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RESEARCH DEPARTMENT

PROGRESS REPORT

FEBRUARY 1980

REMINGTON ARMS CO.
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ILION RESEARCH DIVISION

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HIGHLIGHTS

AMMUNITION

New RXP® Shotshell Body Process

Startup of new Semi-works equipment for new RXP® shotshell body development continues. Using an improved die/mandrel design for slug extrusion has reduced .410 gauge slug wall variation to acceptable levels. Both 12 gauge 2-3/4" and 3" shells have successfully passed body integrity tests. (Page 3)

21mm Seismic Ammunition

Shipments of 21mm seismic ammunition to MAPCO continue on schedule. Cost reduction efforts are yielding positive results. (Page 3)

"Premier" Bullet

Testing of the first caliber .30 "Premier" center fire bullets is in progress with preliminary firing showing encouraging results. (Page 4)

Integral Anvil Battery Cup

The Lachaussee press and die set is on schedule with acceptance testing planned for June. Product development continues with emphasis on definition of sensitivity and flash hole covering techniques. (Page 5)

Automatic Packaging Machine

A special purpose machine is under development to automatically package 8 gauge Industrial shotshells. (Page 5)

Machine Signature Analysis

Signature analysis techniques are being developed to monitor equipment performance and quality of parts being produced. (Page 6)

FIREARMS

Model XSG Shotgun

Testing is continuing on the current prototype model. A total of 3750 rounds has been fired using 2-3/4 magnum loads without major component failure. (Page 6)

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Highlights - Cont'd.

21mm Seismic

MAPCO has returned twelve guns for corrections of the breech bolt, firing pin and alignment problems that were encountered in the field. Twenty-five thousand rounds of ammunition have been received from MAPCO for our field testing use. (Page 7)

High Energy Beam Applications

Preliminary results of the EDL welded M1100 slide block and action bars are expected in March.

Samples of the Ducks Unlimited emblem carved in the M1100 stock were received. Additional samples of laser carved stock and fore ends are expected in March. (Page 8)

ASEA Manipulator

Receiver handling conveyor system design is being reviewed. Three quotes have been received ranging from \$20M to \$33M. An order will be issued to fabricate the system in early March. (Page 8)

Model 870 Competition Trap

Modified fore end tube designs were tested with satisfactory results. During the testing of the new fore end tube designs premature cracking of the receiver was detected. (Page 8)

RESEARCH AND DEVELOPMENT

AMMUNITION

New RXP® Shotshell Body Process

This project is to develop a one-piece plastic shotshell body process capable of producing all seven gauges with a cost reduction objective of \$1MM per year.

Machine debugging of the body former and heatset units is continuing, with a number of problems having been corrected. The remaining major problem is that the heatset body transfer linkage suffers from excessive rebound at the end of its stroke. This condition limits machine speed to 60 ppm vs. 80 ppm rated speed. Corrective action has been initiated and will be implemented over the next four weeks. It is anticipated that product development efforts can be maintained during this period.

Tooling for both 2-3/4 inch and 3 inch 12 gauge bodies has been modified to accommodate the new equipment. Product integrity has been verified in extreme condition testing at -20°F, ambient and 150°F in an oversize chamber, excess headspace M/1100. Performance was excellent.

In previous work with .410 gauge a potential problem with bent bodies was experienced. Bent bodies result from wall variation in slugs and is aggravated by extrusion punch flexure. To reduce slug wall variation, an improved extruder die/mandrel assembly was designed and built. The initial run of the new equipment produced .001" wall variation, versus the .002" maximum necessary. A tungsten carbide extrusion punch to reduce punch flexure is also being fabricated to provide an added margin of safety in producing straight bodies.

Eight gauge caps of single piece design were successfully half-headed and pierced on plant equipment. Subsequent shooting tests showed excellent performance.

21mm Seismic Ammunition

A 21mm cartridge and gun system to be used for seismic exploration for oil and gas is being developed for MAPCO. The cartridge is an electrically primed version of Remington's 8 gauge industrial load.

