/acrylic amine crosslinking chemistry was introduced into the U.S.

While marketplace reception has been positive in most areas, many users, particularly those shops without baking capabilities, have complained about the relatively long time required for the Cronar® clearcoat to cure sufficiently in order to permit light handling and freedom from water spotting when stored outside. Current isocyanate based systems and competitive non-isocyanate clears (also introduced in early 1987) typically require 6-12 hours air dry before handling/outside exposure while Cronar® requires 24-36 hours.

In response to user comments, a revised Cronar® clear has been developed using a higher molecular weight/harder acrylic amine resin in combination with a silicone mar resistance additive. The new clear provides adequate performance properties after overnight dry (16-18 hours) under most shop conditions and exhibits improved application latitude and lubricity versus our previous clear. A 5000 gallon batch has been manufactured in late September and Marketing is in the process of developing a field implementation strategy. Cronar® is expected to add approximately $4MM to Refinish ATOI in 1987.

REFINISH 1988 IMPORT NEW CAR COLOR PROGRAM

Factory package color development for the 1988 Import New Car Color Program began in September, 1987, and is scheduled for completion in February, 1988. This year's program is the largest ever with 120 colors to be developed in Lucite®, nearly doubling last year's program. As with the 1988 Domestic Program, a multi site R&D/Manufacturing development team has been assembled to accomplish the task. Improved manpower productivity (versus the previous program) in obtaining high quality color matches has already been achieved and should continue via the implementation of new training programs utilizing instrumental color technology.

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The strategic importance of the Import New Car Color Program stems from the need to have a complete offering for our customers to prevent the addition of competitors' products. The import car refinishing needs are currently being met with Mixing Machine formulas matched to OEM standards while car parts are used for the higher quality factory package matches. This program will add sales in excess of $100M in 1988.

REFINISH BUSINESS REQUIREMENTS PLANNING PROJECT

Business Requirements Planning (BRP) is being implemented within the Refinish Business in order to improve the management of inventories, planning for on-demand forecasting and distribution of products and resources. Project justification was based on $21MM for reduced inventories and $6.4MM for reduced material (obsolete primarily) usage over a 6-year life of the Project.

An intra-Divisional Technical Team has been assembled to manage the technical aspects of the Project including assurance of formula accuracy. The goal is that an acceptable batch will only require what is listed on the formula card, thereby allowing inventories to be predictable and minimized. A principle for the implementation is that it will be done through existing functional teams so that the quality improvements will be maintained long term through networks of interaction between the teams. As an initial effort, 130 formulas will be revised and upgraded based on their production histories. R&D and Manufacturing are working closely to monitor that these formulas can be accurately executed and that quality systems are in place to monitor performance as well as correct variances.

After several months of involvement, the Technical Team has concluded that additional savings of $300M ATOI and $450M ATOI are available in 1987 and 1988 respectively via Quality programs which would result in reduced in-process raw material consumption. The overall program is on schedule.

DISPERSION PROCESSES

Currently, our annual cost for pigment dispersion manufacture is estimated at $80-90MM. Technical programs are underway to improve our fundamental understanding of the most important of our dispersion processes - media milling - so that we can improve the efficiency of our operation, and capitalize on quality improvement/cost reduction opportunities.

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One recent example of progress in this area is in Refinish Lucite® Lacquer. For several years, Refinish had been purchasing two of the red dispersions for this line from RBH. The decision to do so was based on the fact that these dispersions were difficult to manufacture in the processes available at that time. In recent years, however, the technical capabilities of our media milling process have expanded to include more difficult applications such as this (e.g. Refinish last year partially converted from purchased to in-house transoxides for savings of $800M/yr.). Successful manufacture of these two Lucite reds was demonstrated at Front Royal in September. Annual savings vs. continued purchase from RBH are estimated at $300M/yr. Other dispersions are now being worked on which could yield an additional $500M/yr. savings by year end.

Additional work is under way to further expand our technology base. This work includes a) validation of mathematical models to predict media fluidization and rate of dispersion quality development, b) exploration of potential benefits to be gained from ultrafine media milling, c) establishment of a quantitative quality control test for dispersion transparency, d) alignment of the tandem milling process in the demonstration unit at Toledo. Future quality and cost benefits from these leads will be quantified as more technical data are generated.

FABRICATED PRODUCTS DEPARTMENT

CONSUMER PRODUCTS AND SPECIALTY RESINS DIVISION

MACROMONOMERS USED AS DISPERSANT POLYMERS FOR NAD'S

A joint program between the Automotive and Specialty Resin Groups has established the feasibility of using macromonomers prepared via special chain transfer technology as stabilizers in the preparation of NAD's. NAD's or "Non-Aqueous Dispersions" are high molecular weight crosslinked particles with a stabilizing polymer layer on the surface, which are used for rheology control in automotive clear and base coats.

Macromonomers in which hydroxyl or epoxy groups are incorporated in the chain can be used to prepare NAD's and appear capable of generating smaller particles (150 micron diameter versus 300-350 micron via the normal route). The smaller particle size, which we believe reflects a more efficient stabilization of the particles by having the stabilizing molecule attached at its terminus, gives better rheology control.

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Because of the ease of providing macromolecules with functional groups, it may be possible to develop NAD's which can be reacted into the cross-linking process for the coating system, providing better interaction, and reducing the overall need for crosslinking agents. We are currently looking at an hydroxyl functional NAD to be evaluated in an isocyanate crosslinked system. We are also evaluating an epoxy functional NAD in our epoxy anhydride coating system.

ACRYLIC PRESSURE SENSITIVE ADHESIVES

There is a need in the adhesives business for high performance pressure sensitive adhesives. Acrylic resins have advantages in processing, clarity, color and stability which make them logical candidates, but have previously required non-acrylic additives to achieve all of the performance features required. In so doing they have not achieved the stability that an all acrylic system would have. We are working with comb and block copolymers that can be made with GTP and cobalt catalyzed chain transfer (SCT) technology to provide the thermoplastic elastomer properties required, where hard segments or "teeth" are combined with a flexible acrylic backbone or block. Our proprietary technologies provide economic routes to these compositions that were heretofore unavailable or uneconomic.

An additional complication in this area is the patent situation, in which the 3M Corporation has a patent claiming comb copolymers used as pressure sensitive adhesives. We have prepared twelve prototype comb copolymers which fall outside the 3M patent claims, but which can be formulated to make excellent pressure sensitive adhesives. We are continuing our evaluations of these materials, since our preliminary contacts with several adhesives manufacturers indicate that there is a substantial fraction of the solution and hot melt pressure sensitive adhesives market available for compositions with the above mentioned acrylic polymer performance.

AQUEOUS DEVELOPMENT OF PHOTODEFINABLE FLEXOGRAPHIC PRINTING PLATES

Cyrel® is a family of photodefinable flexographic printing plates manufactured by the Imaging Systems Department. The present technology which utilizes Shell's Kraton® thermoplastic block copolymer in conjunction with diacrylates and photosensitizers, is solvent developed. Environmental regulations make it necessary to develop a water developable system, and Kraton® is unsuitable for this purpose.

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We have synthesized a lightly crosslinked, low Tg core microgel, grafted with higher Tg acid containing (shell) copolymer. The necessary elasticity is provided by the core, while the acidic shell permits development in aqueous systems. At this point, two candidates with a 1% crosslinked poly 2-ethylhexyl methacrylate core, a 2:1 core:shell ratio, and a 20% acid containing shell (acrylic or methacrylic acid copolymer) have been successfully evaluated by the Imaging systems Department. However, these plates, although the best that they have seen to date, can only be developed by brush development, which is not suitable for the large publication market. We are working with them to determine the modifications to the shell composition and thickness necessary to provide the required spray or sonic development. If successful, this could result in $1.8MM annual sales to FPD, or $3MM to $5MM if the large publication market is obtained.

RESINS FOR XEROX TONER SYSTEMS

Xerox is seeking a domestic source for a styrene-acrylic bead resin they use in their toner systems. This is a 1.3MM-pound opportunity and could lead to our sharing other toner resin business. Their manufacturing process has impractically long cycle times so they have agreed to evaluate samples made by our process. We supplied four laboratory made samples that match their XP303 composition and meet their critical melt index specification. We substituted our standard Acrysol suspension system for Xerox's system of tricalcium phosphate and Alkanol XC followed by addition of nitric acid to remove the tricalcium phosphate. Samples were prepared with either Vazo® or benzoyl peroxide initiator. Xerox has completed their tests of these samples and have chosen the one that best meets their needs. We are in the process of making three semiworks batches to submit for approval, aiming for a first production run in December.

MICROWAVE OVEN RELEASE COATING

We have been working to develop a demanding release coating system for the interior of a microwave oven-broiler being marketed by Lucky-Goldstar Company. This project is particularly challenging in that it requires adhesion to aluminum coated galvanized steel with minimal substrate preparation, plus postformability, without sacrificing the chemical and stain resistance of conventional SilverStone® coatings.

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We have developed a two coat system which meets Goldstar's specifications by combining aqueous polyphenyline sulfide (PPS)/PTFE primer technology with a SilverStone® topcoat. The PPS based primer provides improved adhesion and flexibility as compared with our conventional amide-imide primer, sacrificing thermal stability required only for top-of-range appliances. Adhesion between this primer and the conventional topcoat was greatly improved by using an aqueous grind of the PPS versus a glycol based grind used with other PPS systems. At this point we are awaiting feedback from Goldstar with this system. The technology developed for this application may well be applicable to a number of other intermediate severity uses for release coatings, where its lower cost and readier adhesion can be appreciated. The oven-broiler business alone represents a $2MM annual sales opportunity.

PLASMA DEPOSITION AS A SUBSTRATE FOR FLUOROPOLYMER COATINGS

Adhesion of fluoropolymers to a variety of substrates requires a combination of chemical and mechanical bonding in order to provide coatings which are sufficiently durable for appliances and other applications where mechanical and thermal abuse are common. Traditionally, for example, aluminum frying pans are heavily grit blasted to provide sufficient grip for our release coatings. Grit blasting, however, is expensive and does not work well with a number of materials, including glass.

Plasma deposition provides the ability to coat metals, ceramics, and glasses with materials such as other metals and ceramics that will not degrade at fluoropolymer melt temperatures and to provide a porous, hard, and wear resistant surface which can serve as a substrate for fluoropolymer coatings. A German cookware manufacturer has introduced a cast aluminum frypan which is plasma coated with an alumina-titania ceramic, and then impregnated with a PTFE coating.

We have signed a secrecy agreement with APS Materials, Inc., a leading plasma coating applicator, and have coated glass with a ceramic and with a coarse aluminum coating. Although some fluoropolymer coatings exhibited problems with air entrainment on these substrates, our SilverStone® top-of-range coating worked well. We are continuing to develop this technology to both protect and expand our $30MM annual sales of fluoropolymer coatings.

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ELECTROPHORETIC METHODOLOGY USED FOR DISPERSION APPLICATION PROBLEMS

The newly acquired PenKem System 3000 automated electrokinetics analyzer has been used to help understand critical differences between PTFE dispersions from Mechelen and those supplied by Hoechst.

No difference was observed in rheological measurements, but electrophoretic characterization determined that the Hoechst dispersion had a coating of dispersant that was over twice as thick as that from Mechelen. This increased dispersant thickness appears to be more effective in reducing shear-induced aggregation, thereby improving performance in roller coating applications.

This gives us the first indication of the basis for difference in performance and will permit us to attack this problem scientifically rather than empirically. At stake is a significant fraction of future Teflon® coating business as the trade moves from spray to roller coating.

INCREASED METHYL METHACRYLATE CAPACITY VIA RECYCLE OF SPENT ACID

Methyl Methacrylate (MMA) production at Memphis is a two-step process, requiring large quantities of sulfuric acid for conversion of acetone cyanohydrin (ACN) to methacrylamide, followed by esterification of the amide to MMA. The used, or spent, acid from the esterification step is converted back to 100+% sulfuric acid by catalytic combustion for reuse in the process, and recovery of spent acid is the capacity limiting step at present. Spent acid is mainly ammonium bisulfate, with approximately 15% each of sulfuric acid and water. In the amide step, bisulfate ion has been shown to be equivalent to sulfuric acid. Partial recycle of the spent acid can, therefore, increase capacity by providing additional acid to maintain the needed ratio of H_2SO_4 while increasing ACN feed and save operating cost by reducing the amount of spent acid that must be burned to recover sulfuric acid.

The MMA process is currently operating at maximum capacity, and spent acid recycle has been identified as the major technology for capacity increases at reasonable cost. A $175M project was authorized to recycle enough spent acid to compensate for the water normally added for acid strength control. The project was started-up on July 15 and

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equipment operability has been excellent. The project goal was to increase MMA capacity by 15MM ppy or 5 percent, using 6% recycle and maximum virgin acid capability. Actual percent recycle has exceeded the 6% goal, and the additional capacity is being realized. Increased recycle is possible and we are determining ways to further increase recycle and with it capacity.

INCREASED METHYL METHACRYLATE PRODUCTION VIA METHACRYLIC ACID ESTERIFICATION

The Methyl Methacrylate (MMA) plant at Memphis has run at capacity for the last several years and sales continue to increase. Capacity increases by plant round out are planned in 4Q88, but a shortfall projected for the interim has caused us to investigate ways to immediately increase production. One approach is to esterify excess methacrylic acid made at Belle by adding methacrylic acid (MAA) to the esterification step of the MMA process at Memphis, since we believe the esterification equipment has additional capacity.

Two tests have been run esterifying MAA in the MMA esterification step while the plant was running at maximum acetone cyanohydrin feed rate. The results showed that MAA can be added at a 3.5M pounds/hour, (28MM pounds/year MMA) rate to the esterification equipment without unacceptably large increases in MAA concentration in the esterifiers and refining system. This finding allows any excess MAA available from Belle to be used to raise MMA capacity.

Also, when a portion of the process is down or operating at reduced rates, large quantities of MAA can be used to effectively increase the utility of the MMA process. The esterification of MAA has become a strategic part of our plan to provide needed quantities of MMA for the next several years. Methacrylic Acid esterification could add $2MM ATOI/Yr. in 1989 and 1990, if sales demand continues at capacity.

PRIME PLUS® INTRODUCTION

Prime Plus®, our improved polyester/nylon cofilament fishline, was introduced at the American Fishing Tackle Manufacturers Association show in August. This second generation product is stronger and limper than the first version and these changes have been judged to be significant by users in the field. 1988 sales of this product are forecast to exceed $3MM, with a continuation of the market share gains of the past two years since the introduction of Prime®.

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The limpness was achieved by reducing the core content by various amounts depending on size. The increase in tensile strength required changes to increase draw by using three instead of two draw stages. The plant start up is nearing completion and and all sizes have been demonstrated. Programs to eliminate minor problems are underway and we expect this start-up will be successful. Quality is being carefully monitored to ensure that only first quality material gets to the field.

NEW CORIAN® SHAPE PROCESS

Sales of Corian® sinks, vanities, and other "shapes" are limited by our relatively costly and cumbersome shape casting process. A new closed mold shape process is being developed at Yerkes which will increase process flexibility and reduce manufacturing cost by 55% with an expected volume increase. The Scope of Work has been written for new facilities incorporating the new process and a Venture Guidance Appraisal of $12.3MM has been obtained. A ten year IRR of 58%, and a third year OROI of 69% are features of this analysis.

Technical basis for the project is nearing completion including heat and stress analyses and a computer simulation of the process. Development activity is being coordinated through the Engineering Department's Network Planning and Resource Scheduling service. Authorization for the Corian® Shape Facilities Project is projected for December 1988 with turnover in IIQ 1990.

700 - M24 SNIPER WEAPONS SYSTEM

Remington Arms was awarded the U.S. Army M24 Sniper Weapons System Contract on 7/22/87. The contract coordinators were elated over awarding Remington the contract (even though we were not low bidders), due to the ~~superior~~ functional quality of our offering.

The contract initially is for 500 guns at about $2.5MM with first article 25 guns due October 28, 1987, 30 guns April 1988 and 50 guns/month through January 1989. The contract also includes authority for the Army to exercise options of 1) 500 to 1,000 guns/year for three years or 2) 1,001 to 1,500 guns/year for three years.

Incremental ATOI margin on the first 500 systems is 12% and ranges from 15% to 17% thereafter, depending on the options executed.

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The gun will be rollmarked Model 700-M24, which will provide significant incalculable marketing benefits due to tying our commercial Model 700 hunting rifle with the Army's most accurate SWS.

PARKER SHOTGUN

Kolar Arms production of the Parker is progressing favorably as the majority of the receiver components are ready for assembly. The trigger pull of the first assembled action released with a slightly less than a four pound pull with unpolished, as-machined components. The manufacture of the fore-end assembly is also progressing smoothly.

The critical path item continues to be barrel development and our goal is to maintain the safety level of our current Remington line without compromising the fine (classic) balance of the Parker. The recommended heat treatment of our current barrel steel failed to significantly increase the barrel strength. As a result, we are pursuing our alternate solution of using a higher strength alloyed barrel material (4130). A new contour has been developed, barrels are currently being made and are expected by the end of the month. The first new Parkers are expected for test by the end of October.

The Parker will be introduced at the Shot Show in January and a fully engraved show sample will be ready. Orders can be written at the show for the production run of about 50 shotguns to be sold for about $10,000.00 each.

SPECIALTY PRODUCTS AND SERVICES DIVISION

LOW-HEAT-RELEASE, EMBOSSED TEDLAR® SYSTEM FOR AIRCRAFT INTERIORS

Aircraft interiors are a major market for Tedlar® PVF film, generating about 30% of our earnings. This business is threatened by recently issued FAA regulations on the total heat release permitted for aircraft interior composites under burning conditions. These regulations specify a total heat release value of 65 KW min/m2 over a 2 minute period with a peak value of 65 KW/m2 (current composites with Tedlar® film have values of up to 100). New FAA compliant composites with Tedlar® film must be developed rapidly to hold this important market.

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In March we initiated a program with Boeing to develop new Tedlar® films and new composite constructions, with a performance goal of 50 KW min/m2 total release and 50 KW/m2 peak rate. Boeing believes that their product must be below the FAA limits. Two concepts have been used in blocking/slowing the progression of combustion: (1) use of flame retardants to slow the burning rate and (2) use of a char inducing additive, i.e., zinc borate, to form an intumescent char during combustion that "protects" the substrate.

Many compositions were evaluated and our five most promising candidates were sent to Boeing for their evaluations. Three of the five candidates met their "50/50" goal and all five passed smoke test requirements. Film candidates in the desired Boeing colors have been produced in the plant for evaluation at Boeing. Follow-up to meet Boeing's needs continues with an acceptable product required by 1Q88.

IMPROVED TEDLAR® PACKAGING SYSTEM

A new packaging system for finished Tedlar® products (rolls) has been was developed and tested in the field. This packaging system will replace the three existing packages; i.e., tubes, boxes, stack pack and their several variations. The new packaging system will improve product protection against dust and shipping damage, reduce packaging material cost,and increase plant productivity, while at the same time improving appearance and quality image of our high value-in- use product. The annual savings, which consists of reduction in labor and packaging material cost, is estimated at $350M.

A major customer survey, which included test shipments, indicated 80-90% customer acceptance rate. The test shipments also demonstrated the superior performance of the new packaging for product protection, handling, and load stability. Packaging conversion has started with test quantities and will be completed by early 1988. The needed equipment for complete mechanization and automation will be installed in stages, with estimated completion of 2Q88.

POLYVINYL FLUORIDE (PVF) DRUM COATINGS

The chemical inertness of polyvinyl fluoride suggests its use as a coating for drum interiors. Its high cost precludes its competing effectively with epoxy-phenolic coatings now used for packaging low challenge substances, but it is expected to offer cost advantages over drums with polyethylene liners and plastic composite drums.

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We have been working closely with Natico Inc, an innovative drum manufacturer with headquarters in Chicago. We have participated in several coating trials on their line and have identified and overcome certain application deficiencies in our PVF dispersion-based coatings. Thus, by proper pigmentation we have been able to mask objectionable mottle in the product due to localized overbake in uneven oven heat while maintaining spray versatility allowing application by air, air assisted airless, and airless spray as desired in this industry.

In our most recent plant trial, we were able to demonstrate a solution to an "edge peel" problem. By modest increase in the level of soluble acrylic polymers (from 1.5 to 4.5%), anchoring of the forming film is achieved quicker, and "edge peel" kept at an acceptable level in the continuous oven. Tests at Natico show that this new product still retains the desirable high reverse impact of the lower acrylic version. Shells and lids have been prepared for drum storage tests with Freon®. Accelerated tests with concentrated aluminum and zinc salt solutions, and water purification products which have presented unusually difficult packaging problems for some of Natico's customers are underway.

We project an annual sales of this and related products of $1MM early in the 1990's at about 25% penetration of the specialty drum market.

NEW VINYL FLUORIDE POLYMERS AND COPOLYMERS

Polyvinyl fluoride polymers are currently produced for Tedlar® in an 8000 psi autoclave reactor. Improvements in both quality and physical properties of our polymers are desired, and a basic polymerization study to effect longer range improvements has been started. We have been able to adapt an existing polymerization semiworks used for Kalrez® for vinyl fluoride (VF) polymerization studies. In initial scouting studies we have evaluated alternate water soluble initiators, various surfactant systems and combinations of initiators and surfactants for both homo- and copolymers. Conversions of 20 to 70% have been demonstrated under various conditions and characterization of the polymers is underway.

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Copolymerization of VF with vinyl ethers has been demonstrated and copolymers at three levels of perfluoromethyl vinyl ether comonomer have been produced at high rates with monomer conversions up to 70%. Properties of these comonomers are significantly improved over VF homopolymer in terms of solubility, melt flow rheology and lower modulus. In continuing studies we are seeking higher glass transition temperature, greater hardness and improved processing in modified polyvinyl fluoride resins.

VESPEL® ST

Vespel® ST resin produced in the plant pilot unit is now meeting expectations, with eleven out of the last twelve batches of material significantly above preliminary performance specifications. ST is the designation of an amorphous super-tough version of our current SP resin produced via solid-state imidization. A scale-up test in the commercial plant is underway. The areas of concern in the scale-up are the washing and drying/imidization steps where laboratory experiments have indicated the sensitivity of the ST resin to residual pyridine and to the effects of drying bed thickness during imidization. Plans are in place to deal with the pyridine wash problem, and a separate, partially scaled-up drying test is in progress with pilot scale resin to anticipate problems in that area. Achievement of the plant test is critical to the orderly development of the ST product because we are already committed to deliver more resin for customer parts in 1988 than we can produce in our present pilot unit.

In the meantime in the laboratory, we are scouting an alternate atmospheric pressure drying process both as a backup to the existing vacuum drying operation and with a view to improving the economics and quality of both the new resin and our existing products. Early results from this program indicate that this alternate scheme should be better suited to scale up and will produce a higher performance, more uniform material.

KALREZ® 4000

Kalrez® K4000, a perfluoroelastomer curable through a nitrile functionality, was added to the Kalrez® product line about two years ago to meet a need for product renewal. The material offered several improved performance features, reduced compression set, lower durometer materials, and greater oxidative stability than the

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incumbent products, along with a renewed patent position and the promise of significantly improved yields in part manufacture due to its better processibility. This last feature has not yet been realized, although recent molding process developments at the Tralee Park parts facility have, on a spot basis, produced very promising results. At the same time, however, other processing developments have increased the durometer hardness of our current polymer.

Recent laboratory experiments with a modified initiation system and polymerization conditions have produced a polymer with weaker acid end groups, a resultant reduction in polymer bulk viscosity, and improved processing characteristics. Unexpectedly, this change in end groups has also resulted in a step reduction in compound hardness that could permit us to recover the durometer advantage with this product offering. All other properties of this modified polymer appear equivalent to our current product. Our next step is to prove the practical utility of the processing advantages of the modified polymer as well as the equivalency of performance to the point that the business can with confidence develop a plan for introduction of this improved version. If the expected advantages of this modified polymer prove out, we will be in an excellent cost and patent position to meet generic competition.

NEW FASTORQ® BOLT SYSTEM

Development work has continued on the new Fastorq® roof support system using a Du Pont-designed bolt and a fast-curing resin developed by a vendor based on Du Pont input. Extensive field trials have shown consistently higher anchorage strengths and more consistent installations than competing specialty bolt systems. Patent applications have been submitted to protect key mechanical design features of the bolt systems.

The 1987 forecast ATOI for Fastorq® was $900M from sales of 3MM bolts. A delay in executing an agreement with the bolt manufacturer, plus a slower-than-expected process of obtaining regulatory agency approval of the bolting system, delayed the first commercial sale until mid-September. Sales forecasts have been revised downward to 1.5MM bolts in 1988, a break-even position. Although market acceptance still appears good and performance in trials is consistently good, market penetration will be slower than previously expected.

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DEPARTMENTAL STRATEGIC RESEARCH

MACROMONOMERS BY GROUP TRANSFER POLYMERIZATION (GTP)

The ability of the GTP process to put one and only one functional group on every molecule has led us into the area of methacrylate macromonomers in which we prepare the desired GTP polymer starting with a blocked hydroxyl or blocked carboxyl initiator and then convert the resulting monofunctional polymer into a macromonomer by post reaction. We have made a variety of polymeric chains, with and without additional functionality, and have successfully converted them into macromonomers.

These macromonomers undergo free radical polymerization with acrylates to give phase separating comb polymers with properties similar to those needed in pressure sensitive adhesives. We are working with 3M Company in this area and see a potential for $1.5MM sales of macromonomer to them at 40% ATOI margin. The total adhesives market potential for macromonomers is estimated at $10-15MM with 30% ATOI margin.

C&P has made a copolymer from a macromonomer of polydiethylaminoethyl methacrylate and found this to be a good dispersant as a fuel oil additive. Potential for this application is $175-350M in transfer business with 40% ATOI margin. Macromonomers have also been supplied under secrecy agreements to Hitachi Chemical and Kansai Paint Co.

IONIC BLOCK COPOLYMERS FOR WATERBORNE FINISHES SYSTEMS BY GTP

There is need for improved surfactants and dispersants in waterborne finishes to improve the balance of paint stability and water sensitivity of the resultant films. We have prepared hydrophobic/hydrophilic block copolymers by GTP for evaluation as surfactants and pigment dispersants in automotive and refinish water borne systems. Acrylic emulsion polymers prepared using GTP block copolymer surfactants have high surface tension and low particle size and we expect that they will exhibit less foaming and give films with lower water sensitivity than conventional systems. Ionic dispersants from GTP block copolymers show improved resistance to flocculation by added ionic materials compared to controls. Second stage testing is being conducted at Marshall and Troy Laboratories. Based on results from these tests, we will modify the surfactants and dispersants for the best property balance with the initial targets being the butyl acrylate emulsion polymer resin and pigment dispersants for waterborne automotive base coats.

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FUNCTIONAL STAR POLYMER APPLICATIONS AND SCALE-UP

Star polymers, our name for crosslinked polymer particles made by Group Transfer Polymerization, are being tested in several uses. In the past few months we have made significant progress in areas that are important to the commercial use of star polymers as reinforcing agents in flexible coatings applications. We have developed a process for making a hydroxyl functional star polymer that cuts the cost in half. Tests indicated that this polymer provides equivalent performance properties in our refinish "Uniclear" candidate while allowing a significant reduction in VOC to less than 4 pounds per gallon. Process studies have defined the conditions necessary to prepare stable and reproducible star polymers with minimum free arm content. A 300 gallon batch has been prepared for development work at Troy Lab. The incentive for a truly universal clear is the potential to increase clear sales from 100M gallons to 1MM.

A coil coating vehicle that provides an excellent flexibility/hardness balance has been developed using this star polymer, a polyester resin and a commercial blocked isocyanate crosslinking agent. Two potential customers have been supplied with working samples of enamel and a polyester/star blend.

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RD-49-8

REMINGTON ARMS COMPANY, INC.

INTER-DEPARTMENTAL CORRESPONDENCE

Remington (DUPONT) PETERS (DUPONT)

XC: COMMUNICATIONS ROOM
PLANT BULLETIN BOARDS
K.W. SOUCY
J.R. BALIO

"CONFINE YOUR LETTER TO ONE SUBJECT ONLY"

NOVEMBER 11, 1987

TO: J.F. MATOUSEK
FROM: QUALITY ASSURANCE ENGINEERING

ILION MARKETING QUALITY AUDIT RESULTS ON 11-9-87

Wilmington/Ilion Marketing people E.O. Fini, R.S. Santoleri and J.D. Rogers, audited 5 each of Models 700 ADL, 700 FS, 700 RS, 870 Wingmaster and (3) 700 gun Kits.

OVERALL IMPRESSION: VERY GOOD

SUMMARY:

The auditors' consensus was that all except one of the sample guns were Warehouse quality. One M/700 RS was not acceptable because of barrel-fore-end contact on one side.

OVERALL IMPORTANCE RANKING OF NONCONFORMITIES:

1. (M) 700 ADL: Rear swivel stud turned in too far; sling swivel would not assemble to it. Sanding was not uniform on both sides of swivel stud. 1/5

2. (C) 700 ADL, 700 FS, 700 RS, 700 Gun Kit: Hang tags missing. 18/18

3. (M) 700 RS: Front guard screw slot buggered. 4/5

4. (M) 870 WINGMASTER: Barrel-to-Fore-end opening not uniform (Fore-end almost contacts barrel with action open). 1/5

5. (M) 870 WINGMASTER: Excess grip cap margin at right side rear. 1/5

Removal Date: 11/23/87
WAW/rct

OVER

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CLASSIFICATION	DEFINITION
(R)	This is a nonconformity that should not be found in the Warehouse. The product would probably be returned by the customer and create a justified customer complaint.
(H)	This is a highly undesirable non-safety-related nonconformity that detracts substantially from the appearance or perceived quality level of the firearm. The product may be returned by a customer and create a justified customer complaint. However, the individual nonconformity is not significant enough to withhold or withdraw product from the Warehouse. Immediate corrective action is needed.
(M)	This is a nonconformity that detracts from the appearance or perceived quality level of the product.
(L)	This is a nonconformity that detracts slightly from the appearance or perceived quality level of the product. While undesirable, it is only a minor annoyance to the customer and is acceptable at low frequencies.
(C)	This is used (qualitatively) to identify potential issues; describe overall impressions, positive or negative; or note quality-of-design items. It becomes part of the audit report, but does not influence numerical indices of audit results.

RD-49-6

REMINGTON ARMS COMPANY, INC.

INTER-DEPARTMENTAL CORRESPONDENCE

Remington DUPONT PETERS DUPONT

"CONFINE YOUR LETTER TO ONE SUBJECT ONLY"_____

E.O. FINI-WILM.
J.F. MATOUSEK, JR.
K.W. SOUCY-S&K
G.A. HELMER-S&K

APRIL 28,1988

R.S. SANTOLERI- WILMINGTON

ILION MARKETING QUALITY AUDIT RESULTS ON 3-14-88

Wilmington marketing people R.S. Santoleri and J.M. Bunting, audited 5 each of Models 700 BDL, 7600, N66, 11-87 Trap and 870 EXPRESS.

OVERALL IMPRESSION: **VERY GOOD**

SUMMARY: Auditors' consensus: All of the sample guns were Warehouse quality.

The overall appearance of the 7600's and 11-87, was rated "Excellent".

OBSERVATIONS RANKED BY IMPORTANCE AND CORRECTIVE ACTIONS

SERIOUSNESS	ITEM		FREQUENCY	CORRECTIVE ACTION
(L)	700BDL:	Front sighthood interfered with foam box liner.	5/5	Mold alterations to be reviewed with box vendor.
(L)	700BDL:	Wood/metal margin next to safety switch varied.	5/5	Sanding template S&K to be improved.
(M)	700BDL:	Side of grip cap dented.	1/5	
(M)	11-87 TRAP:	Stock rounded off next to recoil pad backer.	5/5	New sample provided to S&K repair people.
(L)	11-87 TRAP:	Rubber flashing on rear face of recoil pad.	3/5	Flashing will now be removed at S&K.
(L)	N66	Minor surface splay on side of trigger guard.	5/5	More control over heat during processing and more awareness at outgoing inspection.

SERIOUSNESS CLASSIFICATION PER ITEM:

(R); Restricted, (H): High, (M): Medium, (L): Low, (C): Comment only
(see reverse side of sheet for definitions)

J.F. WINSKE, PLANT MANAGER

BY: J.R. BALIO, SUPERVISOR
PROCESS ENGINEERING

WAW/slw

OVER

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CLASSIFICATION	DEFINITION
(R)	This is a nonconformity that should not be found in the warehouse. The product would probably be returned by the customer and create a justified customer complaint.
(H)	This is a highly undesirable non-safety-related nonconformity that detracts substantially from the appearance or perceived quality level of the firearm. The product may be returned by a customer and create a justified customer complaint. However, the individual nonconformity is not significant enough to withhold or withdraw product from the warehouse. Immediate corrective action is needed.
(M)	This is a nonconformity that detracts from the appearance or perceived quality level of the product.
(L)	This is a nonconformity that detracts slightly from the appearance or perceived quality level of the product. While undesirable, it is only a minor annoyance to the customer and is acceptable at low frequencies.
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RD-4-8

REMINGTON ARMS COMPANY, INC.

INTER-DEPARTMENTAL CORRESPONDENCE

Remington DUPONT PETERS DUPONT

"CONFINE YOUR LETTER TO ONE SUBJECT ONLY"_____

XC: COMMUNICATIONS ROOM
PLANT BULLETIN BOARDS
K.W. SOUCY
J.R. BALIO

MARCH 24,1988

TO: J.F. MATOUSEK

FROM: QUALITY ASSURANCE ENGINEERING

ILION MARKETING QUALITY AUDIT RESULTS ON 3-14-88

Wilmington marketing people R.S. Santoleri and J.M. Bunting, audited 5 each of Models 700 BDL, 7600, N66, 11-87 Trap and 870 EXPRESS.

OVERALL IMPRESSION: VERY GOOD

SUMMARY:

The auditors'consensus was that all of the sample guns were Warehouse quality.

The overall appearance of both the 7600's and 11-87 Trap's was rated "Excellent".

OVERALL IMPORTANCE RANKING OF OBSERVED NONCONFORMITIES:

1. (L) 700 BDL: Front sight hood did not fit foam box liner properly. 5/5
2. (L) 700 BDL: Wood/Metal margin next to safety switch varied. 5/5
3. (M) 700 BDL: Side of grip cap dented. 1/5
4. (M) 11-87: Stock rounded off next to recoil pad backer; makes it look like an opening. 5/5
5. (L) 11-87 Trap: Rubber flashing on rear face of recoil pad. 3/5.
6. (L) N66: Minor surface irregularities (splay) on sides of trigger guard. 5/5

NYLON 66 SUGGESTION: Create a pre-printed label to identify the scope location inside the box

Removal Date: 4-8-88
WAW/slw

OVER

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CLASSIFICATION	DEFINITION
(R)	This is a nonconformity that should not be found in the Warehouse. The product would probably be returned by the customer and create a justified customer complaint.
(H)	This is a highly undesirable non-safety-related nonconformity that detracts substantially from the appearance or perceived quality level of the firearm. The product may be returned by a customer and create a justified customer complaint. However, the individual nonconformity is not significant enough to withhold or withdraw product from the Warehouse. Immediate corrective action is needed.
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(L)	This is a nonconformity that detracts slightly from the appearance or perceived quality level of the product. While undesirable, it is only a minor annoyance to the customer and is acceptable at low frequencies.
(C)	This is used (qualitatively) to identify potential issues; describe overall impressions, positive or negative; or note quality-of-design items. It becomes part of the audit report, but does not influence numerical indices of audit results.

MONTHLY REPORT

William A. Warren, Jr
12-18-87

SAFETY
- No new initiatives

NEW MACHINE
Safety paint machine accepted 12-3-87.
Installed @ Ilion week of 12/14/87
There are additional items to complete before startup and AS inspection.
We will be doing T&P site runoff late this month or early next month.

QUALITY
The results of the Nov 9 audit, including the corrective actions resulting from it, are complete. They require only KWS signature for distribution.

TRANSMITTALS
The 552/22 BDL restyle transmittals added to Process record / MRP data base are complete. This was referred to in last month's report.

SIGNIFICANT PRODUCTION SUPPORT / PROBLEMS
"Green" surface discoloration on Safeties ready for paint operation. Various "theories" on origin of this. Short term correction was sand tumble to remove. A ~~suggest~~ recent change made to the process record may not have been followed.

SPECIAL ITEMS
Provided experience insights on consequences of a broken connector in M 700, during several 1 on 1 conversations.

PERSONNEL
My appraisal covering my service in [redacted] completed!

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Automotive Products Department

and

Fabricated Products Department

Research & Development

Quarterly Summary

October -- December 1987

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SPECIAL CONTROL
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EDITED BY M.M. COBURN

Distribution on Back Cover

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ABSTRACTS

AUTOMOTIVE PRODUCTS DEPARTMENT

FINISHES DIVISION

TWO COMPONENT CLEARCOATS FOR AUTOMOTIVE FINISHES 7

Customer interest and activity around isocyanate containing two component clearcoats are focused on improved resistance to environmental etching, an increasing source of consumer complaints and in-transit repair costs. The first commercial target is GM's Bowling Green plant representing potential sales of $5MM with Ford's Edison plant and GM's Saturn the next potential targets.

PERFORMANCE COATINGS - AMBIEMT CURE SYSTEMS 7

Commercialization of epoxy/anhydride systems started in the fourth quarter, with additional products scheduled to be introduced in 1988. Initial sales potential is about $4MM. Acrylic silane systems are in the early stages of laboratory characterization and development.

AUTOMOTIVE ALTERNATIVE APPLICATION PROCESS 8

Feasibility of using a lamination coating process to finish exterior vehicle parts has been demonstrated in a joint development effort with Avery Corporation. To establish commercial viability, we are working with GM to make a limited number of fender extensions for captive on-care evaluation beginning at mid-year.

PLASMA TREATMENT OF AUTOMOTIVE SUBSTRATES 9

Application of plasma treatment technology to modify both plastic and metal substrates to upgrade performance properties are being exploited. Its use to upgrade coating adhesion to polyolefin-based plastic substrates has been demonstrated. Preliminary evaluation of a modified polyolefin substrate from PPD also shows promise ~~as~~ a route to upgrade adhesion.

AUTOMOTIVE CATHODIC ELECTROCOATING 10

Efforts to commercialize a non-PPG electrocoat primer outside of Ford are focused on the Suzuki/GM joint venture in Canada. Of three options explored, a Kansai modification of Hoechst technology appears most promising and has been submitted to Suzuki.

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SUPPLIER FINISHES - FLEXIBLE PRIMER 11

New business opportunities for our Flexible Primer for plastic substrates at both Ford and General Motors are expected to materialize in the first quarter of 1988.

IMPROVED REFINISH CRONAR® CLEARCOAT 11

An improved Cronar® clear will be introduced in the first quarter of 1988 and leads have been developed to provide further acceleration in cure to improve performance versus isocyanate enamels.

REFINISH COLOR DEVELOPMENTS 12

With an objective of keeping a complete color product offering for the Refinish Business, 7600 colors were developed in 1987, a 50% increase over 1986. This effort supports the approximately $200MM annual Refinish Color sales and our strong competitive position.

NEW METALLIC THEORY-FINISHES 12

New Metallic Theory (NMT) provides a model of the multi-angle optical behavior of colorant mixtures and a successful test of characterization formula color value prediction was completed.

COMPOSITIONAL ASSURANCE TESTING SYSTEMS (CATS) 13

Cost savings and quality improvement benefits from our CATS (Compositional Assurance Testing) by automated infrared spectrometry have brought enthusiastic adoption by both domestic and international plants. In domestic finishes plants, cost savings for the first three quarters of 1987 are estimated at $2.65MM. This has generated a request for assistance in other quality assurance areas.

FABRICATED PRODUCTS DEPARTMENT

CONSUMER PRODUCTS AND SPECIALTY RESINS DIVISION

RECYCLE OF SPENT ACID IN METHYL METHACRYLATE EXCEEDS PROJECT EXPECTATIONS 14

The project to recycle spent acid in the Methyl Methacrylate process has allowed 10-11% recycle versus the 6% claimed in the project. In addition to allowing us to realize the 15MM ppy extra monomer capacity, the higher recycle has improved process yields relative to that expected at the high production rates. The improved yield has increased ATOI by $150M while the 15MM ppy higher production rate is worth $1.6MM ATOI as monomer sales are at plant capacity.

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HIGHER METHACRYLATE MONOMERS EXPANSION 14

A continuous process for the manufacture of n-Butyl Methacrylate from methacrylic acid has been developed and a $3MM project is scheduled for authorization 1Q88. The project will reduce the internal use of Methyl Methacrylate, avoiding outside purchase and yielding $700M per year ATOI.

CORIAN® CRACKING 15

A more crack resistant formulation has been identified utilizing methyl methacrylate-g-butadiene-styrene (MBS) particles in the Corian® sirup while reducing the alumina tri-hydrate filler content. Subject to additional testing, early 1988 plant conversion is planned to eliminate this leading quality complaint in our $84MM Corian® business.

NEW CORIAN® SHAPE PROCESS 16

A new closed-mold process for producing Corian® Shape products is nearing the semiworks testing stage. Marketing plans to develop the Shape market are being implemented in anticipation of process development and equipment design successes. Achievement of process and product goals will provide a 50% IRR on a $12MM investment.

TEFLON® PFA POWDER COATING APPLICATIONS 16

A joint program between FPD and PPD is moving Teflon® PFA powder-based coatings technology nearer to commercial success. Improvements in the process used to make the powder have been defined. One key market application is a coating for light bulbs, estimated at $20MM at 14% ATOI margin by 1992.

RICE COOKERS IN ASIA - A KOREAN OPPORTUNITY 17

We are working with a Korean firm to develop markets in Asia for coatings developed earlier for rice cookers and possibly microwave ovens. Success of these products could result in penetration of the Japanese market.

ACRYLIC BEAD RESINS BY SPECIAL CHAIN TRANSFER PROCESS COMMERCIALIZED 17

Cobalt-based Chain Transfer technology has been successfully used to synthesize 40M lb of acrylic bead resin to satisfy a commercial order, highlighting the rapid commercialization of this new technology. The initial opportunity represents $1.25MM in sales with a PTOI margin of 28% in 1988. Other opportunities for these sulfur-free resins are being sought.

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MACROMONOMERS FOR ACRYLIC PRESSURE SENSITIVE ADHESIVES 18

Comb-type copolymers utilizing macromonomers prepared via SCT and GTP show promise as thermoplastic elastomeric binders for pressure-sensitive, hot-melt adhesives. A route to these products which avoids adverse patent art has been defined.

SOLUTION POLYMER ISOLATION FACILITY 18

A new facility for the isolation of solution acrylic polymers at the Marshall Laboratory is on schedule, with completion expected by mid-1988. A LUWA Filmtruder is the basis of the process.

ACRYLIC BINDER FOR ELECROSTATIC PRINTING 19

A specially engineered acrylic polymer contributes to the success of the Imaging Systems Department's new Electrostatic Proofing system which is about to be introduced commercially, with polymer sales potential of $0.5-$1.5MM.

ACRYLIC POLYMER FOR AQUEOUS-DEVELOPABLE CYREL® 19

A precisely engineered acrylic microgel polymer shows promise as a candidate for Imaging Systems Department's new aqueous developable Cyrel® flexographic printing system. A functional hard shell over a soft core is the key to the microgel function. Initial sales opportunity for FPD is $1.8MM, with significant growth potential.

CONTINUOUS REACTOR/EXTRUDER PROCESS FOR ACRYLIC RESINS 20

Initial evaluation of new processing equipment, developed by Belland AG, indicates this may be a viable route to manufacture and isolate current resins that have high conversion costs in our bead process. Implementation could significantly increase plant capacity for our other resins.

MODEL 700 MOUNTAIN RIFLES CALIBER ADDITIONS 20

Three popular short-action caliber versions of the Model 700 Mountain Rifle are being added for 1988. Production Trial and Pilot is underway, with annual sales volume estimated at 3000 rifles.

MODEL 1100 MAGNUM RETROFIT BARREL FOR STEEL SHOT 20

A program to provide a retrofit barrel and choke tube system for owners of M/1100 12 gauge Magnum shotguns to handle steel shot is currently undergoing Design Acceptance Testing. Annual sales are estimated at 3000 barrels.

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SPECIALTY PRODUCTS AND SERVICES DIVISION

IMPROVED HIGH TEMPERATURE PERFORMANCE FOR ALDYL® PIPE 21

Aldyl® pipe having improved high temperature performance can be manufactured from polyethylene resin having a modified molecular structure. We are working with our supplier to obtain modified material for experimental pipe fabrication.

LOW HEAT RELEASE TEDLAR® FILMS FOR AIRCRAFT INTERIORS 21

Development of low-heat-release film has progressed to where Boeing is enthused and will use our film on a prototype plane to demonstrate compliance to 1990 FAA regulations. This development is particularly vital to Tedlar® as the aircraft segment of the market accounts for about 30% of Tedlar® annual earnings.

NEW TAPERED PAINTBRUSH BRISTLES 22

We have begun a program with the help of Engineering Department to develop a replacement for natural boar bristle which is in short supply worldwide. This opportunity for $3-4MM per year in new sales requires a new taper profile in the product.

NEW FABRIC FOR DYMETROL® SEATING SUPPORT SYSTEMS 22

Development of a new fabric weave and new equipment for customers to use for installation has contributed to adoptions of this product in the furniture industry. Significant commercial introductions are scheduled for the first quarter, with an $8.2MM sales and $600M ATOI goal by 1990.

DYMETROL® MECHANICAL CABLE 23

Oriented Dymetrol® cable has been made in 3mm and 4mm diameters. Potential applications, particularly in automobiles, have projected sales in 1989 of $2.6MM, growing to $7MM by 1992.

NEW FLEXIBLE EXPLOSIVE PRODUCT 23

Progress has been made on the development of a reduced flammability flexible explosive without sacrifice of the explosive energy of current Deta Sheet®. A partially crosslinked fluorocarbon binder provides the product improvement. New business potential is $60MM over the next seven years.

VESPEL® ST PLANT TEST 24

Development of the Vespel® ST resin process has progressed to a full scale plant test. Problems in drying will require new facilities.

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KALREZ® PRODUCTION RUN 24

A new record in uninterrupted reactor operation has been demonstrated for Kalrez® polymer synthesis. This achievement is expected to be a key factor in the drive for improved product quality, as well as an important cost reduction.

DEPARTMENTAL RESEARCH

MOLDING PROPERTIES OF GTP PREPARED PMMA 25

Extrusion molding tests have demonstrated that GTP prepared polymers give wider extrusion latitude and, because higher molecular weight polymer can be extruded under normal conditions, better mold definition.

ORTHODONTIC LIGATURES 26

We have developed a product concept and manufacturing process for a novel ligature and have begun a study of how we best might approach this market which uses 600MM of these each year. The prototype product appears to offer advantages in time of installation to the dentist.

MACROMONOMER SYNTHESIS VIA SPECIAL CHAIN TRANSFER 26

Technology has been successfully scaled up in the semiworks and several market tests including first small sales will follow.

FUNCTIONAL MACROMONOMERS 26

Functional macromonomers synthesized via Special Chain Transfer technology can be used as polymeric dispersants in both aqueous and non-aqueous paint systems. Initial results show very promising properties in the dispersions.

NEW PARTLY CROSSLINKED POLYMER DISPERSIONS 27

A new technology provides dispersions which have many of the properties of Interpenetrating Polymer Networks (IPN's) that simulate graft polymers, but have additional performance advantages. These new dispersions called Intersecting Coreticulated Polymers or ICPs provide inseparable blends of incompatible polymers with interesting properties. First candidates for commercial follow-up are polyvinyl fluoride/acrylic blends.

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AUTOMOTIVE PRODUCTS DEPARTMENT

FINISHES DIVISION

TWO COMPONENT CLEARCOATS FOR AUTOMOTIVE FINISHES

Customer interest and activity around isocyanate containing two component clearcoats (2K-NCO) are intensifying. The primary incentive for this chemistry is improved resistance to environmental etching, along with expectations of improved appearance. Etching has been an increasing consumer complaint and has been the source of a number of costly repair efforts for original equipment manufacturers on vehicles exposed in pre-delivery lots.

Three cars were painted with 2K-NCO clearcoat/high solids basecoat enamels in three different colors, on line at the Detroit Hamtramck (GM) plant in October. The appearance of these vehicles was considered equivalent to normal production vehicles on horizontal surfaces with a slight disadvantage on vertical surfaces. Despite this, the customer was impressed. GM-Saturn has painted experimental vehicles with our 2K-NCO clearcoat over waterborne basecoat and find the system attractive. Trials at a Ford experimental facility (Glendale) has resulted in significant progress versus Ford requirements.

The first commercial target for Du Pont appears to be the GM-Bowling Green Corvette assembly plant, representing $5MM in annual sales, with conversion anticipated for the 1989 model year. A 2K end-of-the-line repair clearcoat will be trialed in the first quarter of 1988, with in-line trials following. We expect to be the backup supplier for a similar program at Ford's St. Thomas, Ontario plant beginning in the third quarter of 1988, and targeting the Ford Edison assembly plant for the 1990 model year.

PERFORMANCE COATINGS - AMBIENT CURE SYSTEMS

Two new ambient cure chemistries, epoxy/anhydride and acrylic silane, are being developed for applications in Automotive OEM, Refinish, and Industrial Maintenance Finishes.

A new Refinish sealer based on epoxy/anhydride chemistry was commercialized in Europe in October 1987 (1988 sales forecasted at $780M), to be followed by an Industrial Maintenance topcoat in the first quarter of 1988 ($3MM sales potential). Commercialization of a Refinish clearcoat is planned for the fourth quarter of 1988.

In support of the epoxy/anhydride program, exterior durability testing on test cars in Florida and Puerto Rico shows overall ratings well within commercial guidelines after one year exposure. The tests also show that the glycidyl methacrylate (GMA) containing acrylic is the preferred candidate for the epoxy portion of the system for the best durability.

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Continuing development will focus on water sensitivity, the balance between pot life and catalyst type and level, and application latitude. Further definition of re-repairability, and buffability is also required. A baking clear analog is also under development.

Initial application studies on car hoods and one automobile with an acrylic silane system showed promise, but identified some additional deficiencies that need to be overcome. The system, based on a silane resin supplied by Kanegafuchi Chemical Industry, showed slight to moderate gloss die-back on painted hoods, and exhibited moisture sensitivity during the first few hours after a car was painted under cold and damp conditions. Other weaknesses of the current system are poor flexibility and a high residual stress.

Several leads for solving these problems involve changing the crosslinking configuration through the polymer architecture and use of reactive diluents.

AUTOMOTIVE ALTERNATIVE APPLICATION PROCESS

General Motors (along with other domestic manufacturers) has an objective of reducing their cost of manufacture in order to compete more effectively with foreign imports. One such approach is to replace the conventional spray applied paint operation to finish vehicle exteriors with a lower cost process. In line with this objective, we have been working on a strategic effort with the Thermark Division of Avery Corporation under a Joint Development Agreement to develop Thermark's lamination coating process.

In the first quarter of 1987, we demonstrated process feasibility by decorating 100 red Pontiac Fiero quarter panels in a test program. This part used ABS plastic and a basecoat/clearcoat paint based on polyvinylidene fluoride ("Kynar") blended with acrylic (Elvacite®). Although mar resistance of this system in laboratory tests was somewhat poorer than desired, test quarter panels mounted on two test cars at GM's Milford Proving Grounds showed all-around good wear and retained appearance properties after 30,000 test miles and 25 car washes. Also, preliminary results of exposures at GM's Jacksonville test site for environmental etch resistance showed excellent performance.

In November, Du Pont and Avery signed a secrecy agreement with General Motors (CPC Division) to jointly establish commercial viability of this decoration process. Our first target is to produce 150 fender extensions for the Pontiac Fiero in each of 6 colors for mounting on captive cars at mid-year.

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In December, we reviewed for GM management all performance data related to the "Kynar"/Elvacite® paint system versus their specifications. They were impressed with our progress and are moving ahead on their end of the agreement to provide the necessary injection mold and vacuum form tools to enable test runs on the fender extension parts.

Research continues to develop improved paint systems which can be used on flexible substrates for which "Kynar"-based paints are too brittle. Significant progress has been made with polyvinyl fluoride (Tedlar®) paint system and expanded testing is planned for the first quarter of 1988.