To date, 50,000 rounds of ammunition have been shipped to MAPCO. The February production quota of 25,000 rounds will be warehoused by March 1 and has been earmarked for gun development testing at Ilion

21mm Seismic Ammunition - Cont'd.

with MAPCO's concurrence. An additional 7000 rounds of ammunition having low resistance primers which were inspected out of previous runs will also be shipped to Ilion for their test program. Data generated during testing of the latter ammunition will be used to establish a minimum resistance specification for the primer.

Product and process development work is presently concentrated on reduction of costs associated with manufacturing the electric primer and its components. After considerable extreme condition testing, it has been determined that the standard #111 shotshell battery cup can be substituted for the special seismic component. This change, put into effect this month, reduces scheduling complexity and machine changeover downtime in the plant and simplifies primer assembly and shell priming operations.

Plant Accounting has estimated production cost for the December and January 25,000 round MAPCO shipments at \$898/M and \$850/M, respectively. The downward cost trend is expected to continue in coming months as product and process simplification and improvements are implemented.

"Premier" Bullet

A new line of center fire bullets is being developed to advance Remington bullet technology with the objective of improving accuracy and downrange ballistics performance.

The modified split die bullet tools which now incorporate high modulus tungsten carbide inserts in the critical areas are successfully forming 162 grain open nose 30 cal. conical forebody boattail bullets. A preliminary test of the new bullet in handloaded 30-06 ammunition has resulted in acceptable in-flight stability and good accuracy at 50 yards. More extensive testing is presently underway to evaluate downrange ballistics and accuracy, and mush performance. Completion of this work is expected by mid-March.

The feasibility of using the Remington developed POWER LOKT[®] process for producing the "Premier" bullet is also being investigated. Experimenting with the split die tools and 30 cal. POWER LOKT[®] bullet samples, we were able to reform the standard production bullets into the "Premier" bullet contour with only minor problems. It appears that if the plated lead cores more nearly matched the final geometry of the "Premier" bullet, the forming would be entirely successful. Forming tools for producing POWER LOKT[®] "Premier" bullet cores have been designed and are being fabricated. Preliminary evaluation of the POWER LOKT[®] process as related to the "Premier" bullet project will be completed by the middle of May.

Integral Anvil Battery Cup

The objective of the program is to develop an integral anvil battery cup to reduce manufacturing costs, improve consistency of primer quality, and provide greater opportunity for process automation. Lachaussee has provided a list of U.S. made components readily available in Europe for use in the Bi80 press electrical system. Remington's order for this press will be amended to include these items. The main drive motor and controls have been specified and Purchasing has placed an order for this system with six weeks delivery. Acceptance testing of the press and die in Liege remains scheduled for June.

Testing of Lot 1, ABC primed 12 gauge Target Loads has been completed with satisfactory overall performance results. Two areas requiring improvement are "beyond center sensitivity" and low chamber and port pressure at -20°F. The latter problem had been observed previously with conventional primers and is believed to be caused by low pellet weight of 1024 mix. Eight thousand ABC primers were charged in Bridgeport; five thousand with 1024 mix and the remainder with 771 mix. On-center and off-center drop tests at Bridgeport and Lonoke were conducted with excellent results. These primers reflect better sensitivity over previous lots because tamp and foil punches used in Bridgeport were modified from the 104 primer design and had a tip area 70% greater than those used for conventional primers.

ABC primers made with 1024 mix at Bridgeport, designated as Lot 6, were processed through AH&P at Lonoke to make three thousand SP12 primed shells. Plans for next month include loading these shells and submitting rounds to Bridgeport for off-center testing in the pendulum UR barrel. Tamp and foil punches of the 104 type have been received from Bridgeport and will be used to assemble primers at Lonoke.

Efforts to develop a technique for covering ABC triple flash holes are underway. Punches and dies for blanking and inserting paper into the cup are in fabrication at Bridgeport. The alternatives being studied for sealing the holes include liquid cement, Lachaussee water permeable lacquer, and shellac. The effects of these approaches on primer assembly and drying time will be demonstrated during March.