Based on reports from GM, we have established a lead over competitors including PPG and 3M, in alternatives to spray applied paints for vehicle finishing. A patent strategy to protect this lead and to inhibit competitive entry has been defined in conjunction with Business and Legal representatives. An economic model for this process is under development.

PLASMA TREATMENT OF AUTOMOTIVE SUBSTRATES

Thermoplastic olefin (TPO) plastic based on Ethylene Propylene Diamine Monomer (EPDM) reinforced polypropylene, is a low cost and preferred material for automotive body panels except for difficulty with adhesion of coatings. Plasma treatment of TPO cleans the surface, modifies the surface chemistry, provides for excellent adhesion of coatings, and eliminates the need for special adhesion promoting sealers.

We have demonstrated performance with our coatings and long-term tests are underway to establish a technical base for introduction to our customers as appropriate with business plans. Our laboratory plasma unit will be operational in January 1988 and studies will be expanded to include both surface treatment and polymerization capability to impart functional properties to plastic and metal surfaces, such as abrasion resistance, lubricity, corrosion and chemical resistance.

While pursuing plasma treatment as a process route to achieve adhesion of coatings to polyolefinic plastics, we are also supporting efforts by PPD to achieve adhesion via polymer modifications or additions. We have screened a broad array of such polymers through surface energy measurements and actual coatings evaluations. A promising lead based on the addition of an acrylic copolymer to the TPO formulation is now being more extensively evaluated.

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AUTOMOTIVE CATHODIC ELECTROCOATING

The objective of the electrocoating program is to develop and commercialize a cathodic electrocoating technology that does not infringe PPG patents which could then be used to obtain business with new customers beyond the current MCCI (licensed PPG technology) business at Ford. A major component of our strategy to do this has revolved around licensing technology thus giving us a starting point to further our own development. Currently, we have been exploring three options: a Hoechst technology based on transesterification crosslinking, a Kansai modification of a Hoechst technology based on a combination of reactive double bonds and transesterification crosslinking and an ICI technology called ICICLE based on blocked isocyanate crosslinking. In the ICICLE case, we are not as yet under license but are operating under a secrecy agreement allowing us to evaluate the material.

From a patent standpoint, all three options are clear of all compositional patents. However, all three options may have some problems both in the U.S. and Canada with certain patents dealing with bath manipulation and further study is underway.

From a cost standpoint, the Hoechst system and the Kansai modification of the Hoechst system are 10-15% higher than the current MCCI commercial system while the ICICLE system is approximately 10% lower.

Currently, we are focusing on the Kansai modification because of an opportunity to obtain business at the Suzuki/GM joint venture in Canada (CAMI). Plant start-up for CAMI is scheduled to begin the 4th quarter 1988 with normal production to begin during the 1st quarter of 1989. In Kansai's testing versus Suzuki specifications, they found their modification of the Hoechst technology equal to the PPG-ED-3150A type material for corrosion, smoothness, adhesion and throw and superior to that material for edge coverage, bake-off loss and topcoat discoloration. Over the past several months, we have had our technical people working in Kansai laboratories preparing the formal submission to Suzuki. This submission was made in late October. Suzuki testing will continue through February before they make their decision on an electrocoat supplier.

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SUPPLIER FINISHES - FLEXIBLE PRIMER

Our Supplier Finishes Marketing organization has identified six key target accounts for 1988 for both Primer and Topcoat sales. We have made significant progress at two of these accounts - Ford's Utica Fascia and Trim Plant and GM's Fisher-Guide Anderson RIM Fascia Plant - with our GM approved 764-140 Flexible Primer. PPG primer is currently in use at both of these sites along with a Bee Chemical primer at Ford Utica. Over the last several months, we have conducted successful on-line test runs at both sites using standard 30 gloss 764-140 at Fisher-Guide and a 20 gloss analogue at Ford-Utica coded 711-001. A patent application covering this technology was recently allowed.

Fisher-Guide is considering our product as a second source to PPG. While competitive in performance properties to the PPG product, we are able to offer Fisher-Guide an attractive cost reduction while still maintaining an ATOI margin of 10%. Our last line trial went very well and GM is currently in the process of evaluating parts from this run as the final step in the approval process.

The same alternate sourcing/competitive performance/cost advantage position which exists at Fisher-Guide also prevails at Ford-Utica. However, we do not as yet have product performance approvals from Ford for 711-001. Final test panels which demonstrate performance equivalency to their existing primers will be submitted to Ford in January.

Initial projected combined volume at these two sites is in the range of $4MM with an ATOI of $400M.

IMPROVED REFINISH CRONAR® CLEARCOAT

For several months, an intensive program has been underway to assess technical leads to improving the early hardness characteristics of Cronar® non-isocyanate topcoats which were introduced in early 1987. As a result of this work, a revised Cronar® clearcoat for use over Cronar® basecoat colors was developed and introduced in selected areas of the country in the 4th quarter. The new clear provides a 10-40% improvement, depending on shop temperature, in early hardness development along with improved surface lubricity and application characteristics. This product has been very positively received by most users and plans are being formulated by Marketing to replace our existing clear during the 1st quarter of 1988.

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Despite this improvement, Cronar® coatings are still significantly inferior to isocyanate-based technologies for early cure and hardness development and further improvements are necessary for Cronar® to substantially displace isocyanate enamels in the Refinish marketplace. Two leads have been developed which offer promise for further accelerating the cure of Cronar® into the same relative performance as isocyanate enamels. Use of an epoxy functional siloxane additive to provide additional hardness through rapid moisture cure is one route, while modification of our acrylic epoxy crosslinker with a new monomer, acetoacetoxyethyl methacrylate, which reacts rapidly with our acrylic amine clear represents another lead. Extensive field testing of both leads will begin in the 1st quarter for potential commercialization in late 1988. Cronar® is expected to contribute $3MM ATOI to Refinish in 1988.

REFINISH COLOR DEVELOPMENTS

With the goal of providing a complete line of colors to support the Refinish Business, 7600 colors were developed in 1987, a 50% increase over 1986. Refinish Color sales are $200M annually and represents about 50% of the business. The substantial increase in demand for color developments stems from 300 new car color introductions, addition of two new qualities to the product line, on-demand support for new truck colors, as well as upgrading of existing color matches and pigment changes caused by changing availability of supplies. The demand continues to grow, with 8200 color developments projected for 1988. This activity supports our strong market position so that customer needs can always be met with a Du Pont product.

NEW METALLIC THEORY - FINISHES

New Metallic Theory (NMT) provides a model of the multi-angle optical behavior of colorant mixtures so that formula color values and colorant vectors can be accurately predicted. Our objective is to implement NMT in colorant characterization and color vector prediction programs so that we:

- make full use of our three angle measurement (MAC) and shading (TRE) capabilities by predicting a three angle vector database.
- eliminate the need for labor intensive manual vector preparation.
- improve the accuracy of vector predictions to increase shading productivity in Manufacturing and color development.

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We have completed a successful test of characterization formula color value prediction and colorant vector prediction in one line for three angle data. Current effort is directed to debugging software and procedures as we test the system in two Refinish qualities. We expect to have NMT characterization and vector generation capability fully operational by year end. We are establishing an NMT characterization team including internal customers to prioritize and coordinate development of an NMT colorant database for millbase and tint product lines. Topcoat sales represent about $500MM of our Automotive Finishes business, which derives benefits from this program.

COMPOSITIONAL ASSURANCE TESTING SYSTEMS (CATS)

The excellent cost savings resulting from our CATS (computer assisted infrared Compositional Assurance Testing System) system plus a concern with the variability of raw material quality and source, has spurred our international finishes plants to adopt this system rapidly. At the Mechelen, Belgium, plant control laboratory, the vendor supplied a newer model spectrometer which required software modifications. They started up in December 1987, and will be routinely testing some products in the first quarter of 1988. Ajax, Canada started up before the end of 1987, and Spain and Venezuela have approved CATS projects and will start up as soon as all the hardware is received.

All of our U.S. finishes plants are using CATS to test some products routinely, with the number and extent depending on individual plant needs and priorities. Savings for 1987, through the third quarter, are estimated to be $2.65MM. Application of CATS to plant service problems requires more training, which is underway. Our long term goal is to tie all the plant systems together so that they can communicate with each other and share a common spectral data base. We have software from the vendor which will permit us to interface the CATS computers with the Departmental VAX, and are proceeding to write software to permit facile transmission of spectral data.

The manufacturing organization has been sufficiently impressed with this effort that they have asked the infrared committee to expand its charter and to look for other instrumental quality assurance technology. The committee has adopted the name, "Future Analytical Chemistry and Testing System" (FACTS) to reflect their charter. They are now sorting out the most pressing plant problems and assessing potential impact, with pigment and dispersion quality identified as high priority items.

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FABRICATED PRODUCTS DEPARTMENT

CONSUMER PRODUCTS AND SPECIALTY RESINS DIVISION

RECYCLE OF SPENT ACID IN METHYL METHACRYLATE EXCEEDS PROJECT EXPECTATIONS

An increase in plant capacity for methyl methacrylate has been achieved by recycling spent sulfuric acid directly to the process without converting it to 100% sulfuric in the acid recovery plant. Operation of the spent acid recycle process, which was put on line in mid-July, is now routine.

The primary goal of the $175M project, as reported in the 3Q87 R&D Report, was to increase Methyl Methacrylate (MMA) capacity by 15MM ppy, via addition of 6% spent acid recycle to virgin acid in the amidation step. The regeneration of spent acid to virgin acid is the rate limiting step of the MMA process; therefore, direct recycle of spent acid increases MMA capacity. The project has exceeded expectation and actual sustained operation has been at 10-11% recycle. This has permitted realization of the 15MM ppy extra capacity at a higher than anticipated acid to Acetone Cyanohydrin ratio, which has improved yield relative to that expected at the high production rate.

The improved yield has increased ATOI at a rate of $150M per year while the 15MM ppy higher production rate is worth $1.6MM ATOI as monomer sales are at plant capacity. The only significant concern during the implementation was an increase in "low boilers" in MMA product. These are primarily ester and nitrile by-products which boil near MMA, and are not completely removed in the refining process. The increase was traced to higher than anticipated amide step reaction temperatures and variability in amide flow rates. Both of these deviations were corrected and all low-boiler levels are now normal.

HIGHER METHACRYLATE MONOMERS EXPANSION

Our current higher methacrylates (HMA) production is limited to approximately 30MM ppy capacity from the four batch processes operated at the Belle plant. Higher methacrylates have been an attractive segment of the business and, to meet expected growth, we plan to have capacity of 50MM ppy installed by 1989. Higher methacrylates monomers include Ethyl Methacrylate, iso-Butyl Methacrylate, 2-Ethyl Hexyl Methacrylate and n-Butyl Methacrylate (N-BMA). n-Butyl Methacrylate now represents three fourths of the HMA production and is expected to account for most of the expansion. An additional $2MM after-tax earnings could be

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generated from this program as sales reach capacity. Most of the n-BMA is currently produced by transesterification from Methyl Methacrylate (MMA) which will be in a sold out condition for the next three to four years until new capacity is available. The new continuous process will initially produce n-BMA from Methacrylic acid, avoiding the purchase of MMA and yielding an additional $700M per year ATOI.

To achieve best results, the business plan required development of a 40MM ppy continuous process for n-Butyl Methacrylate using Methacrylic Acid as a raw material. New technology has been developed using fixed-bed, strong-acid, ion-exchange-resin catalysts to effect esterification. Two fixed-bed reactors will be used with intermediate distillation and liquid-liquid extraction to drive the reaction near completion. There is an increasing demand for higher quality monomers; thus, a two column distillation system will be utilized to produce purity greater than 99.5%. A detailed computer simulation of the process has been developed to assist process optimization and equipment selection. By using existing columns from the phased-out Methyl Methacrylate process at Belle, anticipated project costs have been reduced to under $3MM. Authorization is scheduled for 1Q88. Project timing is critical to reduce internal use of Methyl Methacrylate in order to meet outside sales.

CORIAN® CRACKING

Corian® sheet cracking in installed kitchen countertops is the leading quality complaint for our thick sheet material. These cracks, which generally occur at cutout corners, are expensive to replace and disruptive to our customers. Progress has been made in defining fabrication techniques to eliminate stress concentration points and at minimizing heat effects, but programs to develop a more crack resistant formulation have also been undertaken. Reducing the alumina trihydrate (ATH) filler level in Corian® from 66 to 62% was demonstrated in the plant to be an effective way of increasing Corian® toughness. Implementation has been delayed because this formulation change requires a higher viscosity sirup, which reduces the present sirup capacity unacceptably.

While continuing a program to increase sirup capacity, we have been working to identify polymeric additives that will allow us to reformulate to 62% ATH with our present sirup. After evaluating over 60 polymeric additives, we have identified an MBS (methyl methacrylate-g-butadiene-styrene) particle that imparts the desired rheology effect to a 62% formula with our current sirup and also toughens the product even when added at concentrations as low as 1%. Laboratory studies were confirmed in a Shape line plant test where bowls cast with this additive gave the predicted product toughening and the rheology control. A sheet line

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test was run in December and initial data indicates that the MBS can be readily incorporated in the formula without process changes. Sheet product will be evaluated and properties measured to quantify the toughening improvement. Early 1988 plant conversion is planned.

NEW CORIAN® SHAPE PROCESS

Sales of Corian® shaped products grew 17% in 1987 and continued growth is expected. To meet anticipated needs, we are developing a new closed-mold process targeted for production in late 1990. In the new process, which we are developing with Engineering Department assistance, Corian® sirup is in a closed mold at low pressure as opposed to the present casting process at atmospheric pressure. Our goal is a 55% reduction in cost of shaped products.

We have now developed three prototype molds which will test release surfaces, seal options, and heat transfer processes in semiworks runs planned for the near future. Automated mold filling and changing equipment is being developed for the next stage of testing. The goal is annual capacity of 600M shape units, about 4X 1987 volume. Achievement of process and product goals will provide excellent project economics of about 50% IRR on a $12MM investment.

TEFLON® PFA POWDER COATING APPLICATIONS

Powder coating with Teflon® PFA powder has turned out to be a complicated process, but potential markets are attractive. We have determined that PFA prepared by the existing Parkersburg non-aqueous process is not satisfactory for most of our applications, probably due to the polymer morphology. The most promising long range product is PFA manufactured by the aqueous process, which is currently operated in Japan by PPD's Mitsui joint venture. The process, however, will be used at Parkersburg in mid-1988. Critical to our product needs is heat treatment, which affects the grindability of the product. Until material from Parkersburg is available, we are using Mitsui's shot tower prepared powder (MP-10), which does not require grinding, and found it to be adequate for some applications, but less satisfactory than ground aqueous process material. We are continuing our close working relationship with PPD to resolve all the supply aspects associated with our PFA powder coating requirements.

Attractive markets for PFA powder coating continue to appear in the consumer light bulb coating area, where GE is enthusiastic about the results of their marketing studies, and for weld nut coating at Nylock. The market for light bulb coating formulations is expected to be $20MM at 14% ATOI in 1992.

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RICE COOKERS IN ASIA - A KOREAN OPPORTUNITY

We have worked for a number of years to break into the attractive Japanese market for rice cooker release coating, and although our technical performance was excellent, we failed to accomplish our objective due to the Japanese preference for domestic sourced products. We have now been working with the Korean manufacturer, Lucky Goldstar Corporation, and may be able to enter the Japanese market through a Korean manufacture. Korea presently imports the aluminum discs used to manufacture rice cookers, coated with a competitive product from Sumiflon in Japan. We are working with Lucky Goldstar to set up their own coating line using our coating, which we believe has superior performance. Our objective is to capture a significant proportion of the Korean and other Asian markets; Korea's ability to trade with Japan is an advantage.

In a second program with Lucky Goldstar, we are developing new applications for fluoropolymer release coatings in second generation microwave ovens which use both microwave and conventional heating units. We have identified three systems which should be cost effective and can compete effectively with Japanese produced coating technology for this market, which according to Goldstar's forecasts should provide us with $2MM to $4MM annual sales for our coatings.

ACRYLIC BEAD RESINS BY SPECIAL CHAIN TRANSFER PROCESS COMMERCIALIZED

In acrylic bead resins, Specialty Resins' major product line, molecular weight control is currently effected by the use of mercaptans, with resultant residual odor and potential detrimental effect on resin durability. We have successfully scaled-up our proprietary cobalt-based special chain transfer (SCT) catalyst to prepare 40M pounds of mercaptan-free resin ordered by Red Spot Corporation for use in a foil coating application. The catalyst, at the 100 ppm level, easily provided precise molecular weight control in 39 consecutive batches, yielding a colorless product which gave water clear solutions in toluene. No signs of polymer build-up in the reactor were encountered.

This successful run is expected to lead to sales of 1MM annual pounds at Red Spot, representing $1.25mm in sales with a PTOI margin of 28% in 1988. More importantly, the elimination of mercaptan from bead resins can provide us a proprietary product advantage in this competitive and increasingly environmentally sensitive market. Further advantages may accrue from elimination of the high molecular weight tail found in many of these resins. We are working closely with the plant to test our ability to exploit this technology with our entire product line.

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MACROMONOMERS FOR ACRYLIC PRESSURE SENSITIVE ADHESIVES

Thermoplastic elastomers prepared by copolymerization of macromonomers prepared via SCT or GTP technologies are being developed as acrylic hot-melt, pressure-sensitive adhesive (HMPSA) products. The value of an acrylic HMPSA arises from known performance advantages of acrylics (i.e., clarity, durability) combined with processing advantages of a 100% solids system (i.e., production rate, EPA compliance). Market research indicates that a product of this type is not commercially available and has a potential opportunity within a five year time frame, of 10MM pounds/year or 25MM $/year sales.

The concept of an acrylic comb HMPSA derived from macromonomers is known, and is covered by a broad composition of matter patent by the 3M Company. We have found that acrylic thermoplastic elastomers can be made which fall outside the 3M claims, but which can be formulated to yield excellent pressure sensitive adhesives. In particular, 12-18% of a methylmethacrylate macromonomer of number average molecular weight 9000 to 20,000, copolymerized with 2-ethylhexyl acrylate and n-butyl acrylate, gave comb copolymers with molecular weights from 60M to 350M, yielded promising candidates. We are now working to optimize the composition, molecular weight balances, synthesis conditions and formulations to develop the best HMPSA candidates for commercial development. Scale-up and market sampling of an initial comb polymer candidate is scheduled for the 2Q88.

SOLUTION POLYMER ISOLATION FACILITY

A key element of our plan to expand our Specialty Resins Business requires isolation of acrylic resins made in solution or emulsion. We plan to use a 5 square foot LUWA "Filmtruder" to be installed at the Marshall Laboratory in June 1988, to prove out this plan. The LUWA unit is designed for both vacuum and pressure operation for the stripping of solvent from a wide variety of thermoplastic solution polymers, in solvents ranging from THF to xylene. The basic unit will be skid mounted and is expected at the Marshall Laboratory momentarily. The product pelletizer, the control panel, resin feed flow meter, and resin feed pump have already been received. This unit, when operational, will be capable of isolating 500M lbs/year of resin for developmental and initial production purposes. Our goal is to justify a unit of 7.5MM lbs/year capacity ($4MM investment) which will be capable of isolating polymer at a cost of about 35 cents/lb.

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ACRYLIC BINDER FOR ELECTROSTATIC PRINTING

The Imaging Systems Department in a joint venture with Xerox is about to introduce a system for the electrostatic printing of print proofs. This product utilizes a polymer film containing a dispersed silver halide, which when photoimaged is converted to silver metal. When the unexposed silver halide is extracted, the film will hold an electrostatic charge and attract pigment, while the conductive silver-containing regions will not. We have worked closely with them to develop a binder polymer with the capability of swelling to permit extraction of silver halide and yet provide a good dielectric material. By fine tuning the structure of the polymer to have exactly the right balance of polarity, water swellable (carboxylate) groups, and molecular weight, and by using an emulsion polymerization system that is free from metal cations, we have met all their requirements for this system. By eliminating the need for spray drying and redispersing the polymer, we have improved both the economics and the performance of the system. The complete system was demonstrated at the November Graphic Arts Show. Imaging Systems Department has ordered scale-up quantities of the emulsion for a plant test in 1Q88. The opportunity is estimated at $0.5-$1.5MM sales of polymer at $5 to $10/lb.

ACRYLIC POLYMER FOR AQUEOUS DEVELOPABLE CYREL®

Imaging Systems Department's Cyrel® is a family of photodefinable flexographic printing plates. The present technology, based on Shell's "Kraton" polystyrene/-polybutadiene/polystyrene block copolymer, requires chlorinated solvents for development, and will be replaced in the near future by an aqueous developable system, for which "Kraton" is unsuitable.

We have been working closely with Imaging Systems to mimic the "Kraton" performance with a microgel comprised of an acid-functional hard shell surrounding an elastomeric, lightly crosslinked core. After much screening, we have arrived at a composition in which the core is a 1% crosslinked poly 2-ethylhexylacrylate core and the shell is an 80/20 butyl acrylate, methacrylic acid copolymer in the ratio of 2:1, core:shell. Although this composition meets most of the requirements for this product, it could be improved in ease of development and in elasticity in thick sections. We are working with personnel in Imaging Systems to use blends of the above microgels with linear polymers and have obtained preliminary encouraging results. Imaging systems has ordered 3000 lbs. of this polymer for further large scale tests in 1Q88. The initial opportunity for FPD is $1.8MM annual sales, and could grow significantly as more lines are converted from solution to aqueous development.

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CONTINUOUS REACTOR/EXTRUDER PROCESS FOR ACRYLIC RESINS

BELLAND AG, a small Swiss Engineering Company, has developed a state-of-technology continuous twin screw reactor coupled with a W&P extruder/compounder to produce specialty acrylic polymers. Six difficult to make Elvacites® were run on their line to produce dry extruded products within each product's Inherent Viscosity specification range.

The flexibility of the process was demonstrated as these six resins were made in successive runs of 2 hours each. The compositions covered a wide range of product characteristics such as very soft resins, a high acid containing polymer for Riston®, odorous Elvacite® 2014, and a potentially new offering for Vacrel®. The process could also be used to make acrylics of low molecular weight without mercaptans. This alternative to our current Bead Process would resolve some key issues (odor, low Tg, etc.) and increase Plant productivity significantly by making low productivity bead resins by Belland Process - all directly in dry pellets, powder or film form. We are assessing the economics of the process to justify the implementation of the technology in FPD for producing not only specialty acrylics by free radical, GTP and SCT polymerization technologies, but also for developing new products such as thermoplastic elastomers, hot melt adhesives and toughenners by polymerization and reactive compounding using polymeric blocks from GTP and SCT technologies.

MODEL 700 MOUNTAIN RIFLE CALIBER ADDITIONS

The Model 700 Mountain Rifle was introduced in 1986 with a lighter-weight barrel and stock contour. The Mountain Rifle concept was well received by the market and is currently one of the most popular versions of the Model 700. For 1988, we are adding three popular short-action calibers: .308, .243, and 7mm-08 to complement the popular long-action calibers.

Production Trial and Pilot is currently underway with final assembly anticipated during January. Annual sales volume of the new short-action version is estimated at 3000 rifles.

MODEL 1100 MAGNUM RETROFIT BARREL FOR STEEL SHOT

This program will provide a retrofit barrel and choke tube system for owners of M/1100 12 Gauge Magnum shotguns. The gas orifice hole is optimized for proper functioning with the lower-powered 2 3/4 and 3 inch magnum steel ammunition. The choke tube system will handle the BBB, T, and F steel shot sizes without deformation, and the choke constrictions are being developed using 2 3/4 inch Magnum 2's as the benchmark ammunition.

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The choke tubes are being developed using VascoMax 250 Maraging steel to provide the strength necessary for the larger steel shot sizes. These choke tubes will be titanium nitrided to provide corrosion resistance and a gold color to distinguish these choke tubes from our current stainless steel choke tubes.

This program is currently undergoing Design Acceptance Testing. Annual sales to current M/1100 Magnum owners is estimated at 3000 barrels. It is expected that there will be a number of choke tube sets sold to other owners of Remington Rem Choke shotguns who shoot large steel shot to improve their pattern performance.

SPECIALTY PRODUCTS AND SERVICES DIVISION

IMPROVED HIGH TEMPERATURE PERFORMANCE FOR ALDYL® PIPE

Aldyl® pipe is under competitive pressure in the U.K. from pipe made from Phillips process polyethylene which easily passes an accelerated 80°C notch test while our materials are marginal. Since the early 1980's, we have measured at least a 10 fold increase in elevated temperature performance with Phillips pipe resin which will translate to more than a 10 fold increase in long-term life when final projections are made.

We have now pinpointed critical molecular structure changes made by Phillips. An increase in Mw, a decrease in Mn, higher levels of comonomer in the high molecular weight fraction and less in the low fraction are key features of the new resins. Based on our own previous work and recent Japanese intelligence, it appears these resin changes are responsible for the step change in Phillips resin performance. We are working with Cain Chemical, our resin supplier, to define a plant run which would provide resin with preferential comonomer placement, increased molecular weight, less low molecular fraction, and minimum change in molecular weight distribution. Using computer models, Cain is developing alternatives around reactor conditions to meet our needs. A best case will be chosen, and the experimental run made in 1Q88, allowing pipe testing by mid-year.

LOW HEAT RELEASE TEDLAR® FILMS FOR AIRCRAFT INTERIORS

A family of new low heat release (LHR) Tedlar® films are being commercialized for the aircraft industry. Aircraft interiors are a major market for Tedlar® Polyvinyl Fluoride film and currently are responsible for about 30% of our annual earnings. The FAA has recently issued new regulations on the total heat release permitted by aircraft interior composites under burning conditions. These standards specify a total heat release value of 65 KW min/m2 over a 2 minute period with a peak value of 65 KW/m2 (current composites with Tedlar® film have values of up to 100). New FAA compliant composites with Tedlar® film must be developed to hold this important market.

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In March 1987, we initiated a development with Boeing to develop new Tedlar® films and new composite constructions, with a performance goal of 50/50 KW min/m2 or better. Boeing believes that their product must be comfortably below the FAA 65/65 limits. Two concepts have been used in blocking/slowing the progression of combustion: (1) use of flame retardants to slow the burning rate and (2) use of a char inducing additive, i.e., zinc borate, to form an intumescent char during combustion that "protects" the substrate. Transparent and pigmented films were developed and scaled up. Boeing has completed the lab evaluation of these films. They have found heat release rates in the 30-35 KW min/M2 range when the LHR Tedlar® is combined with their LHR embossing resins. A significant drop in smoke density is also achieved. Boeing is enthusiastic about these results and plans to fit one airplane for Southwest Airlines with LHR Tedlar® in the interior to demonstrate their 1990 systems.

NEW TAPERED PAINTBRUSH BRISTLES

Our current share of the tapered bristle market is about $10MM, all of which goes into the premium paintbrush segment. Because of changing economic conditions in China, there is a shortage of natural bristle in long lengths and we have determined that a $3-4MM opportunity at 20-30% pre-tax margin exists if we can duplicate the painting and appearance properties of natural boar bristle.

Natural bristle differs from our current product in surface texture and taper profile. We feel confident that we can closely replicate the surface and have prototypes which are encouraging. Changing the taper profile is more challenging, due to viscoelastic effects in the very short air gap used in taper generation. Fortunately, a mathematical model for filament fluid dynamics exists and the Engineering Department is modifying it for our needs. They are designing equipment and a process designed to produce the desired oscillations in filament diameter. We expect to have prototypes based on the new equipment by mid-year.

NEW FABRIC FOR DYMETROL® SEATING SUPPORT SYSTEMS

Dymetrol® Seating Support Systems are now being targeted primarily at the furniture industry. Our financial goals are $8.2MM sales with $600M ATOI by 1990. The original Dymetrol® fabric, developed for automotive seating, had two characteristics that detracted from its acceptance in the furniture industry. It did not have good staple cut through resistance and, although it has proven to be durable, the plain weave was so thin that customers perceived a durability problem.

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To meet the need to improve both deficiencies, a new weave was introduced which provides a significant increase in warp weight, solving both the staple and covering power problems. In addition, the sateen side of the fabric has been shown to print well. This has allowed us to introduce a "dual deck" fabric which allows the customer to replace a spring and fabric construction with a single fabric layer. A white product has been introduced and has been adopted in commercial seating, both domestic and off-shore. Important in these adoptions was our development of several stretching devices that facilitate customer installation and increase the probability that the product will be installed properly. The dual deck product will be introduced in several applications in the first quarter.

DYMETROL® MECHANICAL CABLE

Since the introduction of Dymetrol® Mechanical Drive Tape in 1979, there has been substantial customer interest in a round polymeric product to replace steel cable. Early attempts to provide large diameter oriented polymeric cable resulted in quenching voids and ovality in large diameter extrusions caused by differences in melt and solid densities. We have succeeded in making 3mm and 4mm oriented round cable by using a multi-stage extrusion and have shown dramatic cycle life around tight bends compared to steel cable. Even larger diameters seem achievable should demand exist.

Many potential customers worldwide are developing systems based on our cable, mostly for passive restraint systems with difficult geometrical requirements but also for antenna drives and some non-automotive applications. Since these programs are aimed at qualifying for future models, significant sales ($2.6MM) are not forecast until 1989 with growth to $7MM in 1992. We will initially supply customers from our semiworks which has capacity for 1MM ft./year. A commercial scale process for making 70MM ft./year of 3mm and 4mm cable has been defined and the cost of this new line estimated at $3.5MM.

NEW FLEXIBLE EXPLOSIVE PRODUCT

In response to a DARPA initiative, we are attempting to develop an improved version of our Deta® Sheet flexible explosive with lower flammability and higher energy capability. The current product is a dispersion of pentaerythritol tetranitrate in a plasticized nitrocellulose binder. Early screening of alternate binders using a dummy mix of corn starch in place of the explosive has resulted in the development of a preferred system based on a low-molecular-weight fluoroelastsomer, Viton® C-10. It is interesting to note that the initial compounds of this material were poorer than the nitrocellulose control, in agreement with findings of researchers at government laboratories. With certain additives including a

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crosslinking agent, however, a superior non-dripping composition has been obtained that is self-extinguishing in a vertical flame test. Live mixes are now being prepared and preliminary results indicate that the new non-burning formulation still maintains the same level of explosive energy as current Deta® Sheet. The new composition is of particular interest to the Defense Department with a new business potential of $60MM over the next seven years.

VESPEL® ST PLANT TEST

After a successful demonstration of the pilot scale ST resin process, a test was conducted in the existing commercial scale Vespel® SP resin plant. ST is the designation for the product of our new solid phase imidization process that produces a Vespel® product with twice the toughness of current product. The purpose of the test was to determine (a) if we could make use of the unused capacity in the SP plant on an interim basis to supply resin for market development needs, and (2) to determine the limitations of existing, full-scale equipment in anticipation of a new future resin capacity addition.

The test indicated that the current batch wash system used on SP resin cannot meet the more critical needs of the ST process. This was not unexpected, and we are already in position with a demonstrated continuous vacuum filter/wash system in the pilot unit that can be easily scaled up for commercial use.

The other major conclusion of the test was that although the current double-cone dryers can be used for ST, their efficiency at commercial scale is severely curtailed and would be cost ineffective. In anticipation of this problem, we have had underway the development of a direct contact gas drying process. Laboratory results have been excellent and plans for scale-up are being developed. The development and commercialization of the ST product line is a key element in the Vespel® business strategic plan with earnings over the next 5 years expected to amount to $10MM.

KALREZ® PRODUCTION RUN

The Kalrez® polymer product line consists, at the present time of four base polymer compositions, copolymers, primarily of tetrafluoroethylene and perfluoromethyl vinyl ether, with various third comonomers to provide curesites with different vulcanization functionality and resultant performance capabilities. An abbreviated polymer production campaign has just been completed to rectify problems that occurred during a previous run and to balance polymer inventories before an extended shutdown of the Chambers Works synthesis unit for an instrument modernization project. The objective of this run was to produce a K4000 polymer in the upper half of the perfluoro(methyl vinyl ether) specification range in order to lower the modulus and

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hardness of the product. Polymer from our previous production campaign occasionally fails to meet specifications when compounded at the Tralee Park. Polymerization results were excellent, meeting compositional and viscosity goals and samples of the first lots are under evaluation.

Reactor operation during this campaign has been exceptional, establishing a new record in uninterrupted operation, more than 350 hours, a five fold improvement on this difficult polymer composition. This uninterrupted operation, a long sought goal, is a key factor in our ability to fine tune the polymer composition and improve the quality of our product. The improvement in product quality and improved plant utility are worth, conservatively, $250M/year at current rates or production.

DEPARTMENTAL RESEARCH

MOLDING PROPERTIES OF GTP PREPARED PMMA

Polymethyl methacrylate made by the GTP process has unique properties and offers a better balance of Melt Flow, Heat Distortion Temperature and Thermal Stability than commercial products. Thermal stability is high because there is no residual unsaturation. Commercial products raise the stability to this level by adding comonomers at a sacrifice in heat distortion temperature. Lower melt viscosity due to low polydispersity gives greater processing latitude in addition to that from higher thermal stability.

Our objective is to demonstrate the commercial advantages of these property differences that will justify a slightly higher price and generate $2MM sales of pellets to the extrusion market in 1991.

Satellite, a custom molder of bicycle reflectors who currently uses 5MM pounds of pellets annually, was able to mold 100M m.w. GTP polymer using his normal conditions for lower molecular weight polymer and got significantly improved reflectance because of better mold definition possibly due to better conformance to the mold surface and more complete relaxation before solidification. In our joint venture study with MRC, they found lower birefringence in a molded sample which indicates less molded-in stress. Lower stress may be due to lower die swell ratio versus shear rate and lower residual monomer, both of which they also reported. These evaluations are continuing to establish the commercial value of these property differences, as are process evaluations to define the lowest cost process.

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ORTHODONTIC LIGATURES

Orthodontic ligatures which connect wires and brackets used in corrective dentistry represent an estimated market of 600MM pieces per year at various prices; an example is a polyurethane rubber band selling for a few cents. In a bootleg scouting program, we have developed an adjustable nylon-monofilament prototype product which offers advantages over the urethane product. Tests with an orthodontist under secrecy agreement show the prototype works well and can be installed more quickly, an important cost savings. The orthodontist would like to begin clinical testing.

With an outside manufacturer we have developed a pilot process with cost estimated at $0.10 per ligature. If the improved product can command a $0.25 price and gain 10% share, a $15MM business opportunity is available. New Business Development has been asked to find a business approach. One possibility suggested by the Biomaterials Group in CR&DD is an approach to Johnson and Johnson.

SYNTHESIS OF MACROMONOMERS BY THE SPECIAL CHAIN TRANSFER PROCESS

The preparation of poly-methylmethacrylate macromonomers has now been successfully carried out in the Marshall Laboratory semiworks, using SCT catalyst. Two different macromonomers were prepared with weight average molecular weights of 4500 and 15000 obtained by varying the catalyst concentration. The macromonomers, which were greater than 95% terminally functional, will be used to provide larger quantities for sampling in end use applications such as inks and adhesives. The scale-up also provided key information relative to the handling and use of the SCT catalyst under production conditions. A first small order has been received.

FUNCTIONAL MACROMONOMERS

Functional macromonomers obtained via SCT, containing acidic, hydroxylic, or amino groups, have been used as stabilizers to the preparation of both aqueous and non-aqueous dispersions of polymer particles. Copolymerization of such macromonomers with an acrylic core polymer with different polarity or hydrophilicity permits the synthesis of dispersions in both non-aqueous and aqueous systems. The feasibility of preparing such dispersions has been demonstrated through a joint effort with the Marshall Laboratory and Mechelen Automotive Resins groups. A series of NAD's (non-aqueous dispersions) were prepared at the Marshall Laboratory, using hydroxyl-substituted methacrylic macromonomers, yielding NAD's with improved stability and desirable small particle size. When formulated into a two component clear coat, these systems also provided good coating hardness at reduced isocyanate crosslinker levels, as well as increased distinction of image (DOI). At the

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Mechelen Laboratory, acid functional macromonomers have been found to yield aqueous dispersions which are stable at much lower total acid content than comparable dispersions made by conventional (non-macromonomer) technology. We are continuing our efforts to exploit the unique, proprietary systems with clustered functionality that the SCT technology permits us to make under economically attractive conditions.

NEW PARTLY CROSSLINKED POLYMER DISPERSIONS

Intersecting Coreticulated Polymers (ICPs) is the name that we have coined to differentiate a family of polymer dispersions, from more conventional Interpenetrating Polymer Networks, (IPNs). These systems exhibit discrete microphase separation, counter to the claims of several IPN patents. Since these patents issued, other preparers of IPN's have recognized the significance of microphase separation and we can no longer justify dual nomenclature. We have found, however, that our systems, which are prepared as dispersions, appear to be unique in both their existence as a dispersion and in their amenability to blending, modification and further reaction. Our systems comprise two or more lightly crosslinked polymer networks dispersed in a common solvent, and prevented from separating into different phases by the catenation of the polymer chains of their respective networks. In a nutshell, this amounts to a system having the properties of a graft copolymer with no actual bonding between the two polymer systems. We believe that these dispersions are patentable and we are working with our attorney to develop a broad patent coverage.

Advantages of our technology, in addition to resulting in dispersion which can be made into coatings, solid objects or otherwise manipulated, is that almost any two incompatible polymers which are soluble can be tied together and in effect compatibilized, even in cases where grafting is difficult or impossible. In many cases, these systems possess properties that combine the best features of both constituents, rather than the average, or in the case of many blends, of grossly inferior properties. Thus for example, we have systems of polyvinyl fluoride and acrylic polymers which combine desirable properties of both polymers and which do not separate on processing or on standing. We are working closely with the Electronic Products Department to make a Vacrel® solder mask polymer which possesses toughness, hardness, and resistance to thermal cycling that has not been achieved with a single copolymer. Other candidates are being tested in automotive, adhesive, and primer systems.

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To: THOMASP --ISCDCVM1 Patricia Thomas

From: William Coleman FPD, Ilion NY, 8-2461-318
Subject: R&D QUARTERLY REPORT 2Q88

R & D QUARTERLY REPORT 2Q88
ILION TECHNICAL SECTION

ABSTRACTS

SAFETY MILESTONE ACHIEVED

The Ilion Technical Section achieved 31 years without a Lost Workday or a Restricted Workday injury on June 28th, 1988.

MODEL 700 RIFLE STOCK OF DU PONT ARYLON

Remington's synthetic stock offering for 1989 will be molded from Du Pont Arylon. This stock will replace the current synthetic stock offerings of fiber glass and Rynite. This program with Six Enterprises will give Remington the first use of Arylon as a stock material.

SUPPLIER QUALITY PROGRAM

The Ilion firearms plant relies heavily on suppliers for many components used in the Remington line of sporting firearms. A team has been visiting key suppliers presenting a "Standards For Excellence" program, identifying chronic problems, and following up with additional visits. Nine visits to five suppliers have identified nearly forty issues to be addressed.

FLEXIBLE MANUFACTURING SYSTEM PHASE II STATUS

All equipment has been installed and has passed a system acceptance test. Phase II has been turned over to Plant Operations. System reliability and part quality is very good. Computer system and machining center up - time has exceeded project specifications.

STATISTICAL PROCESS CONTROL

The Ilion site initiated a program to introduce the concepts of Statistical Process Control into the manufacturing operations in March 1988. Four Engineers have been fully assigned to develop the program, provide necessary training and oversee the program implementation. Successful implementation of SPC is viewed as vital to the success of other improvement programs such as Synchronous Manufacturing now being introduced at the site.

SAFETY MILESTONE ACHIEVED

The Ilion Technical Section achieved 31 years without a Lost Workday or a Restricted Workday injury on June 28th, 1988.

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MODEL 700 RIFLE STOCK OF DU PONT ARYLON

Remington's synthetic stock offering for 1989 will be made from DuPont Arylon. Stocks made from foamed 501 Arylon are superior to fiberglass and are lighter in weight than Rynite. This stock will replace the current RS Rynite stocks and the right hand FS fiberglass stocks. This stock will be molded for Remington by Six Enterprises. This will give Remington a first in the use of Arylon in a rifle stock.

The cost of the Arylon stock is approximately $10 less than the Rynite stock and $100 less than the fiberglass which must be bedded by hand, a costly operation. The cost of the Arylon stock is $30-$50 less than typical wood stocks used on the Model 700.

Current price premiums are $75 for the Rynite stock and $125 for the fiberglass stock.

The primary constraints on Model 700 production are wood availability and NC checkering capacity. The Arylon stock avoids these constraints. It is planned to price the Arylon stocked specifications as aggressively as the supplier's capacity permits for optimum earnings impact. Volume for these specifications are anticipated at 10,000 units over the next two years.

SUPPLIER QUALITY PROGRAM

The Ilion firearms plant relies heavily on suppliers, sourcing 1200 items with over 100 suppliers.

Since purchased items have a major effect on Ilion's total quality (product quality, service, and cost/value), efforts to continually upgrade the supply quality are underway.

Nine visits have been made to five suppliers, who cumulatively make 30% of the purchased parts. Each supplier participated in a "Standards For Excellence" program, in which they were encouraged to work with Remington in resolving chronic problems. Following these meetings, suppliers identified a variety of issues, ranging from communications to specific dimensional items. In total, nearly 40 issues were identified. Several have already been resolved.

Suppliers are consistently enthusiastic in their response to this effort.

FLEXIBLE MANUFACTURING SYSTEM PHASE II STATUS

In February 1987, $8.0MM was authorized to continue the Flexible Manufacturing System (FMS) Phase II modernization of Ilion's component manufacturing. All equipment has been installed and has successfully passed a system acceptance test. The four day test, run from April 18th through the 21st, was to prove the equipment and the system. It differed from Phase I acceptance in that parts were produced and that Remington personnel operated the system instead of Cincinnati Milacron (CMI).

System downtime due to CMI problem was 5.4%, and overall downtime was 10.7%. The criteria for success was 7.1% for CMI problems and 18% for overall downtime. A punch list of all problems discovered was developed and the system has been conditionally accepted from CMI. CMI has resolved approximately 50% of these items, and has committed to complete all software items by August 1st. Concerns to be resolved are: pallet

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KINZER V. REMINGTON

registration failures, CMM hydraulic upgrade, Single Stump Park Station operation, and machining center chip containment.Final payment to CMI is contingent upon resolution of the punch list items.

Phase II has been turned over to Plant Operations, and has been performing well. System reliability and part quality is very good. Computer system and machining center up-time has been greater than project specifications.

STATISTICAL PROCESS CONTROL (SPC)

Without control of the Production process, programs such as Synchronous Manufacturing, J.I.T., Design for Assembly and Geometric Tolerancing have little hope of achieving any real long-term impact at the site. By bringing the production process under control through the use of SPC, these other programs will not only be able to work, but they will then enhance Remington's competitive position in the marketplace.

The introduction of the SPC into the manufacturing site is being implemented with the assistance of the Technical Group and Process Engineering Sections. The first groups of production employees in the Auto-Drill line and GFM Barrel areas have had initial training in the essentials of data collection and charting and are now collecting data.

Lesson plans, visual aids, demonstrations and practice exercises have been completed for the training of production employees. Audio-visual training aids and instruction manuals have been purchased for class use. An SPC control chart form for the specific use of Remington has been developed and printed. A long term training schedule for the rest of the site has been outlined and training is underway.

The Process Engineering Section will soon start a long term program of training under the guidance of ESD's Applied Statistics Group. The Engineers will learn the basics of statistics, SPC technology and Design of Experiments techniques.

In June Jim Snedeker visited Rock Lositio at the Hazen Ark. Powdered Metal Plant to observe their successful SPC program in operation, (Hazen recently attained a Ford Q-1 rating) and seek the advice of those who developed the program.

Additional means of expediting the program schedule are being continuously explored by Production and Technical Group Management.

cc: ATKINSRL--ISCDCVM1 Robert L. Atkinson COBURNMM--ISCDCVM1 Matt M. Coburn
ATKINSRL--ISCDCVM1 Robert L. Atkinson COBURNMM--ISCDCVM1 Matt M. Coburn

RD-61-5

REMINGTON ARMS COMPANY, INC.

INTER-DEPARTMENTAL CORRESPONDENCE

Remington DUPONT PETERS DUPONT

"CONFINE YOUR LETTER TO ONE SUBJECT ONLY"

xc: D. M. Condon
R. L. Atkinson
R. F. Ulak
J. F. Winske
J. R. Snedeker
D. J. Anderson
L. B. Bosquet
File

Ilion, New York
March 10,1988

TO: M. M. COBURN

FROM: W. H. COLEMAN, II/T. C. DOUGLAS

R & D QUARTERLY REPORT 1Q88
ILION TECHNICAL SECTION

ABSTRACTS

PARKER DOUBLE-BARRELED SHOTGUN

The legendary Parker double-barreled shotgun is being returned to production in 1988. It will be offered in AHE grade, 20 gauge only. This custom gun will retain the aesthetics and feel of the original Parker. Annual sales of this custom gun is estimated at 50 units with a selling price of approximately $13,000.

MODEL 1100 RETROFIT BARREL FOR STEEL SHOT

This program will provide a retrofit barrel and choke tube system for owners of M/1100 12 Gauge shotguns. The choke tube system will handle the BBB, T, and F steel shot sizes without deformation to the barrel or choke tube. Annual sales to current M/1100 owners is estimated at 5000 barrels.

MODEL 700 CLASSIC .300 WEATHERBY MAGNUM

The Model 700 Classic offering for 1989 will be the .300 Weatherby Magnum. This will be a synergistic offering from Firearms and Ammunition. Annual sales volume of this popular Weatherby caliber is estimated at 6000 rifles.

"STANDARDS FOR EXCELLENCE" VENDOR PROGRAM

The Ilion firearms plant relies heavily on vendors for many of the component parts used in the Remington line of sporting firearms. A "Standards For Excellence" program has been developed to enable Remington and our vendors to work together as a "partnership" with benefits to all. Efforts have been initiated with four major parts suppliers.

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KINZER V. REMINGTON

PARKER DOUBLE-BARRELED SHOTGUN

The legendary Parker double-barreled shotgun is being returned to production in 1988. It will be offered in AHE grade, 20 gauge only. This custom gun will retain the aesthetics and feel of the original Parker. It has been redesigned with modern, heat-treated metals and a new single selective trigger mechanism. Annual sales of this custom gun is estimated at 50 units with a selling price of approximately $13,000.

The Parker was unveiled at the January Shot Show in Las Vegas, where it was very well received. Every year at the Shot Show, a different gun is selected to be auctioned as a special event. The Parker was selected for 1988, and was auctioned for $21,700.

The prototype guns for Design Acceptance Testing are currently being fabricated. Testing is anticipated to be complete by July 1st with delivery of the first production guns in the third quarter of 1988.

MODEL 1100 RETROFIT BARREL FOR STEEL SHOT

This program will provide a retrofit barrel and choke tube system for owners of M/1100 12 Gauge shotguns. The gas orifice hole is optimized for proper functioning with the lower-powered 2 3/4 and 3 inch magnum steel ammunition. The choke tube system will handle the BBB, T, and F steel shot sizes without deformation to the barrel or choke tube. The "EXTRA LONG-RANGE STEEL SHOT" choke constriction was developed using 2 3/4 inch Magnum 2's as the benchmark ammunition. This choke tube will deliver 80% of the shot in a 30" circle at 40 yards.

The choke tubes are manufactured from VascoMax 250 Maraging steel to provide the strength necessary for the larger steel shot sizes. These choke tubes may be titanium nitride coated to provide corrosion resistance and a gold color to distinguish them from our current stainless steel choke tubes.

This 1989 Catalog product has successfully passed Design Acceptance Testing and product specifications are being finalized. Annual sales to current M/1100 owners is estimated at 5000 barrels. It is also expected that there will be a significant number of choke tubes sold to customers who currently own a Remington Rem Choke shotgun and want to shoot the larger steel shot sizes.

MODEL 700 CLASSIC .300 WEATHERBY MAGNUM

The Model 700 Classic offering for 1989 will be the .300 Weatherby Magnum. This will be a synergistic offering from Firearms and Ammunition. The Lonoke ammunition plant has provided the Ilion firearms plant with the chamber drawings and chamber reamers. Ilion has provided Lonoke with three pressure barrels and one completed rifle for the ammunition development. Ilion has five completed rifles ready for Design Acceptance Testing. It is anticipated that the pilot run ammunition will be available in April, 1988.

Annual sales volume of this popular Weatherby caliber is estimated at 6000 rifles. It is expected that the lower cost of the Model 700 versus the higher cost of the Weatherby models will result in lost sales to Weatherby.

"STANDARDS FOR EXCELLENCE" VENDOR PROGRAM

The Ilion firearms plant relies heavily on vendors for many of the component parts used in the Remington line of sporting firearms. A "Standards For Excellence" program has been developed to enable Remington and our vendors to work together as a "partnership" with benefits to all.

Three major suppliers were visited this month for presentation of the "Standards For Excellence" program. Tool Products, located in Minnesota, supplies aluminum die castings. These include the trigger plate housings for the Models 870, 1100, and 11-87 shotguns, the Models 552 and 572 rimfire rifles, and the Model Seven trigger guard assembly. They are highly structured in Statistical Process Control and have extensive equipment and facilities supporting their quality effort. Tool Products has consolidated their customer base from 120 to 80, and has plans to further reduce to 60. They consider Remington as a long-term, important customer.

Parker & Harper, located in Massachusetts, is an old-line screw machine parts supplier with a very minimal quality effort. They produce 80 different parts for Remington. They rely almost entirely on the experience of their key set-up people to assure meeting specifications. We talked extensively with their Vice President of Manufacturing concerning potential benefits to his business through quality management. He intends to attend a Deming course, at our suggestion, to become more informed about Total Quality Management and its application in his business.

The third vendor was Connecticut Spring & Stamping. They manufacture 130 different parts for Remington. The presentation was done as part of our third recent visit to their site.

In addition to the above three companies, H & P Die & Stamping, located in Ohio, was visited in February. This visit resulted in initiation of a new quality program. H & P manufactures over 200 different parts for Remington.

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

AUTOMOTIVE PRODUCTS DEPARTMENT
FABRICATED PRODUCTS DEPARTMENT
RESEARCH & DEVELOPMENT DIVISION

cc: R. A. Darby - B-3324
B. C. Anderson - ESL 174/303
A. G. Armour - MRL
R. L. Atkinson - B-3324
W. H. Coleman, II - Ilion

February 15, 1988

C. T. SCIANCE
CR&D
D-6018

2) file

QUARTERLY REPORTS TO STOCKHOLDERS
FIRST QUARTER 1988

APD/FPD R&D DIVISION

Attached is material for the first quarter report to stockholders 1988.

Please contact me directly on this and future stockholder report issues.

M. M. COBURN

MMC/pt

Attach.

REMINGTON ARMS CO.
RECEIVED
FEB 18 1988
FIREARMS RESEARCH DIVISION

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KINZER V. REMINGTON

STOCKHOLDERS QUARTERLY

DYMETROL® FABRIC FOR SEATING SUPPORT SYSTEMS

Dymetrol® Fabric, based on oriented Hytrel® fibers, is used in seating to provide the comfort usually obtained with spring-cushion combinations. A new sateen weave construction has recently been introduced worldwide in the furniture industry, providing comfort in a light-weight, bulk-free construction. New stretching devices enabling our customers to install Dymetrol® Fabric efficiently have aided the introduction. The ability of the new weave to accept color printing provides additional design convenience.

RD-41-8

REMINGTON ARMS COMPANY, INC.

INTER-DEPARTMENTAL CORRESPONDENCE

Remington DUPONT PETERS DUPONT

"CONFINE YOUR LETTER TO ONE SUBJECT ONLY"

xc: D. M. Condon
M. M. Coburn
R. F. Ulak
J. F. Winske
J. R. Snedeker
D. J. Anderson
L. B. Bosquet
File

ILION, NEW YORK
JANUARY 7, 1988

TO: R. L. ATKINSON

FROM: W. H. COLEMAN, II/T. C. DOUGLAS

R & D QUARTERLY REPORT 4Q87
REMINGTON

PARKER

The Shot Show Parker is nearing a successful completion due to the dedicated efforts of Don Mainland, Larry DelGrego, Bryson Gwinell and a number of Remington personnel. The fully engraved receiver is expected on January 11th for color case heat treatment. It will then be hand carried to Kolar Arms for final assembly and to the Shot Show in Las Vegas.