Automatic Packaging Machine

Industrial 8 gauge shotshells are packaged 250 to a box, in layers of 50 with appropriate filler materials. Because of difficulties with this packaging arrangement hand-labor is used exclusively.

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Automatic Packaging Machine - Cont'd.

Rising labor costs combined with improvements in the loading area has forced automation of that operation.

Since attempts to identify commercial packers for automation were unsuccessful, ER&D has undertaken development of this special purpose machine system. The machine under development will automatically position boxes; and a special manipulator will batch, count, and deposit shells in layers with the required fillers. Filled boxes will be automatically discharged to final box closure.

This new machine system, to be built in 1980, will provide the degree of automation needed to reduce labor and packaging costs.

Machine Signature Analysis

Component forming machines usually produce some percentage of off-quality parts which may be traceable to material problems, tool wear, tool damage, or poor machine performance. This can result in equipment downtime, equipment damage, or costly parts inspection in subsequent operations due to good product lot contamination.

It is ER&D's objective to develop signature analysis techniques to monitor equipment performance and quality of parts being produced. Such techniques could alert operating personnel of impending machine failures or deteriorating parts quality prior to contamination of good product lots.

The point of focus is the experimental "new RXP® shotshell" machine which produces one-piece plastic shotshell bodies. The use of load cells in this machine appear to provide reproducible force/time traces which could be used to monitor tooling, incoming plastic slug quality, and resultant shotshell body quality.

Experimental work is underway and collection of hard data will start mid-month. EDL and ETL personnel in Wilmington will assist in development of signal processing hardware to demonstrate feasibility in the laboratory. If successful, a system will be developed for the production body forming machine presently under construction.

This technology could potentially have broad application.

FIREARMS

Model XSG Shotgun

A new autoloading shotgun is under development for introduction in the 1983 or 1984 model year. The design goals of lighter weight and reduced manufacturing cost have been incorporated in the proto-

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Model XSG Shotgun - Cont'd.

type currently in test. The prototype model has been fired 3750 rounds using 2-3/4" magnum loads without major component failure. However, slide blocks have separated from the action bar at the braze joints.

Design investigation into the slide block separation problem is in progress. The joint area and the braze operation also are being reviewed.

The action spring has been redesigned to improve the problem of spring setting. At 3,000 rounds the spring has a set of 1.560 inch (the spring is 13 inches long). A new square wire spring design was completed and sample springs ordered from Connecticut Spring Co.

The locking block - actuating system is being redesigned for better mass distribution at unlock. The revised locking system is in the final design stage. The gas system is being evaluated for an expansion/cutoff. A M1100 has been converted to automatically cutoff the orifice as the action moves rearward. Initial measurements indicate that the bolt velocity will be reduced to a greater extent on magnums than it is on light loads.

21mm Seismic

A 21mm gun system is being evaluated for MAPCO which is to be used for seismic exploration for oil and gas. An electric ignition design breech bolt has been developed for incorporation in the standard industrial 8 gauge kiln gun. The breech bolt - fire control system was designed to be interchangeable with percussion style bolt.

Twelve standard kiln guns were modified for electric ignition and shipped to MAPCO. Problems with the breech bolt - firing pin system as well as alignment problems were detected in the field. The twelve guns have been returned for design correction and modification.

A program to redesign the breech bolt and mating parts to assure model interchangeability has been expedited. An extensive endurance and interchangeability test program is currently under way. One gun will be endurance tested to 20,000 rounds. The major components such as the breech bolt and receiver will be dimensionally measured to determine the appropriate tolerances and these dimensions will be used in a later test.

The interchangeability test will consist of firing 20 rounds in each gun/breech block combination. The five worst cases will be selected and used in the dry cycle test. The dry cycle test consists of two tests; one for mechanical wear of the firing pin and insulator,

21mm Seismic - Cont'd.

the other for arc erosion of the firing pin tip. The final test is the 20,000 round endurance test. The target reliability is 99.83%. This will give us an overall reliability of 98% for simultaneous firing of 12 guns which is the most that can be reasonably expected in the field.