Prototypes for testing will be produced similar to the show gun except that the barrels will be functional and the engraving will be omitted. A barrel contour and process was finalized at a December 9th meeting with DuPont metallurgist Fred Schmidt. Current Remington 1140 Modified barrel steel will be used in conjunction with an induction hardening heat treatment of the chamber area. Barrels for the test guns are through our GFM and are ready to be turned. Kolar Arms has special turning equipment on order with an expected run-off expected the first week of February. In the interim, Kolar is continuing the barrel brazing development in addition to their work on the balance of the Parker components. A schedule outlining the test program timing is being developed.

MODEL 700 MOUNTAIN RIFLE CALIBER ADDITIONS

The Model 700 Mountain Rifle was introduced in 1986 with a lighter-weight barrel and stock contour. The Mountain Rifle concept was well received by the market and is currently one of the most popular versions of the Model 700. For 1988, we are adding three popular short-action calibers: .308, .243, and 7mm-08 to complement the popular long-action calibers.

Production Trial and Pilot is currently underway with final assembly anticipated during January. Annual sales volume of the new short-action version is estimated at 3000 rifles.

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MODEL 700 CLASSIC .300 WEATHERBY MAGNUM

The Model 700 Classic offering for 1989 will be the .300 Weatherby Magnum. This will be a synergistic offering from Firearms and Ammunition. Lonoke has provided Ilion with the chamber drawings and chamber reamers. Ilion has provided Lonoke with three pressure barrels and one completed rifle for the ammunition development. Ilion has five completed rifles ready for Design Acceptance Testing. It is anticipated that the pilot run ammunition will be available in April, 1988.

Annual sales volume of this popular Weatherby caliber is estimated at 6000 rifles. It is expected that the lower cost of the Model 700 versus the higher cost of the Weatherby models will result in lost sales to Weatherby.

MODEL 1100 MAGNUM RETROFIT BARREL FOR STEEL SHOT

This program will provide a retrofit barrel and choke tube system for owners of M/1100 12 Gauge Magnum shotguns. The gas orifice hole is optimized for proper functioning with the lower-powered 2 3/4 and 3 inch magnum steel ammunition. The choke tube system will handle the BBB, T, and F steel shot sizes without deformation, and the choke constrictions are being developed using 2 3/4 inch Magnum 2's as the benchmark ammunition.

The choke tubes are being developed using VascoMax 250 Maraging steel to provide the strength necessary for the larger steel shot sizes. These choke tubes will be titanium nitrided to provide corrosion resistance and a gold color to distinguish these choke tubes from our current stainless steel choke tubes.

This program is currently undergoing Design Acceptance Testing. Annual sales to current M/1100 Magnum owners is estimated at 3000 barrels. It is expected that there will be a number of choke tube sets sold to other owners of Remington Rem Choke shotguns who shoot large steel shot to improve their pattern performance.

Press Contact: Dick Dietz
302-774-5048

REMINGTON RECALLS BOLT ACTION CENTERFIRE RIFLES PRODUCED AND SOLD BETWEEN JULY 25 AND DEC. 11, 1987

The Remington Arms Company is replacing the trigger assembly mechanisms of the Model 700™, Seven™, 40-XB™, 40-XC™, and "Sportsman" 78 centerfire rifles manufactured between July 29 and December 11, 1987.

This action is being taken because a limited number of rifles produced during that period may have an improperly manufactured part in the trigger assembly mechanism. Although it is unlikely, the defective part could break and cause the rifle to fire accidentally.

While the possibility of such a malfunction is quite low, Remington requests the owners who have purchased one of these rifles since July 29, 1987 not to load it. They should call the toll-free number 1-800-634-2459 with the model and serial number of the rifle. The customer will immediately be informed if the rifle is potentially affected.

For any affected rifles, Remington will supply the name and location of a designated repair gunsmith who will install a replacement trigger assembly at no charge.

Remington Arms Company, Inc.

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SUMMARY

- Only subject Remington bolt action centerfire rifles pur chased after July 29, 1987 are potentially affected.

- These include only MODEL 700 (all versions), MODEL SEVEN, "SPORTSMAN" 78, MODEL 40-XB, and MODEL 40-XC rifles.

- They do not include autoloading and pump action centerfire rifles or shotguns.

- All owners of potentially affected rifles should call the toll-free number 1-800-634-2459 before using those rifles.

EDITOR'S NOTE: The toll-free 800 number is the contact number to be published for customer inquiries. The number at the beginning of the release is for press contact only and should not be published.

Remington Arms Company, Inc.

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Remington.

DUPONT

REMINGTON ARMS COMPANY, INC.

SPORTING ARMS-AMMUNITION-TARGETS-TRAPS

ILION, NEW YORK 13357

TELEPHONE (315) 894-9961

January 15, 1988

TO OUR GUNSMITHS:

Remington has uncovered a potential trigger assembly problem with a small quantity of Model 700 series rifles produced and shipped between July 29 - December 11, 1987. The involved models include Models 700, Seven, 40XB, 40XC and Sportsman 78 rifles. You have already been informed of the problem restated below and elected to assist Remington in replacing these trigger assemblies in the field.

During routine test firing, Remington discovered the possibility that an improperly manufactured trigger part may have been assembled in a number of Model 700 series rifles. Although unlikely, the improperly produced part could possibly break and allow the rifle to fire when the safety is moved from the safe position to the fire position without the trigger being pulled.

Since the safety and quality of our firearms is of our utmost concern, Remington will replace the trigger assemblies in all rifles which possibly contain the impacted part. To accomplish this, a trigger assembly replacement program has been instituted.

We are currently contacting all distributors, dealers and consumers who have purchased these rifles requesting they have their guns up-dated by a Remington New Gun Repair Station in their area.

Under separate cover, we are sending you ten (10) replacement trigger assemblies at no charge, along with a supply of a form you're to complete and promptly return for each repair. You will find that the replacement assemblies will have a prick punch mark on the left side of the trigger piece for easy determination in the future of trigger assembly replacement.

IMPORTANT: To assist you, we have enclosed a detailed explanation of the trigger assembly replacement process. Please review that information carefully before beginning any replacement.

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KINZER V. REMINGTON

After the trigger assembly has been replaced, the following procedures must be followed:

1) Complete the repair form, being sure to provide all information listed, especially YOUR IDENTIFICATION NUMBER, customer's FULL name, address, telephone number, if known, and the serial number of the rifle. Additional forms and trigger assemblies may be obtained by calling 800-634-2459.

NOTE: YOUR CUSTOMER NUMBER IS _____.

2) Your total fee is not to exceed $22.00 per gun. This includes labor, postage, shipping and handling. However, we will reimburse any incurred incoming C.O.D. shipping charges which you should add to the $22.00 total and specify on the form.

3) Send the complete replaced trigger assemblies to:

Remington Arms Company, Inc.
14 Hoefler Ave.
Ilion, NY 13357
Attn: J. Kast

NOTE: All parts of the replaced trigger assemblies such as sear safety cam and slave pins, etc., must be returned.

4) Send the fully completed invoice form to:

Remington Arms Company, Inc.
Department RP
14 Hoefler Ave.
Ilion, NY 13357

- For technical assistance, call our Arms Service Division at (315) 895-7791.

- For all other Model 700 series trigger assembly replacement information, you may use our toll free number (800) 634-2459 (8:00 - 4:30 EST).

IMPORTANT NOTE: If you have purchased any Model 700 series trigger assemblies since July 29, 1987, return them to Remington and notify us at the toll free number for free replacement. If you installed any of these triggers in any of your customers' guns, please contact that customer and replace the trigger assembly and send us the form as usual.

NOTE: WHEN REPORTING THIS TYPE OF TRIGGER ASSEMBLY REPLACEMENT, PLEASE EXPLAIN FULLY ON FORM SINCE THE SERIAL NUMBER WOULD NOT NORMALLY SHOW UP ON OUR RECORDS.

Remington Arms Company, Inc.

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KINZER V. REMINGTON

We apologize for whatever inconvenience this may cause you. However, we feel our mutual customers deserve our very best combined efforts in repairing the involved rifles.

Rifles involved in this replacement program will be marked with one of the following barrel codes:

OH July 1987
WH August 1987
DH September 1987
EH October 1987
RH November 1987
XH December 1987

We appreciate your assistance in this replacement program and wish you every business success in 1988.

Sincerely,

Fred Emhof

F.D. Emhof
Fild Service

FDE:tpp

Remington Arms Company, Inc.

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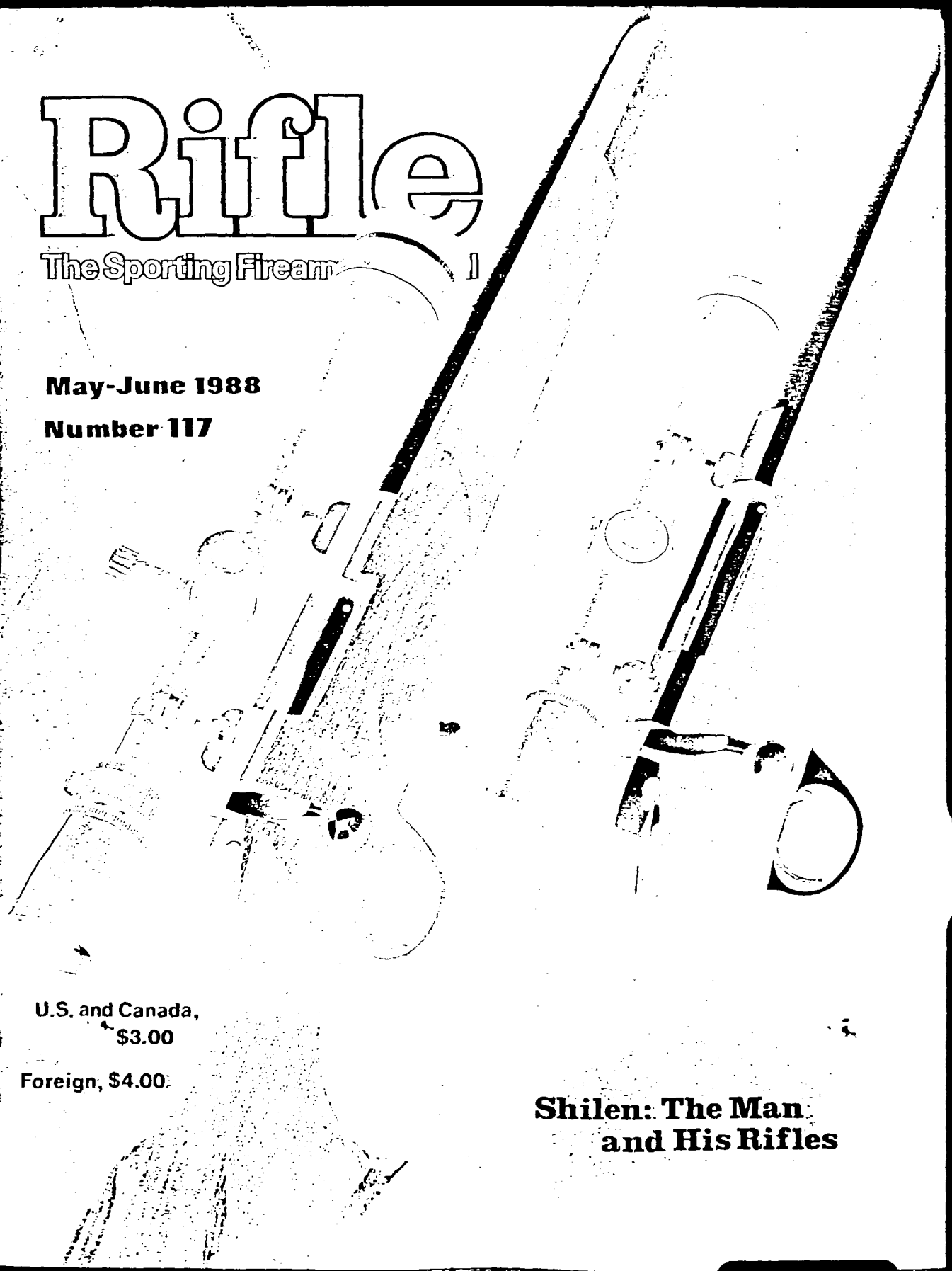
KINZER V. REMINGTON

Rifle

The Sporting Firearm

May-June 1988

Number 117



U.S. and Canada, $3.00

Foreign, $4.00

Shilen: The Man and His Rifles

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KINZER V. REMINGTON

R2540772

Shooting the Kalashnikov

(Continued from page 31)

69-grain Sierra match bullets are not recommended for use in twists slower than 10 inches. On the other hand, M193 ball shoots as well in the seven-inch M16A2 twist as it does in the 12-inch twist M16A1 barrel.

Ammunition supply is no problem. There are plenty of 5.56mm NATO and .223 Remington components around. PMC, CBC, Norma, Sako and Midway all make Boxer-primed 7.62x39mm brass. Berdan-primed, non-reloadable 7.62mm ammunition is also widely available. Case-lot quantities of fresh Chinese, Yugoslav and other 7.62x39mm hardball cost less than the components needed to reload the same number of rounds. For hot loads expected to be dented on ejection, or for use in deep brush or snow conditions where brass recovery is a nuisance, many here shoot the non-reloadable ammunition. They pull the bullets from as many rounds as may be required for hunting, substituting softnosed bullets and commercial powder and never bother searching for fired brass.

The handloads listed in the accompanying tables were chronographed in the 19-inch AKs. They are uncorrected, measured approximately 15 feet from the muzzles. Ambient temperature averaged about 60 degrees Fahrenheit. Many of the loads exceed those listed in various reloading manuals. Successful use of the hotter loads can be attributed to the often larger-capacity, stronger military brass (some made of steel) in which the loads were developed. The long military throats of the rifles and their oversized, hence pressure-relieving, groove diameters also helped.

Anyone developing loads for his own AK or Mini-Thirty should first mike his barrel's groove diameters and start 10 percent under the reloading manuals' recommended maximum, working up slowly and watching for pressure indications.

Sako offered MOA-capable bolt action sporters in 7.62x39mm on the short Vixen action for years. Ruger now offers the Mini-Thirty in the caliber as a short-range deer and black bear chambering. Mini-Thirty factory acceptance accuracy proof requires two-inch grouping ability at 50 yards using iron sights.

In one test, three, five-shot groups, each out of five different Mini-Thirties with four different kinds of ammunition (300 rounds total), fired with a 6x scope at 50 yards, averaged 2.07 inches. The tightest three-group average was 1.43 inches. The Mini-Thirty chamber and throat are cut to short commercial rather than long military dimensions and the groove diameter is .308 inch. The pressure effect of firing .310-inch diameter steel-jacketed and steel-cored military ball in a Mini-Thirty is unstated.

The 7.62x39mm cartridge, upon which the .220 Russian and 6mm PPC benchrest cartridges are also based, operates at 47,000 psi nominal breech pressure. Sako sporting ammunition in the caliber is listed at that pressure level in Sako literature. Factory proof pressure is 70,000 psi.

Among the Kalashnikov's legendary merits are its massive front locking lugs which make the action virtually indestructible. Similarly legendary is the AK's functional reliability under adverse operating conditions.

Both overload strength and underload functional reliability were tested. The cross-sectional areas of the 7.62mm and 5.56mm case heads are .157 and .110 square inch respectively. At 50,000 psi breech pressure, each of the AK's lock-

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Golden CO 80402-0304

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ROCKY MOUNTAIN RIFLE WORKS, LTD.
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(307) 237-2414

J.M. RABOURN
Premium Grade Sporting Firearms
NEW ADDRESS
Route 1, Box 260, Heavener, OK 74937
Phone 918-653-7460

Important Notice To Recent Buyers Of Remington Bolt Action Rifles.

Remington Arms centerfire rifle Models 700, Seven, 40-XB, 40-XC and Sportsman 78 *manufactured between July 29 and December 11, 1987,* have been withdrawn from sale temporarily for replacement of trigger assembly mechanisms.

This action was taken because a limited number of rifles produced during that period may have an improperly manufactured part in the trigger assembly mechanism. Although it is unlikely, the defective part could break and cause the rifle to fire accidentally.

Remington Arms has launched a program to identify and recover all rifles made and sold during this period, and as a precaution, will replace the trigger assembly on every affected rifle without charge to the owner.

All Remington trade customers and individual rifle owners are being notified, and it is expected that this program will quickly identify owners of the affected rifles.

This notice applies only to those bolt action models listed. *No other Remington firearms are involved.*

If You Have Purchased One Of These Rifles Since July 29, 1987, Do Not Load It.

We ask that you call our Trigger Assembly Replacement Program at

1-800-634-2459

with the model and serial number of your rifle. From that number, we can tell you immediately if yours is one of the affected rifles, and if it is, how you can arrange for a free replacement of the trigger assembly.

Remington. DUPONT

Remington and Sportsman are trademarks registered in the U.S. Patent & Trademark Office by Remington Arms Company, Inc. Model 700, Model Seven, Model 40-XB and Model 40-XC are trademarks of Remington Arms Company, Inc., Wilmington, Del. 19898.

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KINZER V. REMINGTON
R2540773

Remington
DUPONT

REMINGTON ARMS COMPANY, INC.

SPORTING ARMS-AMMUNITION-TARGETS-TRAPS

ILION, NEW YORK 13357

TELEPHONE (315) 894-9961

Dear Customer:

Our records show you are the holder of a Model 700 series rifle in need of a replacement trigger assembly. The serial number of the concerned rifle is listed on the enclosed form.

As it came to you from the factory, your rifle met all Remington tests and standards for reliability and performance that have made Remington bolt action rifles the preferred choice of serious shooters.

However, during routine test firing, Remington discovered the possibility that an improperly manufactured trigger part may have been assembled in a number of Model 700 series rifles. Although unlikely, the improperly produced part could possibly break and allow the rifle to fire when the safety is moved from the safe position to the fire position without the trigger being pulled.

Since the safety and quality of our firearms is our utmost concern, Remington will, at no charge, replace the trigger assemblies in all rifles which possibly contain the impacted part. To accomplish this, a trigger assembly replacement program has been instituted.

Therefore, we request that you bring or ship your rifle(s) to the nearest Remington New Gun Repair Station in your area. A list of such locations is enclosed.

If it is inconvenient or difficult for you to return the rifle to a listed New Gun Repair Station, you can elect to ship the rifle via United Parcel Service, transportation C.O.D., to:

Remington Arms Company, Inc.
Dept. RP
14 Hoefler Ave.
Ilion, NY 13357

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

In returning your rifle to either a New Gun Repair Station or to our above factory address in Ilion, NY, please do the following:

1. Mark the outside of the package clearly with "DEPT. RP - TRIGGER REPLACEMENT"

2. Include your name and return address on the outside of the box and on a note placed inside the box.

This will speed the repair of your rifle and its return to you.

If you need a box for shipping purposes, please advise me at the Ilion address.

If your rifle has already had its trigger assembly replaced or has been sold by you, please provide the information requested on the form enclosed. Then, return that form to Remington, Dept. RP, using the postage paid envelope provided.

We apologize for any inconvenience this may cause you.

In appreciation of your efforts, we will send you a "Remington Country" elk head belt buckle, especially designed for Remington by Sid Bell, as soon as the repair of your rifle(s) is recorded.

Please remember that this trigger replacement program applies only to a limited number of recent Model 700 series guns (Models 700, Seven, 40X series and Sportsman 78) and not to any other Remington gun models.

If you have any questions about this trigger assembly replacement program, you may call toll free at the following 800 number:

(800) 634-2459
(8:00 a.m. - 4:30 p.m. EST)

Sincerely,

R.H. Potter
Supervisor
Product Service

RHP:tpp

Remington Arms Company, Inc.

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

Remington
DUPONT

REMINGTON ARMS COMPANY, INC.

SPORTING ARMS-AMMUNITION-TARGETS-TRAPS

ILION, NEW YORK 13357

TELEPHONE (315) 894-9961

Dear Remington Dealer:

Our records show you are the holder of one or more Model 700 series rifle(s) in need of a replacement trigger assembly. The serial number of the concerned rifle(s) is listed on the enclosed form.

As it came to you from the factory, your rifle(s) met all Remington tests and standards for reliability and performance that have made Remington bolt action rifles the preferred choice of serious shooters.

However, during routine test firing, Remington discovered the possibility that an improperly manufactured trigger part may have been assembled in a number of Model 700 series rifles. Although unlikely, the improperly produced part could possibly break and allow the rifle to fire when the safety is moved from the safe position to the fire position without the trigger being pulled.

Since the safety and quality of our firearms is our utmost concern, Remington will, at no charge, replace the trigger assemblies in all rifles which possibly contain the impacted part. To accomplish this, a trigger assembly replacement program has been instituted.

Therefore, we request that you bring or ship your rifle(s) to the nearest Remington New Gun Repair Station in your area. A list of such locations is enclosed.

If it is inconvenient or difficult for you to return the rifle(s) to a listed New Gun Repair Station, you can elect to ship the rifle(s) via United Parcel Service, transportation C.O.D. to:

Remington Arms Company, Inc.
Dept. RP
14 Hoefler Ave.
Ilion, NY 13357

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

In returning your rifle to either a New Gun Repair Station or to our above factory address in Ilion, NY, please do the following:

1. Mark the outside of the package clearly with "DEPT. RP - TRIGGER REPLACEMENT".

2. Include your name and return address on the outside of the box and on a note placed inside the box.

This will speed the repair of your rifle and its return to you.

If you need a box for shipping purposes, please advise me at the Ilion address.

If your rifle has already had its trigger assembly replaced or has been sold by you, please provide the information requested on the form enclosed. Then, return that form to Remington, Dept. RP, using the postage paid envelope provided.

We apologize for any inconvenience this may cause you. However, we're sure you agree that our mutual customers deserve every opportunity to participate in this important program.

Please remember that this trigger replacement program applies only to a limited number of recent Model 700 series guns (Models 700, Seven, 40X series and Sportsman 78) and not to any other Remington gun models.

If you have any questions about this trigger assembly replacement program, you may call toll free at the following 800 number:

(800) 634-2459
(8:00 a.m. - 4:30 p.m. EST)

Sincerely,

R.H. Potter
Supervisor
Product Service

RHP:tpp
encl.

Remington Arms Company, Inc.

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

Remington.

DUPONT

REMINGTON ARMS COMPANY, INC.

SPORTING ARMS-AMMUNITION-TARGETS-TRAPS

ILION, NEW YORK 13357

TELEPHONE (315) 894-9961

January 14, 1988

TO OUR AUTHORIZED FUNCTIONAL WHOLESALERS:

Remington Arms Company has uncovered a problem that may develop with a small number of Model 700 series rifles and is requesting you hold further shipment of these guns that remain in your inventory until appropriate action has been taken. This letter provides you with the necessary details regarding our request.

The Model 700 Series firearms involved include Model 700 rifles, Model 40X series centerfire rifles, Model Seven and Sportsman 78 rifles shipped between July 29, 1987 and December 11, 1987. A complete serial number listing of the invovled rifles shipped to your business is enclosed.

Please note that Model 700 series rifles with serial numbers other than those shown on the attached list are not involved, and you need not take any action on those guns. Also, no other Remington gun models are involved.

During routine test firing, Remington discovered the possibility that an improperly manufactured trigger part may have been assembled in a number of Model 700 series rifles. Although unlikely, the improperly produced part could possibly break and allow the rifle to fire when the safety is moved from the safe position to the fire position without the trigger being pulled.

Since the safety and quality of our firearms is our utmost concern, Remington will replace the trigger assemblies in all rifles which possibly contain the impacted part. To accomplish this, a trigger assembly replacement program has been instituted.

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

R2540778

Therefore, we are requesting your timely assistance with the following actions:

1. Please hold shipment of any involved Model 700 series rifles in your inventory.

2. Call Remington at 800-634-2459 and provide the number of involved guns in your inventory so we can devise a plan to replace trigger assemblies for you in the best way possible.

3. If you have sold some of the involved guns, please provide the full name, address and phone number (if known) of each of your customers and matching serial number so we can contact them as soon as possible. This information should be mailed to:

   Remington Arms Co., Inc.
   Department RP
   14 Hoefler Ave.
   Ilion, NY 13357

   If you need help in searching your records for this information, or if you prefer to provide your customer information by telephone, please let us know by calling the toll free number. (800-634-2459)

We apologize for any inconvenience this may cause you. However, we feel our mutual customers deserve our very best combined efforts in repairing the involved rifles.

If you or your customers have any further questions concerning this request, please call us on the above mentioned toll free number between 8:00 A.M. and 4:30 P.M. Eastern Standard Time.

Thanks in advance for your cooperation in resolving this important matter.

Sincerely,

K.D. Green
Manager
Product Service

KDG:tpp

Remington Arms Company, Inc.

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

Remington.

DUPONT

REMINGTON ARMS COMPANY, INC.

SPORTING ARMS-AMMUNITION-TARGETS-TRAPS

ILION, NEW YORK 13357

TELEPHONE (315) 894-9961

Dear Customer:

Our records show you are the holder of a Model 700 series rifle in need of a replacement trigger assembly. The serial number of the concerned rifle is listed on the enclosed form.

Please note that this is the second important letter of request mailed to you. Since we consider the situation urgent, please make every effort to promptly have your trigger assembly replaced by one of our authorized agents or by the Remington Service Division here at the factory. A review of the problem follows along with trigger assembly replacement service details.

As it came to you from the factory, your rifle met all Remington tests and standards for reliability and performance that have made Remington bolt action rifles the preferred choice of serious shooters.

However, during routine test firing, Remington discovered the possibility that an improperly manufactured trigger part may have been assembled in a number of Model 700 series rifles. Although unlikely, the improperly produced part could possibly break and allow the rifle to fire when the safety is moved from the safe position to the fire position without the trigger being pulled.

Since the safety and quality of our firearms is our utmost concern, Remington will, at no charge, replace the trigger assemblies in all rifles which possibly contain the impacted part. To accomplish this, a trigger assembly replacement program has been instituted.

Therefore, we request that you bring or ship your rifle to the nearest Remington New Gun Repair Station in your area. A list of such locations is enclosed.

If it is inconvenient or difficult for you to return the rifle to a listed New Gun Repair Station, you can elect to ship the rifle via United Parcel Service, transportation C.O.D., to:

Remington Arms Company, Inc.
Dept. RP
14 Hoefler Ave.
Ilion, NY 13357

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

In returning your rifle to either a New Gun Repair Station or to our above factory address in Ilion, NY, please do the following:

1. Mark the outside of the package clearly with "DEPT. RP - TRIGGER REPLACEMENT"

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This will speed the repair of your rifle and its return to you.

If you need a box for shipping purposes, please advise me at the Ilion address.

If your rifle has already had its trigger assembly replaced or has been sold by you, please provide the information requested on the form enclosed. Then, return that form to Remington, Dept. RP, using the postage paid envelope provided.

We apologize for any inconvenience this may cause you.

In appreciation of your efforts, we will send you a "Remington Country" elk head belt buckle, especially designed for Remington by Sid Bell, as soon as the repair of your rifle is recorded.

Please remember that this trigger replacement program applies only to a limited number of recent Model 700 series guns (Models 700, Seven, 40X series and Sportsman 78) and not to any other Remington gun models.

If you have any questions about this trigger assembly replacement program, you may call toll free at the following 800 number:

(800) 634-2459
(8:00 a.m. - 4:30 p.m. EST)

Sincerely,

R.H. Potter
Supervisor
Product Service

RHP:tpp

Remington Arms Company, Inc.

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

Remington
DUPONT

REMINGTON ARMS COMPANY, INC.

SPORTING ARMS-AMMUNITION-TARGETS-TRAPS

ILION, NEW YORK 13357

TELEPHONE (315) 894-9961

Dear Remington Customer:

Please note that this is the third important letter of request mailed to you concerning the limited Model 700 series recall. This third mailing underlines the absolute urgency that you give full attention to this notice and promptly have your trigger assembly or assemblies changed by one of our authorized agents or by the factory. Again, it is essential that you react now to this Model 700 series trigger assembly replacement program. A review of the problem follows along with easy to follow trigger assembly replacement service procedures. We implore you to take time to address this critical situation.

Our records show you are the holder of one or more Model 700 series rifle(s) in need of a replacement trigger assembly. The serial number(s) of the concerned rifle(s) is listed on the enclosed form.

As it came to you from the factory, your rifle(s) met all Remington tests and standards for reliability and performance that have made Remington bolt action rifles the preferred choice of serious shooters.

However, during routine test firing, Remington discovered the possibility that an improperly manufactured trigger part may have been assembled in a number of Model 700 series rifles. Although unlikely, **the improperly produced part could possibly break and allow the rifle to fire when the safety is moved from the safe position to the fire position without the trigger being pulled.**

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(800) 634-2459
(8:00 a.m. - 4:30 p.m. EST)

Sincerely,

R.H. Potter
Supervisor
Product Service

RHP:tpp
encl.

E.I. du Pont de Nemours & Company
Remington Arms Company, Inc.
Business Services Division
Ilion, New York

xc: D.M. Condon
W.H. Coleman, II
K.T. Krewson
S.M. Morris
J.F. Winske

File 700 Recall

December 22, 1987

CONFIDENTIAL

REMINGTON ARMS CO.
DEC 2 1987
FIREARMS ... VISION

T.J. PERRY
B-2266
WILMINGTON

REQUEST FOR RESERVE ACCOUNT
MODEL 700 RECALL

Because of a defective vendor supplied component, Remington is initiating a recall of certain Model 700 Rifles produced during the third and fourth quarters of 1987.

This recall will affect approximately 20,000 rifles which have been shipped from the warehouse, plus an estimated 18,000 rifles and sub-assemblies which are either in-process or in the warehouse.

The estimated cost of this recall is $2 Million (see attached). We are requesting that a reserve account be established to charge the anticipated cost of this recall against 1987 earnings.

RICHARD S. DOBZELECKI, JR.
SUPERINTENDENT - BUSINESS SERVICES

RSD:sp
Attach.

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KINZER V. REMINGTON

ESTIMATED MODEL 700 RECALL COSTS 12/22/87

NOTIFICATION				
MAILING				
SAY 40,000 LETTERS (2 PER GUN) @ $2 PER LETTER		40,000	$2.00	$80,000
TELEPHONE				
SAY 5 "800" LINES FOR FIRST YEAR, PLUS ONE LINE FOR TWO ADDITIONAL YEARS @ $17,500 PER LINE PER YEAR		7	$17,500	$122,500
TELEPHONE SWITCHING EQUIPMENT				$12,000
OPERATORS (TEMPORARY EMPLOYEES) - SAY $ 8.00 PER HOUR FOR 2,000 HOURS PER LINE PER YEAR		7 2,000	$8.00	$112,000
ADVERTISING SAY - PER MARKETING				$250,000
		SUB - TOTAL		$576,500
SHIPPING				
FREIGHT				
SAY 15,000 GUNS TO BE SHIPPED (IN AND OUT) @ $6.00 EACH WAY	15,000	2	$6.00	$180,000
PACKING MATERIAL - SAY 15,000 BOXES @ $1.25 EACH		15,000	$1.25	$18,750
		SUB - TOTAL		$198,750
REPAIR COSTS				
REPLACEMENT PARTS - SAY 10,000 REPLACEMENT TRIGGER ASSEMBLIES @ $8.56 EACH		10,000	$8.56	$85,600
REPAIR COST				
SAY 11,000 GUNS AT WARRANTY REPAIR STATIONS @ $25 EACH		11,000	$25.00	$275,000
SAY 5,000 GUNS AT DEALERS / DISTRIBUTORS (BY REMINGTON PERSONNEL) @ $50 EACH		5,000	$50.00	$250,000
SAY 4,000 GUNS AT FACTORY @ $30 EACH		4,000	$30.00	$120,000
RECONDITIONING OLD TRIGGER ASSEMBLIES				
SAY 10,000 ASSEMBLIES TO BE RECONDITIONED BY DISASSEMBLING, REPLACING CONNECTOR, REASSEMBLING, AND RETESTING @ $9.00 EACH		10,000	$9.00	$90,000
		SUB - TOTAL		$820,600
IN - HOUSE COSTS				
SORTING CONNECTORS				$5,000
SORTING AND RECONDITIONING GUNS AND TRIGGER ASSEMBLIES IN PROCESS OR WAREHOUSE - SAY 18,000 UNITS @ $9.00 EACH		18,000	$9.00	$162,000
ENGINEERING, SUPERVISION, AND ADMINISTRATION				$200,000
PROGRAMMING AND SYSTEMS SUPPORT				$15,000
REARRANGEMENT AND WIRING				$6,000
		SUB - TOTAL		$388,000
		TOTAL		$1,983,850

RD-49-B

REMINGTON ARMS COMPANY, INC.

INTER-DEPARTMENTAL CORRESPONDENCE

Remington DUPONT PETERS DUPONT

"CONFINE YOUR LETTER TO ONE SUBJECT ONLY"_____

Ilion, NY
January 16, 1987

TO: [redacted]
K.C. ROWLANDS

FROM: T.C. DOUGLAS

QUARTERLY AND MONTHLY REPORTS - 1987

Please have quarterly reports to me by:

March 19	September 17
June 18	December 17

Quarterly reports should include a summary of the work done during that quarter on each of your programs.

Monthly reports are due on:

January 22 Jan 28	July 23
February 19	August 20
April 16	October 22
May 21	November 18

Monthly reports need not be written on each program. Only significant achievements during the month need to be included.

TCD:sps

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

Automotive Products Department

and

Fabricated Products Department

Research & Development

Quarterly Summary

April - June 1987

CONFIDENTIAL
SPECIAL CONTROL
NOT TO BE REPRODUCED

EDITED BY M.M. COBURN

Distribution on Back Cover

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ABSTRACTS

AUTOMOTIVE PRODUCTS DEPARTMENT

FINISHES

EPOXY/ANHYDRIDE ACID ETCH RESISTANT AUTOMOTIVE CLEAR.....10

Several leads have been identified to develop an epoxy/anhydride acid etch resistant automotive clear for use over 871/872-Line high solids basecoat. The cure rates of clearcoat and basecoat must be balanced to overcome wrinkling and solvent popping problems of the initial candidate. Potential 1988 sales are $30MM, with an ATOI of 9-10%.

EXPANSION OF G.M. PRIMERS TO FORD.....10

Several primer/surfacers, originally developed for G.M. have been reformulated as offerings to Ford in order to increase our share of the business with this important customer. Line trials have been scheduled.

EXPANDED USE OF STONEGUARD® ANTI-CHIP COATINGS.....11

A higher solids, EPA conforming modification of existing products was successfully line trialed at G.M.-Doraville in competition with PPG for new business valued at $1MM/year at an ATOI of 8%. This result provides encouragement to compete for additional business against PPG at G.M.-Fairfax. Other opportunities will be sought at NUMMI and G.M.-T-400 Truck and Bus.

AUTOMOTIVE CATIONIC ELECTROPRIMER.....11

It has become increasingly unlikely that a suitable automotive cationic electroprimer can be developed for G.M. from technology licensed from Hoechst. An initial offering, SWE-5244, was withdrawn because of weakness in corrosion resistance. Hoechst continues to work on a second generation product. Meanwhile, evaluation of ICI's ICICLE technology has been re-initiated to determine the feasibility of using this technology as a platform for further development. Assessment should be complete by the 4th Quarter.

PLASMA TREATMENT OF PLASTIC SURFACES.....12

As part of a Corporate Interdepartmental Steering Committee, we continue to explore the feasibility of utilizing plasma treatment to promote adhesion of coatings to plastic substrates. The possibility of acquiring additional technology in this field from Battelle Research is under consideration.

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ABSTRACTS

AUTOMOTIVE BODY PLASTICS AND ALTERNATIVE APPLICATION PROCESSES....13

Efforts to decorate automotive body plastics have been expanded. While the lamination program with G.M. has been extended to the plastic fender extensions on the Pontiac Fiero, a joint program with the Bexloy® Group is addressing the decoration of low cost skins by in-mold coatings and thermoforming of predecorated substrates. Further evaluation is underway.

REFINISH CRONAR® PROGRAM 14

Cronar® commercialization is proceeding at a better than anticipated rate and expected 1987 ATOI is now forecasted at $4-5MM. With added field experience, the need to speed up the dry time and to improve appearance over lacquer-based original paints has been identified. Leads to make these improvements have been identified and development work is proceeding. Meanwhile, two competitors have begun limited commercialization of non-isocyanate topcoats in competition with Cronar®.

NON-ISOCYANATE AMBIENT CURE CLEARCOAT FOR REFINISH.....15

Two chemistries, epoxy/anhydride and silanes, are under development as future generation upgrades of the Cronar® Refinish System. While both systems show substantial promise, deficiencies in color and toughness in the epoxy/anhydride, and flexibility and residual stress in the silane were identified. Leads to deal with these issues are being pursued.

IMPROVED REFINISH COLOR MATCHING PROGRAMS.....15

Successful field color matches were obtained using portable field colorimetry coupled with laboratory instrumental systems. This could provide the business with a competitive edge in adjusting colors in the field without shipping painted parts to the laboratory. A strategy is being developed on how best to exploit this technology.

SUPPLIER FINISHES - FLEXIBLE PRIMER.....16

Ford-Utica has authorized a line trial for our 711-001 polyester based flexible automotive primer for priming RIM plastic fascia. This represents an opportunity to replace PPG on $4MM/year sales with an ATOI of 9%.

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ABSTRACTS

DISPERSION PROCESS STUDIES.....16

A 30-40% increase in pigment dispersion rate and a 7-8% increase in product quality was verified experimentally based on a preliminary mathematical dispersion model. The result was obtained with ultra-fine media and increased rotating disc surface area. Scale-up to a 4.5 gallon semi-works Schold mill is planned. The goal is to significantly reduce the current $80-90MM direct dispersion manufacturing cost.

START UP OF PRESSURE PROCESS AT TOLEDO.....17

A pressure process to produce a high solids acrylic resin for Automotive has been demonstrated in semi-works. A resin reactor at Toledo has been modified to handle such pressure polymerization. Plant scale-up is expected in August. This first resin to be converted to a pressure process will result in a cost savings of $350M/year and 3 hours reduction in cycle time.

AUTOMOTIVE PAINT RESINS COST REDUCTION.....17

A lower cost version of RC-H-69465 High Solids Acrylic Resin, used in Automotive's rigid clearcoat, was scaled up at Front Royal. The savings, estimated at $96M was achieved by reducing the initator content. Conversion to the modified resin will be made once product performance testing is completed.

IN-HOUSE MANUFACTURE OF VOE/LOFA ESTER.....18

The first plant batch of vinyl oxaziline ester of linseed oil fatty acids (VOE/LOFA) was successfully made at Front Royal. This represents a cost saving program to replace a purchased intermediate used in producing air-dry Refinish resins for Centari® and Cronar®. Total cost savings incentive is over $500M/year.

ANALYSIS OF COMMERCIAL MELAMINES BY MASS SPECTROMETRY.....18

A new technique, "Potassium Ionization of Desorbed Species (KIDS)" provides a more complete analysis of commercial melamine crosslinking resins, which should improve our ability to utilize this complex, but important cross-linking chemistry.

COMPOSITIONAL ASSURANCE TESTING (CATS).....19

Our six domestic finishes plants reported a first quarter cost savings of $2MM by utilization of CATS. Utilization is being explored with other Departments in the Company. This capability will be reviewed with Automotive Finishes to seek ways to enhance our offering to our customers.

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KINZER V. REMINGTON
R2540790

ABSTRACTS

FABRICATED PRODUCTS DEPARTMENT

CONSUMER PRODUCTS AND SPECIALTY RESINS DIVISION

SPECIALTY RESINS-COBALT CATALYSIS IN METHYL METHACRYLATE POLYMERIZATION 19

The first commercial batches of cobalt catalysts were prepared. Synthesis of macromonomers and low molecular weight polymers continues and commercial applications are being sought.

SPECIALTY RESINS WATER-BASED CONFORMAL COATING FOR PRINTED CIRCUIT BOARDS 21

Environmental pressures are driving the replacement of solvent-based resins with water-based systems to coat printed circuit boards. New emulsion candidates that coalesce without solvent have been sampled to our customer, Columbia Chase. A problem of residual tackiness is being addressed. This work is aimed at protecting annual sales of $300-$600M.

UNSATURATED POLYESTERS FOR COOK PAINT AND VARNISH 22

Initial semi-works batches of unsaturated polyester resin were prepared at Ft. Madison to establish the capability of toll manufacturing for Cook Paint and Varnish. Potential volume is 160,000 lbs./month to 160,000 lbs./week comprising four different resins. Once selling prices are established, estimates of ATOI can then be made.

WA ADHESIVES 22

WA adhesives are a specialty resins latex sold to Imaging Systems to coat Kapton®. Complaints regarding unsatisfactory and variable quality resulted in a review and upgrading of the manufacturing process. 1987 production is forecast at 526M lbs. and an overall ATOI to Du Pont of $5MM/year.

GTP PMMA FOR PROPOSED MRC JOINT VENTURE 23

A feasibility study was initiated, as part of deliberations to joint venture with Mitsubishi Rayon Corp.(MRC), to determine the cost/property balance of making solid PMMA pellets by GTP. The potential for better thermal stability and lower melt viscosity could command a price premium, thereby enhancing the attractiveness of a joint venture.

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KINZER V. REMINGTON

ABSTRACTS

TEFLON® COATINGS FOR CORNING GLASS.....23

A SilverStone® clear silicone topcoat has been accepted by Corning Glass as a coating for Pyrex glassware, with sales potential of $1MM. Other coatings have been submitted for ceramic cookware and bakeware with additional sales potential of $5-$6MM.

TEFLON® MANUFACTURING CONSOLIDATION 23

The manufacture of Teflon® products is being consolidated at Parlin, New Jersey and Mechelen, Belgium with the Toledo plant production being phased out. Mechelen is fully aligned, and Parlin is in the final alignment stage. The incentive is reduction in product variability by eliminating equipment, formula and raw material differences between manufacturing sites.

GTP DISPERSANT IN LUCITE® XL SHEET.....24

Laboratory and plant tests have demonstrated improvements in color uniformity and dispersion stability with GTP based pigment dispersions. R&D has proposed commercialization, and with business concurrence, start-up will be planned for the fourth quarter of 1987.

LUCITE® ACRYLIC SHEET PROCESS FLEXIBILITY.....25

The potential for an additional 25% rate increase in the production of Lucite® XL sheet was identified by increasing the initiator content, reducing the dimethacrylate content, and eliminating the chain transfer agent. If implemented, the increased production rate will apply to both Lucite® L as well as XL and provide flexibility for shorter delivery times to customers.

CORIAN® SIERRA.....25

Commercialization of Corian® Sierra has met with excellent market acceptance. The plant has produced 1MM lbs. against orders of 1.3MM lbs. in two colors, Sierra Dusk and Midnight. An additional $1MM of increased earnings is expected from the new products during this first year. At least one additional Sierra color will be commercialized by year end.

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KINZER V. REMINGTON

ABSTRACTS

NEW CORIAN® COLORS 26

Two additional Sierra colors, a beige and a cranberry, along with two coordinated solid colors, under development, are expected to be commercialized by the first quarter of 1988. In cooperation with a color consultant, and inputs from marketing research, the laboratory has demonstrated the capability of formulating a wide range of colors, thereby improving our position to respond to color trends in the marketplace.

WARP IN CORIAN® SHEET 26

Changes in manufacturing procedure have minimized warp within the constraints of the existing process, and have eliminated seasonal variations. The warp problem costs the business $120M each year in rejects and returned goods, as well as an estimated lost sales of 1% of total sales. Further reductions in warp will require major re-design of the manufacturing process.

NEW FLAT FISHLINE 27

A flat monofilament fishline for casting reels has been enthusiastically received by a test panel of fishermen. The flat monofilament is being reinvestigated by Textile Fibers for industrial uses, and we are following this development. Commercialization is planned contingent upon Textile Fibers' ability to supply the product.

SHOTGUN BARREL AUTOMATION 27

Mixed results were obtained in cold forming tests aimed at eliminating present turning and reaming operations in shotgun barrel production. Process optimization and testing continues. Forecasted capital for an automated system is $1.6MM with an O.R.O.I. of over 50%.

REMINGTON SP-10 MAGNUM 28

The Remington SP-10 Magnum is planned as an upgraded version of the Ithaca MAG 10 for which we recently purchased rights to make and sell. A six gun test of the enhanced version is scheduled for August, with commercialization planned for 1988. Potential sales are estimated ultimately at 10,000 guns by 1990.

SPECIALTY PRODUCTS AND SERVICES DIVISION

TEDLAR® PROTECTIVE CLOTHING 28

Textile Fibers Department is pursuing the development of disposable protective clothing with selected customers, based on Tedlar®/polyvinylalcohol composites developed in

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KINZER V. REMINGTON

ABSTRACTS

our laboratory. Additional laminates are being prepared for evaluation. This represents an additional market for Tedlar® film projected to grow to several million dollars per year.

LOW HEAT RELEASE EMBOSSED TEDLAR® SYSTEM.....29

Low heat release modifications of Tedlar® film are undergoing laboratory tests to develop an offering to Boeing for replacement of existing Tedlar® laminates on the interior of commercial passenger aircraft. The program is aimed at complying with new FAA regulations and to preserve this very profitable segment of our Tedlar® sales valued at $1MM. Samples will be submitted to Boeing in the third quarter of 1987.

NEW TEDLAR® FILM DEVELOPMENTS.....29

The first penetration of Tedlar® film was made in surfacing aluminum-sided trucks with an intense orange film for Wabash Trucks. Offering better color and gloss retention than paint, Tedlar® should be capable of capturing a share of this $43MM market segment. Programs are in place to support this effort.

NEW TYPE FABRIC FOR DYMETROL® SEATING SUPPORT SYSTEMS.....30

A new weave for Dymetrol® fabric for use in seating support systems was developed which provides a significant increase in warp weight to improve staple cut through. Customer sampling verified the improvement. Market introduction of the improved fabric is scheduled for September. The financial goals are $7.5MM sales with $600M ATOI by 1990.

HYTREL® ELASTIC BAND PRODUCTS.....30

In cooperation with Textile Fibers, a family of elastic band products were extruded from Hytrel® 6133. A meeting is planned with Fibers to ascertain which group will explore various markets. For example, there is an estimated $1MM market in swim goggles and exercise bands at about 20% ATOI.

KALREZ.....31

Recent developments with K-4000 polymer suggest the possibility of a "universal" Kalrez® product to simplify the existing product line which now includes four base polymer compositions and numerous compounds derived therefrom. This would simplify the task of our distributors in their resale recommendations, while providing a complete performance package to our end-use customers.

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON
R2540794

ABSTRACTS

VESPEL®.....31

Production of commercially acceptable Vespel® ST was demonstrated in the Circleville pilot unit when sufficient attention was given to detail and cleanliness. A program is being developed to demonstrate plant scale capability before year end in order to meet customer commitments for product.

SPECIALTY EXPLOSIVES.....32

In response to a DARPA initiative, an improved version of Deta sheet flexible explosive is being developed having lower flammability and higher energy capability. Initial production and test results are expected by the third quarter of 1987.

DEPARTMENTAL STRATEGIC RESEARCH

GTP BULK POLYMERIZATION.....32

Encouraging initial results were obtained in exploring bulk polymerization by group transfer polymerization as a low cost route to polymethyl methacrylate. This could be useful in deliberations regarding a joint venture with Mitsubishi Rayon. Emphasis is being placed on continuous preparation of extrusion grade polymer and syrups.

G-SERIES ELVACITE® RESINS.....33

The first customer order was received from New York Bronze for a G-series analog of Rohm and Haas' Acryloid B-66. This GTP prepared analog enables the customer to double the package solids at comparable viscosity. Tankwagon quantity sales are expected if our product is adopted. Overall, Specialty Resins forecasts selling 400M pounds of G-series resins in 1987 growing to 3MM pounds ($3MM sales, $150M ATOI) by 1990.

MONOFUNCTIONAL POLYMERS.....33

Using GTP, monofunctional polymers have been routinely prepared. With Specialty Resins, the market opportunity is being defined. Samples have been supplied to PPD as well as external companies for evaluation as potential building blocks.

THERMAL PROPERTIES OF GTP PREPARED POLYMERS.....33

In comparative tests, GTP prepared polymethyl methacrylate demonstrated a superior balance of thermal stability and heat distortion temperature. This substantiates that, by process alone, these important thermal properties can be affected. End-use application still needs to be identified.

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ABSTRACTS

POLYMER ISOLATION FACILITY.....34

The $1.75MM project for a polymer isolation facility at Marshall Laboratory is in the final stages of approval. This will provide the capability to convert polymer solutions into pellets or other appropriate solid forms. The anticipated isolation capacity is 1MM pounds/year, depending upon the materials processed. The major equipment components are skid mounted for movement to Parlin for routine production in the future.

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AUTOMOTIVE PRODUCTS DEPARTMENT

FINISHES

EPOXY/ANHYDRIDE ACID ETCH RESISTANT AUTOMOTIVE CLEAR

A clearcoat development program to protect our automotive high solids colorcoat/clearcoat business (Sales forecast 1988 $30MM; ATOI 9-10%) is targeted at: (1) improved environmental (acid) resistance; (2) compatibility with 871/872-Line solvent borne basecoats; and (3) improved appearance. Low temperature epoxy/acrylic anhydride (E/A) clear designed for use over waterborne basecoats results in severe popping and wrinkling when applied over 871/872-Lines. The mismatch of chemistries and cure rates has been shown to be the cause. To overcome the problem, the basecoat cure rate must be accelerated, while the clearcoat cure rate must be retarded.

Two E/A clear types are being investigated. One, similar to the low temperature clear uses a liquid glycidyl ester, while the second utilizes a dispersion of trigylcidylisocyanurate (TGIC). TGIC is essentially insoluble in the system, but melts at the bake temperature, hence acting as a latent reactant. In both cases, the objective is to slow the rate of cure. Both systems appear to give environmental (acid) resistance.

Two sub-programs involving in-depth catalyst studies for both the basecoats and clearcoats are underway. Our objective is to reduce or eliminate a yellowing problem, and improve the appearance to an acceptable level. Several leads including selectively blocked acid catalysts in the basecoat, and phosphonium, quarternary ammonium, and blocked basic compounds in the clearcoat appear promising. Full property evaluations of likely candidates are underway, and we expect to discuss this system with General Motors in the fourth quarter.

EXPANSION OF G.M. PRIMERS TO FORD

Several opportunities to use primers developed for General Motors at Ford have been identified in cooperative development efforts with MCCI. 711-192, low VOC 250°F bake, Taupe Surfacer has been formulated for Ontario Truck and 500 gallons is being manufactured for a line trial. Use will be in truck beds to highlight dirt which can then be spot-sanded. If successful, we will replace an Inmont product currently in use which hard settles. A light gray analogue of 711-192 was formulated for Louisville Truck and coded 711-002. This material will be used as a surfacer/guidecoat on Ryder Rental Trucks to provide a light colored undercoat for the poor hiding Ryder Yellow. This is a new application, which, if successful, will be expanded for use under other light colored special order and fleet colors. A 1,000 gallon Toledo batch of 711-002, checked out satisfactorily and will be line trialed at Louisville in late July.

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Forecasted volumes and profitability at Ford are being established.

EXPANDED USE OF STONEGARD® ANTI-CHIP COATINGS

We are currently selling our Stonegard® Anti-Chip coatings at two automotive plants - G.M. Lansing (N-Car) and at Nissan in Smyrna. Recent development work has been directed at developing a VOC conforming analogue of this product which can be applied by air spray as opposed to current airless or air-assisted airless application. By adjustment of the rheology package and solvent balance, and incorporation of a reactive diluent we have developed a viable candidate. Using this candidate we have been competing for the anti-chip business head-to-head against PPG at G.M. Doraville and Fairfax. Both of these plants are in the midst of conversion to our 871-Line/872-Line Basecoat/Clearcoat topcoat system.

PPG trialed their product at Doraville and could not achieve target film build - they obtained 2 mils max. vs. a 3 mil minimum specification. We successfully line trialed our candidate. Based on these results and acknowledgements offered by the Doraville paint superintendent we expect confirmation of this business award. Forecasted volume is $1MM/year at an ATOI of 8%.

We are encouraged by the Doraville results as we prepare for a line trial against PPG at Fairfax. Other opportunities will be sought at NUMMI and G.M.-T-400 Truck and Bus.

AUTOMOTIVE CATIONIC ELECTROPRIMER

The objective of this program is to develop and commercialize a cathodic electroprimer suitable for use at GM. The incentive to do this arises from our desire to be a full line finishes supplier to GM and thus protect our competitive position there. To date, the approach we have taken to accomplish this objective has been to pursue a technology licensed from Hoechst.

Within the Hoechst technology we have been pursuing parallel paths, simultaneously working with their SWE-5244 system and their SWE-5260 system. The SWE-5244, which was introduced to GM in April 1986, was originally designed to be a high build body system however deficiencies in its surface smoothness precluded its use. Pending the development of a true body system, which is hoped to be the SWE-5260 system, we have attempted to make incremental improvements in the SWE-5244 system while using it in a number of programs with G.M. in order to keep their interest alive. These programs have involved submissions as small parts products and corrosion performance programs at high film build. As part of the corrosion performance program a large number of test substrates were evaluated using a number of different commercial and experimental competitive cathodic systems. The

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performance of the SWE-5244 system in this study was significantly inferior to the competitors performance. This result coupled with additional laboratory testing which indicated corrosion weaknesses in the SWE-5244 system has caused us to withdraw the product from all submission and testing programs with GM.

Hoechst continues to do formula optimization work on the SWE-5260 system. They remain confident that surface smoothness will be improved over that of SWE-5244 and that the new system should also have acceptable corrosion properties. Our opinion is less optimistic based on earlier evaluations of prototype versions of SWE-5260. Hoechst should complete their optimization work by mid-July at which time we will receive the final version of the product for our extensive evaluation. In addition, concerns about the high cost of these Hoechst systems is being studied for reductions.

As a contingency plan, we reopened our dialog with ICI relative to their ICICLE electrocoat technology. The ICICLE system in itself will not likely be a commercializable product for the North American market; however, it is very likely that it could serve as a platform for our own development efforts. We have now received a sample of a medium film build, high VOC formulation of ICICLE. Initial results indicate that smoothness is better than PPG's ED-3150A while throw power is equal in performance. The ICICLE does have weaknesses in chip and adhesion compared to control. A much more extensive study is underway looking at performance over a variety of substrate and baking conditions. In addition, in mid-July we will receive a high build, low VOC version of ICICLE for testing. Our goal is to determine the technical feasibility of using the ICICLE technology as a platform for our own development work by the end of the 4th quarter.

PLASMA TREATMENT OF PLASTIC SURFACES

Plasma technology has progressed rapidly over the last 10 years, but industrial applications, outside of the electronics industry, have been slow to develop. Recently, activity has accelerated, especially for use with fibers, films and plastics. We have been evaluating plasma treatment as a route to improving adhesion of our coatings to plastic substrates. We have treated Bexloy® thermoplastics and TPO's (polypropylene and polyethylene) with oxygen plasmas and in all cases achieved excellent adhesion with conventional primers and with topcoats direct to the treated plastics.

A standard treatment is done in a vacuum with exposure to the plasma (a microwave or radio frequency excited gas) for a few seconds to a few minutes. We achieve excellent results with 3 to 5 minutes exposure. The treatment is stable at least 4 months when exposed to ambient conditions prior to painting and we believe indefinitely after painting. Long term performance testing is continuing. In addition to improved adhesion, plasma treatment removes surface contaminants thereby reducing cleaning

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procedures, and by increasing surface polarity, reduces static charges and associated dirt pickup. Total costs and quality will be impacted positively.

We have been working as a member of a Corporate Interdepartmental Steering Committee on plasma (headed by Textile Fibers Department) in order to develop a strategy to maximize our opportunities, develop cost comparisons and establish working relationships with equipment suppliers.

A major concern is the effect a successful plasma operation with thermoplastic olefins may have on our Bexloy® programs. We have discussed the program with APD Marketing to address this issue. In any event, we feel strongly we must continue to work with both Bexloy® and the olefin thermoplastics to establish viability of both to plasma.

Battelle Research has approximately 11 years research invested in plasma and its applications. They are now considering a package of technology, including patents, to license or sell. They agreed informally to talk to DuPont first. A secrecy agreement to allow both parties to talk more freely in assessing their technology is being drafted.

AUTOMOTIVE BODY PLASTICS AND ALTERNATIVE APPLICATION PROCESSES

General Motors, along with other domestic manufacturers, has an objective of reducing their cost of manufacture in order to compete more effectively with foreign imports. Two strategic efforts are targeted at this objective: lamination coating; and low cost decorated plastic.

We are working with the Thermark Division of Avery International to develop lamination coatings for plastic substrates. In the first quarter, we demonstrated process feasibility by decorating 100 red Fiero quarter panels in a test program. This system was comprised of ABS plastic and a Kynar® polyvinylidene fluoride basecoat/clearcoat paint system. Although gloss and mar resistance were below specs, results were sufficiently attractive that G.M. has mounted several sets on test cars at their Proving Grounds for on-car studies.

G.M.-C.P.C. Division continues to support this effort and has offered the TPO plastic fender extensions on the Fiero as our next target. We recently ran injection molding tests with TPO plastic with an improved Kynar® polyvinylidene fluoride paint system and an Lucite® acrylic basecoat/clearcoat system both of which showed commercial level of appearance. Further testing is underway.

In a joint scouting effort between FPD and APD, we are exploring various options to a low cost decorated skin with an objective of a 25% cost reduction versus current steel substrate with conventionally applied paint. We are bringing paint and application expertise to the program while the Bexloy® Group is bringing their plastic materials know-how.

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Based on output from the "low-cost skins" study completed in the first quarter, efforts are underway on two low cost processes - in-mold coatings and thermoforming of predecorated substrates - and on two low cost plastics - polyethylene and polyethylene terephthalate.

REFINISH CRONAR® PROGRAM

Cronar®, a new non-isocyanate Refinish enamel based on epoxy/amine chemistry which was introduced in the 1st Quarter 1987 has been very positively received in most areas of the country. Cronar® is expected to add $4-5MM ATOI during 1987. Sales have grown at a better than anticipated rate and strong interest exists on the part of jobbers and large volume "A Accounts" to introduce Cronar® at new locations. As additional field experience has been gained with the system, it appears that early cure response of the Cronar® clear used to match OEM basecoat/clearcoat colors will require improvement at locations which rely solely on air dry. While typical isocyanate clears require 4-8 hours to permit light handling and freedom from water spotting, current Cronar® clear, when air dried, requires 24 hours. Reformulation work to date shows promise for reducing Cronar® cure time to 12-18 hours. Upgraded formulations will be commercialized expeditiously to avoid any significant customer dissatisfaction.

In addition, Cronar® must be applied over enamel and lacquer original paints. Cronar® performs well over enamel substrates, but its aggressive solvents preclude it being applied directly over lacquers, and a barrier coat (sealer) is required. Initially, Cronar® will be used over commercial sealers which provide poorer barrier properties than desired for optimum appearance, and current R&D programs are evaluating routes to improved sealers for lacquers. Expanded body shop testing is about to begin with a sealer which can be commercialized in a relatively short time period.

This sealer provides better barrier properties than currently available products, but where ovens are not available, it requires overnight dry for optimum appearance. Two other approaches are being pursued to achieve good barrier properties with shorter dry times: high molecular weight lacquers are being screened to identify those which will provide the best barrier; and two-component sealers based on epoxy/anhydride and epoxy/versamide technology are being optimized for cure/barrier balance. The best candidates from these programs will be extensively evaluated in captive body shops during the next quarter to determine feasibility for commercialization.

During the past quarter, both PPG and Akzo have begun limited commercialization of non-isocyanate topcoats in competition with Cronar®. PPG has introduced a clearcoat under the trade name "NCT" while Akzo has introduced both clear and pigmented systems under the trade name "Autonova". Only limited samples of these competitive products have been

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obtained thus far and initial analytical work has determined that both are based on chemistry different than that used in Cronar®. As soon as sufficient samples are available, we plan to extensively assess the performance of these competitive products versus Cronar®.

NON-ISOCYANATE AMBIENT CURE CLEARCOAT FOR REFINISH

Epoxy/Anhydride and silane chemistries are under development as second and third generation clearcoats to be used in conjunction with Cronar® Refinish systems. Each of these systems have unique property balances and are expected to broaden our offerings.

Field testing of Epoxy/Anhydride clear coats began last year and to-date, 25 cars have been painted. This quality is judged to have commercial potential except for a need to reduce color and improve toughness. More extensive laboratory and field tests are planned in the third quarter.

The source of color was identified as a complex of amine and benzoquinone (from oxidation of the inhibitor) and a charge transfer complex of Dabco and Citraconic anhydride. Processes to reduce and eliminate these complexes are being developed. The purified products did result in a reduction of color. Further, the addition of an acrylic polyol to this chemistry was found to improve the toughness as well as color of the resulting film. This new formula will be used for phase II shop testing.

Examination of clear based on acrylic-silane chemistry, submitted to us by Kanegafuchi Chemical, showed attractive properties. The weaknesses are: (1) poor flexibility and (2) high residual stress. Our approach to solve these problems involves changing the configuration of the polymer to obtain more effective crosslinking. We have synthesized comb polymer from a GTP macromonomer where only the branches contain the silane group. Initial results indicated that only half of the silane groups were needed to achieve the same crosslinking rate. Mechanical properties were also improved. A patent proposal has been filed.

IMPROVED REFINISH COLOR MATCHING PROGRAMS

A major Refinish Business strategy is to upgrade the quality of color matches to the vehicle in the field. Often, the supplied color standard panel differs from the actual vehicle due to application variability or mid-year color changes. Car parts are commonly sent to the Laboratory in order to reposition formulas which don't match the cars in the field. Recently, a method using portable field colorimetry coupled with laboratory instrumental systems expertise has been proven successful in providing field color matches without the need for car parts in the laboratory. In both the Cronar® and Lucite® qualities, improved matches were obtained in the field after several color adjustments. On one occasion, two field sales

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representatives with previous color experience were trained in about four hours to use this system. Their success with the system generated enthusiasm about the "edge" this could give them on their competitors by being able to field adjust colors. A comprehensive strategy is now being developed in conjunction with the Refinish Business to determine how best to exploit this technology.

SUPPLIER FINISHES - FLEXIBLE PRIMER

The Supplier Finishes Marketing organization has identified an opportunity to use our recently General Motors approved polyester based flexible automotive primer (764-140) at Ford's Utica Plant for priming RIM plastic fascia. Recoded as 711-001, all performance data have been covered with Ford technical personnel and they have given approval for a line test to be conducted the week of July 13.

711-001 represents two changes from our standard 764-140. A single stage manufactured analogue with different diacids replaces the two-stage structured polyester resin and the gloss is lowered to 20% at 60° by use of a stir-in syloid flatting base. The resin (TSCA approved) was manufactured at Flint and the flatting base and finished product required for the line trial are in process.

The business target is $4MM/year on line 2 at Ford Utica on which a PPG primer is currently used. While selling price strategy is still under development, our going-in selling price of $31.28/gallon will yield an ATOI of 9%.

DISPERSION PROCESS STUDIES

The development of an understanding of the mechanism of the media mill process continues with the objective of reducing significantly the current $80-90MM direct dispersion manufacturing cost. Previously, we reported development of a preliminary mathematical dispersion model and its use in predicting the positive impact of using ultra-fine (0.25mm) media and increasing the rotating surface area via adding more discs. Preliminary tests run last quarter verified this impact in both cases.

During this quarter, further runs using a second vendor's equipment verified the 30-40% increase in dispersion rate and the 7-8% increase in ultimate product quality found in the initial runs. However, contrary to the previous tests, no hydraulic packing was noted in these runs which used a more effective media separation/retention system. Evaluation of the resultant product at Troy Laboratory indicated a noticeable, but not large, improvement in metallic saturation. Steps have been taken to provide internal capability to further study the advantage/limitations of using ultra-fine media.

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Further verification was also achieved of the effect of increasing the mill disc area. These tests indicate that we have achieved approximately twice the dispersion rate capability of the unmodified unit and 8-10 times the volumetric dispersion efficiency of our standard Schold units. Further tests with more millbases are planned to verify this improvement.

The media flow pattern study continues to demonstrate the importance of media fluidization in achieving reproducible milling performance and a high quality product. During this quarter we have largely finalized the media fluidization models for both horizontal and vertical units. The models are derived from theoretical force balances around a media particle and correlate well with experimental data. Verification of the vertical model in a 4.5 gallon semi-commercial Schold mill, using a differential pressure measuring system to verify fluidization, is planned for the next quarter.

START UP OF PRESSURE PROCESS AT TOLEDO

Additional equipment has been installed on Toledo Reactor 7 to accommodate running processes up to 35 psig of pressure. Currently no other general purpose resin reactor can be operated under positive pressure. Pre-start up checks and formalizing proper procedures remain to be completed before an actual batch is run.

Working with the plant, the steps necessary to check-out the equipment and establish proper procedures have been established. We have developed one pressure process version of an existing resin formula, a high solids automotive acrylic resin, (RC-3870) in the semi-works. A savings of about $350,000/year and 3 hours in cycle time would result from conversion of all RC-3870 to this formula. The new process runs at a higher temperature and thus allows use of a less expensive initiator, as well as a reduced amount. This formula (RC-H-88012) is now being tested for quality. Approval of this formula would provide a process to start up the new pressure facility. Start up is expected in August.

We plan to develop pressure process versions of other existing resins and development resins where a cost incentive can be shown. After approval for quality the new processes would be scaled up in the Toledo facility.

AUTOMOTIVE PAINT RESINS COST REDUCTION

RC-H-69465 High Solids Acrylic Resin is currently made for use in RK-G-54400 Rigid Clear. By reducing the amount of initiator used in RC-H-69465, the manufacturing cost is reduced by $32/100 gallons. Annual savings will be at least $96,000 based on the previous year's production of 300,000 gallons.

The first 5000 gallon alignment batch was made in Front Royal meeting all formula specifications. Troy Laboratory

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is testing this batch for automotive and truck/bus systems. Satisfactory performance is expected based on results to date. The new lower cost resin will replace the existing after approval.

IN-HOUSE MANUFACTURE OF VOE/LOFA ESTER

The first plant batch of RC-H-45016, vinyl oxaziline ester of linseed oil fatty acids, (VOE/LOFA), was manufactured at Front Royal in June. Test results were all satisfactory. Historically, this has been a purchased intermediate.

A minimal batch size (2500 gallons) was used in Front Royal #2 Reactor. The formula is being revised to reflect minor changes in procedure found necessary during manufacture. Cycle time was long (26-27 hours) and further attention will be given to reducing the cycle.

Further evaluation of RC-H-45016 to make RC-3554 and RC-6096 resins for Refinish are planned, followed by evaluation in Centari® and Cronar® enamels. A batch of the tall oil fatty acid (TOFA) analog, RC-H-45014, is scheduled for Front Royal in July. Total savings for this work are over $500M/yr.

ANALYSIS OF COMMERCIAL MELAMINES BY MASS SPECTROMETRY

Analysis of larger molecules such as melamines by mass spectrometry has always been very difficult because the high voltage necessary to generate ions contains so much energy that molecular fragments comprise the bulk of the ionic species generated. A new technique, "Potassium ion Ionization of Desorbed species" (abbreviated "KIDS" where K is the symbol for potassium) provides a means of generating ions of relatively large molecules, essentially uncomplicated by fragments. We have recently analyzed a commercially available hexamethoxymethylmelamine (HMMA) obtained from Pfalz and Bauer, Inc. The bulk material was also fractionated by preparative scale Gel Permeation chromatography and the lower molecular weight fraction analyzed by the KIDS technique. Tentative structures were assigned to twelve components found in the commercial HMMA; pure HMMA accounted for only 30% of the original material. Pentamethoxymethylmelamine and several hydroxy-containing monomeric melamines were detected in addition to several dimeric melamines.

The final performance of melamine crosslinked resins will depend on the relative abundances of monomer, dimer and higher oligomers. The KIDS technique provides more information than was previously available on HMMA and should permit us to advance our understanding of this complex, but very important crosslinking chemistry. In addition, this technique should assist the analysis of other complex materials such as the reaction mixtures involved in the synthesis of methyl methacrylate.

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COMPOSITIONAL ASSURANCE TESTING

Our Compositional Assurance Testing System (CATS), described in the previous Quarterly Report, has resulted in first quarter savings of nearly $2MM in our Finishes Plants. Other divisions of the company, impressed by the ease of operation and demonstrated savings produced by CATS, are preparing to use this approach or are investigating the application of CATS to their operations. CATS is also expanding to other departments. The Chambers Works has ordered the equipment for certifying incoming raw materials, and Electronics Products is looking into the use of CATS for critical raw materials. Textile Fibers and Polymer Products have asked for information pertinent to their evaluation of CATS.

CATS appears to fulfill a widespread need in the chemical industry for a quality assurance technique that works. We will seek ways through the Automotive Finishes Business Team to utilize CATS to enhance our offering to our customers.

FABRICATED PRODUCTS DEPARTMENT

CONSUMER PRODUCTS AND SPECIALTY RESINS DIVISION

SPECIALTY RESINS COBALT CATALYSIS IN METHYL METHACRYLATE POLYMERIZATION

In previous quarterly reports, we have discussed cobalt catalyzed molecular weight control in free radical polymerizations involving methyl methacrylate. An important feature of the catalytic mechanism is the production of vinyl terminated polymer, i.e. macromonomer. These macromonomers have been incorporated into copolymers giving branched polymer systems ("comb" polymers). The research this past quarter has been focused mainly in three areas: (1) catalyst preparation, (2) synthesis of functional macromonomers and their incorporation in copolymerizations, and (3) catalytic synthesis of low molecular weight, highly functional polymers.

CATALYST PREPARATION

During the last quarter, we have synthesized the first commercial batches of Co(DMG-BF2)2, the preferred solution and emulsion polymerization catalyst, and Co(DPG-BF2)2, the preferred suspension polymerization catalyst. These cobalt catalysts are now TSCA listed.

FUNCTIONAL MACROMONOMERS - GROUPING FUNCTIONALITY IN SIDE CHAINS

Taking advantage of the tolerance of the cobalt catalysts to a wide variety of functional groups, we have pursued the synthesis of "functional" macromonomers. We believe

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that properties such as surface energy, dispersability or solubility, and reactivity can be markedly affected by concentrating functionality in flexible side chains. Copolymerization of highly functional macromonomers with relatively non-functional monomers can be used to generate a large number of different systems of this type. Thus, we have successfully synthesized the macromonomers of fluoromethacrylates (Zonyl®), and incorporated these macromonomers into a butyl acrylate polymerization at 0.5% total fluorine. At constant total fluorine level, the water contact angle, as compared to that of the linear copolymer of the same original monomers, increased as the chain length of the fluoromacromonomer incorporated in the copolymerization increased. In fact, the surface property change in going from side chains with one fluoroalkyl unit (i.e. linear copolymer) to ones with six units was as great as that gained with the linear copolymer in going from zero to 0.5% total fluorine. Experiments to determine utility of this finding are underway.

In the refinish area, we have found that clustering functional groups containing alkoxy silanes substantially increases their effectiveness in crosslinking over those in linear polymers of the same overall composition. We have prepared a low Tg macromonomer containing a high level (30%) of trimethoxysilylpropyl methylmethacrylate, and converted it into a (branched or "comb") copolymer of the appropriate overall composition for a refinish enamel. This copolymer with a total of 14% silane monomer, was compared with a linear copolymer of the same overall composition. Tests carried out on formulated coatings made from each of these systems showed that the branched copolymer cured much more rapidly than the linear analog, and had solvent resistance after one day comparable to that of a linear copolymer containing 30% total silane monomer.

SYNTHESIS OF LOW MOLECULAR WEIGHT POLYMERS

Molecular weight control with cobalt allows synthesis of low molecular weight polymers with lower initiator levels than by conventional means, because of the unique cobalt catalyzed re-initiation step. During this past period, we applied the cobalt technique to synthesizing a 60:40 butyl methacrylate: hydroxypropylacrylate copolymer at 70% solids in xylene. Currently it is necessary to use 3% t-butylperacetate initiator (based on monomer) at high temperatures to produce the low molecular weight desired for use in automotive enamels (Mw=7000). In addition, a starved feed process is employed so that at any one point in the polymerization, the initiator radical concentration is maximized and the monomer level is minimized. When the cobalt catalyst is used, however, these conditions are counterproductive as well as being expensive, since we know that the oxygen-centered radical (t-butoxy radical) and the cobalt catalyst react to remove both the catalyst and initiator from the catalytic cycle. Using lower concentrations of initiator radicals and higher concentrations of monomer gives more polymer-centered radicals which react favorably with the cobalt and yield much improved molecular

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weight control. A redesigned non-starved feed synthesis, with 150 ppm cobalt, at 0.75% initiator gave Mw=70500, at 0.275% initiator gave Mw=19700, and at 0.10% initiator gave Mw=6160. By reducing the cobalt-oxygen side reaction, we are permitting lower initiator concentrations to yield lower, rather than higher molecular weight polymers.

An increased initiator feed time allows us to decrease molecular weight (Mw=5100) even further. Work is continuing in optimizing the cobalt and initiator levels to obtain a cost effective version of the automotive enamel resin with Mw=7000. The current process has initiator costs of approximately $0.10/lb. where at this point in our work, the initiator costs can be reduced by $0.095/lb. Adding the catalyst cost of approximately $0.015/lb., we have a raw material cost savings of approximately $0.08/lb. Exposure tests of this resin in coatings are planned for this material upon completion of the optimization process.

Our conclusion from these experiments is that the cobalt catalyst should not be expected to work in all cases as a simple drop-in means of molecular weight control, but that some understanding of the process is necessary to take advantage of its unique capabilities. The economic benefits to be gained from doing so are substantial, as in the case of the automotive enamel, where annual savings of $.08 per lb. in a 3MM lb. market would amount to $250M.

SPECIALTY RESINS WATER-BASED CONFORMAL COATING FOR PRINTED CIRCUIT BOARDS

We are presently selling a homopolymer of N-butyl methacrylate (Elvacite® 2044) as a conformal coating to protect printed circuit boards. Although the customer, Columbia Chase Corporation, is quite satisfied with the performance of Elvacite® 2044, they are being driven towards water-based systems because of environmental concerns. Poly-butyl methacrylate can be prepared as an aqueous emulsion, but will not coalesce to a coherent film without a coalescing solvent. We have provided Columbia Chase with a copolymer of butylmethacrylate and ethyl acrylate which readily forms films under these conditions, but which is somewhat tacky as a dry film. We have synthesized two new acrylic emulsions, a higher Tg version of the butyl methacrylate-ethyl acrylate copolymer which forms clear films at the required temperatures (170°F. bake), and a butylmethacrylate, methylmethacrylate, ethyl acrylate terpolymer which has a Tg comparable to Elvacite® 2044, but forms films under these conditions. Both polymers are noticeably less tacky than the original emulsion polymer. We are continuing to work with Columbia Chase to support this business which should amount to $300-$600M annual sales.

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UNSATURATED POLYESTERS FOR COOK PAINT AND VARNISH

In the last quarter a toll manufacturing venture with Cook Paint and Varnish was begun which could result in sales of 160,000 pounds per month to 160,000 pounds per week of four unsaturated polyester resins. Selling prices of these products will be established soon. ATOI estimates can then be made for this work.

Unsaturated polyester resins are compounded with fillers and/or fibers in the liquid state and cured via free-radical polymerization to yield thermoset articles such as fiberglass reinforcements used in boat manufacture. Unsaturated polyester resins differ from those normally produced in the Fabricated and Automotive Products Departments in that the resin is partially comprised of maleic anhydride and the thin down solvent is inhibited sytrene. The styrene, although inhibited some 10 times over the normal amount, still must be handled in fill-out lines, etc. with appropriate care.

Initial semi-works batches occurred in early June with a visit to Fort Madison in mid-June to perform a Process Hazards Review of the process. Initial pricing will be developed by late June and the first large scale batch is planned for mid-July. Key technical questions lie in the thinning operation, the use of solvent to enhance reaction rate, and the reduction of the current two stage process to a one stage process.

WA ADHESIVES

WA Adhesives are a speciality resins latex used as an adhesive to coat Kapton®. The product, produced at Parlin, is sold to the Imaging Division in Towanda, where it is coated. Forecast for 1987 production is 526M lbs. and ATOI for Du Pont are approximately $5MM/yr. Customer complaints about unsatisfactory and variable quality have resulted in a review of the process.

Key areas are the accuracy of weighing methacrylic acid and its mixing in the feed tank, the instability of the pH of the deionized water and the filtration of the final product. The handling of methacrylic acid and the order of its addition are being revised. Additional purifying columns were added to the water system and are undergoing analysis by Roland Leathrum, an ESD consultant. The filtration system was evaluated by Howard Zakheim from Marshall Laboratory and his recommendations are in the process of being implemented. A printer has been purchased for the Mettler balance to record the weight of initiator and other raw materials used in small quantity. Raw materials are approved before use by testing the raw material or by retaining a certificate of analysis provided by the manufacturer. We expect to see significant quality improvements in the next 6 months.

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GTP PMMA FOR PROPOSED MRC JOINT VENTURE

A study has begun to determine the feasibility of making solid pMMA pellets by GTP as a key part of a proposed joint venture with Mitsubishi Rayon Corp. (MRC). The goal with GTP technology is to take advantage of the better thermal stability, achieved through the absence of vinyl end groups, and the lower melt viscosity, achieved through narrower molecular weight distribution. A GTP product with these advantages could command a premium price in some markets for acrylic injection molding and extrusion polymers and could be profitable if its mill cost were not too much higher than conventional acrylics.

The current study will focus on the various polymerization routes that may be possible based on what is known about GTP and related process technologies around the Company. These routes include continuous, batch, bulk and solution polymerization. The initial work will involve cost estimating to screen the various process options and some experimental work to determine the limiting values of key parameters such as polymerization temperature and viscosity. The economics of the joint venture is confidential and can be obtained from the Specialty Business manager on a need to know basis.

TEFLON® COATINGS FOR CORNING GLASS

In a significant departure from our work on non-stick coatings for metal cookware, we have been working closely with Corning Glass Corporation to develop coating systems for a variety of their glass and ceramic products. We have now completed laboratory testing and characterization of coating systems for three different types of substrates. One coating, our 462-350 Silverstone® clear silicone topcoat has recently been accepted by Corning as a replacement for a Dow Corning silicone formulation as a coating for Pyrex glassware. Our product was found to be superior in release, adhesion, and resistance to staining and cloudiness. Coatings have also been developed for Corning's Visions ceramic cookware and their French White bakeware. These coatings are based on our standard Teflon® II, Silverstone®, and Silverstone® Supra fluoropolymer coatings, applied over grit blasted substrates. Our marketing group is defining performance standards for these candidates. The Pyrex coating is expected to provide $1MM annual sales, and the others as much as $5-$6MM.

TEFLON® MANUFACTURING CONSOLIDATION

The manufacture of Teflon® products is being consolidated at two main locations worldwide; Parlin, New Jersey, and Mechelen, Belgium. The Mechelen facility is now in full operation and our products are aligned in the plant. The Parlin facility is now in the final stages of consolidation and alignment. In addition to the process of moving from Toledo to Parlin without disruption, we are converting a variety of mixing and grinding equipment to standard types. This

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process involves a large amount of realignment of existing products and procedures, and is proceeding smoothly. We are also moving to coordinate the quality improvement of our overall operation by addressing the issues of product reproducibility (via QFACS), product "on-load, on-aim", labeling, containers, and testing procedures.

The main thrust of the manufacturing consolidation is the reduction of process and product variability in this worldwide business by eliminating equipment, formula, and raw material differences between manufacturing sites. Of these, the first is now complete, the second is being handled manually until our computer system is developed to handle a worldwide formula file in several different languages, and the third will have some variability because of the need for local source supply, but such differences can be minimized.

GTP DISPERSANT IN LUCITE® XL SHEET

Lucite® XL is acrylic sheet sold into the sanitary ware market for tubs and spas. It is produced in solid colors and marble pattern and is the most profitable, fastest growing segment of the sheeting business. Color uniformity within the sheet and from run to run is extremely important to our customers and is necessary to achieve good plant yields and cost performance.

Three problems resulting from our present color dispersant system have reduced the efficiency of producing colored sheet in the continuous belt casting process. They are: (1) Color variation across the sheet; (2) Belt shift - a shift in color in going from the laboratory matched color to the plant; and (3) Marginal dispersion stability as a function of time, creating color shifts from one run to the next. We previously reported that laboratory and plant testing demonstrated that items 1 and 2 were greatly improved by using a pigment dispersant made by group transfer polymerization, GTP. Further testing has shown that dispersion stability has been improved to the extent that colors will be reproducible from one run to the next. Thus, customers can be offered faster service because large volumes of shaded pigments can be kept in inventory allowing rapid changes in the campaign schedule without having to mix a new batch of colorant.

In laboratory testing, four different 300 gallon batches of GTP dispersant produced at Marshall Laboratory have been evaluated and approved for use in our process. In light of the very positive results from each phase of testing, Research is recommending that we commercialize the use of this new dispersant in the XL process. Leading to commercialization, in excess of forty colors will need to be matched in the laboratory and short qualifications tests for each color run in the plant. Shading vectors for the Troy color computer will also be developed to improve color matching precision. With business concurrence, the commercialization of solid colors utilizing GTP dispersed pigments will be implemented in October, 1987.

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LUCITE® ACRYLIC SHEET PROCESS FLEXIBILITY

In January of this year, a program was implemented to increase the polymerization rate by 42% of Lucite® XL for sanitary ware. The potential for an additional rate increase of 25% has now been demonstrated in the plant. More importantly, this increase results from using the same initiated syrup that is used in making Lucite® L, clear acrylic sheet. If implemented, this would greatly improve the flexibility of switching from Lucite® L to XL production allowing the business to more effectively respond to customer requests for shorter delivery time.

Our current Lucite® XL formulation includes lauryl mercaptan (LM) chain transfer agent for reducing molecular weight as a co-ingredient with ethylene glycol dimethacrylate (EGDMA) to obtain an optimal degree of crosslinking for thermoformability. As an outgrowth of our program to eliminate chemistry limits to Lucite® sheet capacity, we discovered that we could obtain equivalent crosslinking in the XL product with lower EGDMA and LM content at faster polymerization rates using higher initiator concentrations. This is due to the inherently lower molecular weight produced by higher initiation rates. In our current process the molecular weight is lowered through chain transfer by using LM, which also reduces production rate by delaying the onset of gelation. In laboratory tests and two plant tests, we have demonstrated that production of XL sheet using a reduced EGDMA concentration without LM provides equivalent crosslinking and thermoformability to standard XL sheet, but at higher rates. A patent proposal has been written based on existing ICI and Du Pont patents for thermoformable acrylic sheet which require a chain transfer agent to optimize crosslinking. A thorough patent search has been conducted.

We consider the removal of lauryl mercaptan from our current formulation a major product change since we believe all competitive sanitary ware products contain a chain transfer agent. Initial customer testing has all been very positive; however, there are longer term and more subtle property changes such as adhesion to the fiberglas backing that have not been thoroughly investigated. The program leading to implementation of this technology includes a basic study of polymer properties as they relate to thermoforming and adhesion to polyester/glass. Customer testing will continue in the second half of 1987 with commercialization expected in early 1988.

CORIAN® SIERRA

The Corian® Product Group has introduced a new version of Corian® known as "Sierra" which has a granite look. Manufacture of this product required additional manufacturing facilities at Yerkes. To meet the pressure of competitive offerings, these facilities had to be installed as quickly as possible consistent with sound engineering practice. A $2.7 MM project was authorized in September, project mechanical completion occurred in April and the commercial startup occurred on May 15, 1987.

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The unique esthetics of the granite look require particles of various sizes and colors to be blended into the Corian® Mix in a controlled way. We have initially commercialized two granite products, Sierra Dusk and Sierra Midnight. These products contain five different grades of Corian® particles in several different blends. One of the grades consists of ground standard Corian® sheet material which would otherwise be discarded. We plan to commercialize at least one additional Sierra color by year end.

Market acceptance of the new products has been excellent. Marketing began accepting orders for the new products in March with over 1.3 MM lbs. of material being committed for shipments beginning in June. The plant started up with minimal problems and we have already produced and packed 1 MM lbs. of the new Sierra material. We expect an additional $1 MM of increased earnings as a result of the new products during the first year.

NEW CORIAN® COLORS

The Corian® business has had a stable line of colors since the introduction of Almond in 1982. Competition is aggressive, and one approach they are using is a multi-color line, including granite-like appearances. To provide the marketplace with the desired appearances, we accelerated the development of new color/effect. We introduced Satin Gray - a neutral shade of gray - in April, 1986. The sales of the Satin Gray have been climbing since commercialization and currently account for 8% of total Corian® sales. This year we commercialized Corian® Sierra. The Sierra line is projected to make up 15% of the total Corian® sales in 1988.

To continue the strategy of introducing a completely coordinated color family, two additional Sierra colors, a beige and cranberry, along with two coordinated solid colors are currently being developed at Yerkes. The commercialization is anticipated by first quarter of 1988. In addition to the Sierra series, efforts are also being made to develop more colors to complete the neutral palette. We have demonstrated in the lab the ability to formulate a large number of desirable solid colors based on marketing research as well as input from an outside color consultant. We are now in an improved position to respond to color trends in the market place.

WARP IN CORIAN® SHEET

Warp in Corian® sheet is a serious quality deficiency. The problem has plagued the plant and Corian® customers for many years. The problem worsens each winter, as customer returns, complaints, and plant rejects increase during that season. The warp problems cost the business $120M each year due to rejects and returned sheet. Also, lost sales due to warp is estimated to be 1% of total sales.

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Warp is caused by non-uniform stresses in the sheet. Non-uniform polymerization, cooling or wetness can all cause warp and several steps have been taken to minimize their effects. The sirup and casting belt temperatures have been made the same to provide more uniform reaction rates throughout the curing sheet. The peak temperature has been raised and occurs sooner, thereby giving more time for annealing or relieving of polymeri- zation induced stresses. The air cooling zone has been brought to its full potential by regular cleaning and improved operating controls and techniques.

These changes in operating procedure have eliminated the seasonality of the warp problem. The level of warp has decreased to 30-35 mils which is at least equivalent to the best months under the old operating procedure. Further reductions in the level of warp are not possible without major redesign of the process.

NEW FLAT FISHLINE

Stren®, as a branded fishing line, was first introduced in 1958. At that time a significant portion of the market involved revolving spool fishing lines, i.e., casting reels which were primarily filled with braided Dacron®. We also sold a flat monofilament made from nylon 6 under the Stren® brand for that use. The market moved to round nylon as fixed spool spinning gear became absolutely dominant in the market and flat monofilament disappeared from the marketplace.

Recently, Textile Fibers Department has been reinvestigating a flat 66 nylon industrial fiber and we have been field testing the same monofilament under secrecy agreements with knowledgeable fishermen. Their response has been very enthusiastic. Since the casting reel portion of the market, which now uses round monofilament, is about 30% of the total reel market, we feel a significant potential exists for this program and we plan introduction as soon as Textile Fibers can supply, but not until the introduction of PRIME PLUS® this summer. We have consulted with Textile Fibers on the patent aspects of the development and expect to have a claim to a 66 flat fishline.

SHOTGUN BARREL AUTOMATION

Shotgun barrel cold forming tests were run in late May at NOR-SAND Metals in Ontario, Canada, on a Pilger Tube Mill set up as a demonstration process. The test objective was to produce near net shaped outside contours and internal bores, eliminating our present turning and reaming operations.

Barrels produced from our current C-1140 modified steel cracked during cold forming, however, this could possibly be remedied with tooling changes or preformed blanks. Thirteen barrels from C-4130 steel were successfully formed. These samples will be thoroughly analyzed and made into finished barrels for testing.

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Forecasted capital for an automated system to handle the full shotgun barrel capacity is $1600M with an O.R.O.I. in excess of 50%.

REMINGTON SP-10 MAGNUM

Remington purchased the rights to manufacture the Ithaca MAG 10 in the first quarter of 1987. Our objective is to have the Remington SP-10 MAGNUM available for the fall 1988 hunting season.

The Ithaca gun is being redesigned to meet Remington standards for functionability and manufacturability. The receiver and fire control have been totally redesigned on the R&D CAD/CAM facilities. The receiver and trigger plate have been designed to be manufactured on the Flexible Machining System. The slide extension assembly has been redesigned extending its useful life from approximately 300 rounds to no failures in 4000 rounds. The fire control, barrel, and breech bolt are also being redesigned to prevent interchange with Ithaca manufacture guns due to potential safety concerns. The gun has also been restyled for cosmetic and ergonomic enhancement.

Prototype parts are currently being fabricated for a six gun test which will include the new fire control design and additional improvements. This test is scheduled for early August.

Expected sales for the Remington SP-10 MAGNUM are 5,000 guns in 1988, 7.500 guns in 1989, and levelling off at 10,000 guns in 1990.

SPECIALTY PRODUCTS AND SERVICES DIVISION

TEDLAR® PROTECTIVE CLOTHING

The Textile Fibers Department is interested in the Tedlar®/poly(vinylalcohol) (PVA) composite we have identified as having unusally good barrier properties. They expect to offer a product based on this construction to makers of disposable protective clothing. At their request we have developed Tedlar®/PVA/Tyvek® laminates in the laboratory. This work required proper adhesive selection, location and qualification of a source of poly(vinylalcohol) film (a DuPont Elvanol® customer), and design and construction of appropriate structures. Test results on lab samples were encouraging, and we have prepared 3 different candidate structures on the 24" laminator at our Chestnut Run Laboratory. These structures have been tested in our lab, and shown to have barrier properties markedly superior to Tyvek®/Saranex and other potential competitors.

Textile Fibers displayed samples of our Chestnut Run prepared material to several selected customers at the Industrial Hygiene Show in Montreal earlier this month. Textile

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Fibers is now setting up Secrecy Agreements with protective clothing manufacturers to develop suitable means of seaming and garment fabrication using these laminates, and has requested a second laminating run at our Chestnut Run Laboratory. This gives Textile Fibers an opportunity to offer a unique, superior, and possibly proprietary product for the rapidly growing protective clothing market. For FPD, it is an additional market for Tedlar® film projected to grow to several million dollars sales per year.

LOW HEAT RELEASE EMBOSSED TEDLAR® SYSTEM

We began in March 1987 to develop a low-heat-release, embossed Tedlar® system for use as interior laminates in commercial passenger aircraft. FAA has set more stringent flammability requirements for aircraft interior material. These changes have resulted in the removal and requalification of many standard materials. One of the most difficult is the heat release rate test as defined by FAA in 14CFR parts 25 and 121. This method is known as Ohio State University (OSU) chamber test. An average heat release value is calculated over the first two minutes of the test. A peak value for heat release rate over the length of the test is also defined. FAA requires compliance with values of 65 (KW.min/m2) and 65 (KW/m2) for 1990. Interim standards of 100 and 100 for 1988 are allowed.

Boeing has opted to directly comply with 1990 standards and requires 50/50 rates to allow for a safety margin, and we are working with them to meet the requirements for this million dollar market segment.

We have concentrated on qualifying our embossed Tedlar® for the 747-400, since it provides Boeing with significant savings in parts manufacturing. A flame modified Tedlar® Film (FM) was demonstrated to reduce the peak rate. The average value was not affected significantly. Char inducing additives are under evaluation. These additives generate an intumescent char layer which resists combustion. We are currently in the process of testing the lab films for heat release. The best formulation will be selected for a plant run by the end of June 1987. Heat release results on the plant films should be known in July, 1987. Production of sufficient quantities of film are planned to allow timely sampling of Boeing if the results of evaluations are satisfactory.

NEW TEDLAR® FILM DEVELOPMENTS

There has been a heavy demand recently for new Tedlar® films designed to exploit new business opportunities, counter competitive threats and, in general, to respond more aggressively to customer needs. Several new films are aimed at transportation businesses. We currently sell 180M lbs of film to surface FRP/plywood truck sides, primarily Ryder trucks. Tedlar® provides good appearance and performance both initially, and because of its durability and cleanability, for an extended period of time. Although surfacing FRP/plywood trucks has been

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a good business for Tedlar®, aluminum-sided trucks dominate the truck-siding market with 85-90% of the business. Tedlar® has not penetrated this market, in part, because gloss of Tedlar® was deemed too low. We have recently made our first penetration into this market. We have developed an intense orange film with an acceptable gloss for Wabash (Schneider) trucks. This film has much better retention of gloss and color than their existing paint. We believe that this successful entry will open up the much larger aluminum truck market. Our programs are designed to increase the rate of growth of this $43MM market where Tedlar® has excellent performance and high value-in-use.

NEW TYPE FABRIC FOR DYMETROL® SEATING SUPPORT SYSTEMS

Dymetrol® Seating Support Systems are now being targeted primarily at the Furniture Industry. Our financial goals are $7.5MM sales with $600M ATOI by 1990. Dymetrol® fabric, as currently made with a plain weave and two ply yarn, has two characteristics that detract from its acceptance in the furniture industry. It does not have good staple cut through resistance and, although it has proven to be durable, the plain weave appears so light weight that customers perceive a durability problem. To improve this situation a new weave was selected which provides a significant increase in warp weight and a short weaving trial was made at Milliken on a commercial scale loom. Small samples have been shown to potential customers who report that the staple and covering power problems have been solved. In addition, the sateen side has been shown to print well and demonstration samples have been made. This new fabric is covered by our original patent. We plan a commercial run soon and market introduction is scheduled for September 15.

HYTREL® ELASTIC BAND PRODUCTS

In cooperation with Textile Fibers Department, we have extruded bands of Hytrel® 6133, the proprietary polymer presently used in their diaper tape product. In these experiments we:

- demonstrated that Westin® 618 inhibits the catalytic activity of the titanium catalyst, enabling us to compound 20% talc into the polymer without foaming, and may lead to an improved diaper tape product.
- produced four varieties of elastic band products which have good power and low loss at 100% extension but an ultimate elongation over 1000%; hence a good factor for safety as an elastic product.
- produced 15,000 and 25,000 denier strips for testing as leg bands in bathing suits, a potential new product for Fibers.

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We plan to meet with Fibers to ascertain which group will explore various markets. We estimate about a $1MM market in swim goggles and exercise bands at about 20% ATOI and expect to be able to identify other new products for the Filaments and Dymetrol® businesses.

KALREZ®

The current Kalrez® product line has grown, like many other products, from a single item to now include four base polymer compositions and numerous compounds derived therefrom. These include K1000 and K3000, two different molecular weight versions of our first offering; K4000, a material with better high temperature performance and expected processing benefits; and our latest, K9000, a peroxide curable product to match the first in-kind competitive product, Daikin's Perfluor. The K9000 product, although inferior in most properties, does offer an improvement in hot water and steam performance that derives from the peroxy cure system. This growth in the number of compositions, with its concomitant performance benefits, unfortunately adds to our customers' (o-ring distributors) confusion in their resale recommendations.

Two recent developments with the K4000 polymer, a modified initiation system and a peroxy cure, suggest that we may be able to improve that product further, and combine many of the best features of our current diverse product offering. The modified initiation system gives lower viscosity polymers with reduced ionic end groups that should help us achieve the improvement in yields that so far have eluded us. The peroxy cure system with the K4000 polymer provides superior water and steam resistant composition without a significant loss in high temperature oxidative resistance. Further modifications are being considered to improve its low temperature capabilities and provide us with a "universal" Kalrez® product that will provide a complete performance package to our end-use customers and be of great benefit to our distributors in the management of their product offering.

VESPEL®

Progress on Vespel® ST development and commercialization has been slow because of our inability to provide good quality product in our Circleville pilot unit on a routine basis. In the last few weeks we have demonstrated that with sufficient attention to detail and cleanliness, excellent product can be produced in that unit. Recent revisions to equipment should make it easier to maintain the level of cleanliness required.

Our attention is now focused on running a test in the commercial scale resin plant, where one of the uncertainties is in the scaleup of the solid phase imidization step in the plant scale dryers. A plan is being formulated so that we can run a separate test of that equipment before we attempt to run the

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entire process at full scale using filter cake prepared in the pilot unit. It is important that we demonstrate plant scale capability before the end of this year, if we expect to keep up with our commitment to our first customer for Vespel® ST, Toyota, and at the same time provide capacity for the development of additional products that are being requested by our aerospace customers. A million dollar opportunity at Rolls Royce is in current jeopardy, because our existing SP commercial product is not meeting the customers' performance requirements. We have begun an effort to develop an ST composition that could meet their needs.

SPECIALTY EXPLOSIVES

In response to a DARPA initiative we are attempting to develop an improved version of Deta Sheet flexible explosive with lower flammability and higher energy capability. The current product is a dispersion of pentaerythritol tetranitrate in a plastiziced nitrocellulose binder. Early screening of alternate binders using a dummy mix of corn starch in place of the explosive has resulted in the development of a preferred system based on a low molecular weight fluoroelastomer, Viton® C-10. It is interesting to note that the initial compounds of this material were poorer than the nitrocellulose control, in agreement with findings of researchers at government laboratories. With certain additives including a crosslinking agent, however, a superior non-dripping composition has been obtained that is self-extinguishing in a vertical flame test. Equipment is now being assembled to prepare live mixes of this preferred system. Initial results are expected by early third quarter.

DEPARTMENTAL STRATEGIC RESEARCH

GTP BULK POLYMERIZATION

We have begun exploration of bulk polymerization by group transfer polymerization as a low cost route to polymethyl methacrylate and to gather information useful in the study of a potential joint venture with Mitsubishi Rayon Corporation. Of prime initial interest is the extent to which we can control the exotherm, molecular weight and polydispersity. Our initial results are quite encouraging. Unmodified, the reaction is complete in 2 to 3 minutes with most of the polymer being the desired molecular weight but also a very high molecular weight fraction. The reaction exotherm can be slowed by the addition of trimethylsilyl chlorobenzoate and, in 30 to 60 minute reaction times, polymers can be made reproducibly to 40% conversion with polydispersities of 1.4 to 1.5. We plan to give increased emphasis to defining the procedures, problems and limitations of bulk polymerization by GTP as they relate to the continuous preparation of extrusion grade polymer and syrups.

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G-SERIES ELVACITE® RESINS

Last Fall the Specialty Resins business introduced three new solution acrylic resins as G-Series Elvacites®. These were GTP prepared analogs of three commercial resins being sold in large volumes to the coatings industry. These new products differed from their Rohm and Haas counterparts only by the higher solids/viscosity relationship resulting from low polydispersity. Many potential customers were sampled and the first small order has been received. New York Bronze makes private label aerosols and are reformulating away from nitrocellulose. They find they can double the package solids using our G-Series analog of Acryloid B-66. If our product is adopted for this application, we expect them to order in tankwagon quantities. Specialty Resins has forecast selling 400M pounds of G-Series resins in 1987 growing to 3MM pounds ($3MM sales, $150M ATOI) by 1990.

MONOFUNCTIONAL POLYMERS

Using Group Transfer Polymerization we can make acrylic polymers with one functional group on each chain and we have been doing this routinely when we prepare precursors to macromonomers. We are now assisting Specialty Resins in defining the market opportunity for these monofunctional polymers by making internal and external presentations and supplying samples to interested parties. We are offering hydroxy, carboxy or epoxy terminated polymers. PPD has been given epoxy samples to evaluate for end capping of carboxyl groups as a route to lower viscosity. Samples have also been prepared for Kansai and Norton and in both of these cases we believe they want them to make ABA polymers using a polymeric diisocyanate as the B-segment.

THERMAL PROPERTIES OF GTP PREPARED POLYMERS

Thermal stability of acrylic resins is important for extrusion processing and heat distortion temperature is an important polymer performance characteristic. Indications that the GTP process gives an inherently more stable polymer because of absence of vinyl unsaturation in the final product led us to compare properties against 10 samples from Mitsubishi Rayon Corporation, two bead polymers and three competitive domestic products. The 300oC thermal stability of GTP-PMMA, Lucite® 147K and one MRC sample were equal and significantly better than all others. Since we know that a way to improve thermal stability is to add a small amount of ethyl acrylate as we do in 147K, with a lowering of Tg, we measured heat distortion temperatures. The 104oC distortion temperature obtained with GTP-PMMA was in the ball park of the three MRC ST-series samples (101-108oC) which are promoted for high heat distortion temperature, and these were higher than all other samples. No samples other than GTP-PMMA had high values in both properties. Thus, by process only we can favorably influence these important thermal properties.

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POLYMER ISOLATION FACILITY

Our project for polymer isolation facility to be located at the Marshall Laboratory is in the final stages of approval. This project, which is estimated at $1.7MM (CAC) comprises a 5 sq. ft. LUWA Filmtruder®, coupled with facilities for polymer solution feed and for conversion of the isolated product into pellets or other appropriate solid forms. This facility is intended to provide developmental quantities of a wide variety of acrylic polymers, prepared in solution by both conventional and by Group Transfer Polymerization processes. Tests at the LUWA Development Center have shown its capability to isolate a 35% solids GTP PMMA polymer in solid form to 3% residual volatiles, even though the original solution contained both THF and higher boiling solvents. Depending on the initial feed solids level, the type of solvent, and the polymer Tg, the unit is capable of providing moderate or very low solvent or monomer residuals. It can be operated under pressure or vacuum as appropriate to keep the polymer fluid, and to most effectively strip residuals. It is also capable of dual pass operation so as to provide the lowest possible residuals with minimal thermal history. The anticipated isolation capacity is 1MM lb. per year, but will depend somewhat on the types and solids levels of the solutions processed. The major components of this system are skid mounted, so that, if appropriate, it can readily be moved to Parlin for routine production in the future.

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R. F. ULAK, B-3370
E. F. KREUZBERGER, P191290)
G. F. SCHREIBER , P192164) IN TURN
W. A. LEWING, B-4242
R. W. VAUGHN, B-4201)
R. V. WESTERMAN, B-4208) IN TURN
R. S. LAUGHLIN, DU PONT CANADA
A. B. MC KINNEY, DU PONT MEXICO
J. P. GALLAGHER, DU PONT VENEZUELA
J. R. LEWIS , B-11266)
W. VAN HOEVEN, B-11268) IN TURN
M. CAMELON, MT. CLEMENS
J. L. ALLEN, YERKES
R. L. RACKLEY, WASHINGTON WORKS
R. G. SHEPPARD, MEMPHIS

MONTHLY REPORT

William A. Warren, Jr.
11.30.87

SAFETY

- Attended Central Safety and briefed Soucy's Staff. My suggestion to B. Firman on how to make significance of safety statistics more obvious to all, was accepted by the group.
- Contributed to N66 serious incident investigation and written report on split barrel @ gallery. My portion of followup corrective action has been completed.

NEW MACHINE

The 4TH vendor sample from the new Safety paint machine was received 11.30.87. Previous samples following an earlier trip to Detroit have indicated additional work was required of vendor.

We are planning runoff of machine in Detroit 12-3-87.

QUALITY

The first "Marketing Quality Audit" of 1987 was conducted 11-9-87. Rating: VERY GOOD.

Internal report has been issued to comm. room and plant bulletin boards. External report will be completed when production responds to corrective action requests in writing. This is the first such audit in 13 months.

TRANSMITTALS

I am behind on 552/72 RESTYLE wood. This will be a learning experience for me on MRP - PROCESS RECORD requirements.

SIGNIFICANT PRODUCTION SUPPORT/PROBLEMS

- Trip to WHIP CITY to run r.d l. conn. with our tooling and material. Improvements were made to flatness and fit with trigger. There is more work to be done on this items. Trip with F. WORSLEY to keep production running.
- Locating/identifying soft left connectors. All have been found.

CONFIDENTIAL-SUBJECT TO PROTECTIVE ORDER
KINZER V. REMINGTON

12/9/87

1987 PLANT PROPRIETORSHIP REPORT

W. WARREN

SAFETY

RESPONSE TO N66 BBL SPUT @ TEST
(COPY OF "SERIOUS POTENTIAL INCIDENT" ATTACHED)

QUALITY

RESUMPTION OF MARKETING QUALITY AUDIT PROGRAM, 11-87, AFTER 13 MONTH ABSENCE.

PRODUCTIVITY

NEW SAFETY PAINT MACHINE ACCEPTED @ VENDOR'S PLANT ON 12/3/87.
ADVANTAGES:

- PRODUCTION RATE UP TO 1000/HOUR
- AUTOMATIC OPERATION - WILL ~~NOT~~ REQUIRE FULL TIME OPERATOR IN ATTENDANCE
- QUALITY IMPROVEMENT RELATIVE TO YIELD OF PRESENT WORN-OUT MACHINE.

THIS IS EXPECTED TO BE OPERATIONAL BEFORE END OF YEAR.

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KINZER V. REMINGTON