The target date for completion of these tests is April 1, 1980.

High Energy Beam Application

Laser Welding: M1100 and M870 shotgun slide blocks are currently being brazed to action bars or slide plates. The brazed joints are inherently unreliable and difficult to inspect without destructive testing. Scrap rates run as high as 20% in subsequent operations. A laser welding process was proposed to replace the troublesome brazing operation. The estimated gross savings are \$30M per year at a 38% ROI.

Parts have been redesigned, fabricated and submitted to EDL for laser welding. Preliminary results are expected in March.

Wood Decorating: Laser wood carvings offer improved aesthetics over the current pressed checkering method of stock and fore end decorating. Laser carving is comparable in detail to the traditional and expensive hand carving methods but at greatly reduced cost. Samples of carved stocks for the next edition of the Ducks Unlimited shotgun have been obtained. Additional samples of carved stocks and fore ends are expected in March.

ASEA Manipulator

Rectangular rifle and shotgun receivers are rough and finish polished. ASEA, Inc., an industrial manipulator manufacturer, demonstrated the capability of automatically polishing M742 and M760 receivers. The estimated gross savings are \$67M per year.

All support equipment has been received and installed with the exception of the part handling conveyor system. Three vendor quotes were received in February. The quotes ranged from \$20M to \$33M and are currently being reviewed. An order is expected to be placed in early March. Delivery is estimated to be 8 to 14 weeks.

The complete system startup is expected during the Second Quarter of 1980.

Model 870 Competition Trap

Production of this new model still is being delayed pending com-

Model 870 Competition Trap - Cont'd.

pletion of design modification testing. Three fore end tube design modifications have been tested.

The first design tested was the present production tube with the thread design changed to increase the area thru the threaded section by approximately 40%. The complete action bar is copper brazed together, microcarbed and heat treated. Using accelerated firing tests, one assembly went to 15,000 rounds with the tube failing next to the action bars. Two assemblies went to 25,000 rounds without failure. A slow rate of fire test was also conducted to determine if the rate of firing was a factor. Two assemblies went to 25,000 rounds without failure.

The second design tested was the same as the first with the exception of a shock ring added to the test gun between the fore end nut and the gas cylinder. Using the accelerated firing test method one assembly went to 25,000 rounds without failure.

The third design tested was fore end tube of heavier wall thickness, copper brazed together, microcarbed and heat treated. Two assemblies went 25,000 rounds without failure under the accelerated mode of testing.

Test results indicated that the first design using the standard production tube is satisfactory, however, for ease of assembly a heavier wall tube will be pursued.

During the intensive testing of the new fore end tube designs the premature cracking of the receiver was detected. Initial endurance testing of the prototype guns shows cracks developing at the rear of the ejection port at 32,000, 35,000 and 30,000 rounds. Cracking of receivers on production guns began to show after 5,000 rounds. Two Model 870 control guns went to 25,000 rounds without cracking the receivers.

To investigate the problem, strain analysis tests were conducted on the Model 870 competition trap gun receiver using CT barrels and a standard M870 barrel. Test results showed similar stress levels. Tests on a standard M870 receiver showed similar results.

Strain analysis measurements also were made using the same locking block in both the M870 competition trap shotgun and standard M870. The stress level results in both models proved to be the same.

Effects of a tight or loose magazine cap on the M870 competition trap and standard M870 are being evaluated. Preliminary results indicated that when the magazine cap is loosened one turn strain measurement reading is double. Two production guns are currently in test.

PROGRAM STATUS

AMMUNITION

3" 12 Gauge RXP® Shell

The development of a 3" field version of the integral basewad RXP® shell is underway with the objective of eliminating the asbestos basewad from our 12 gauge magnum line products.

Following tool development work and the establishment of desired tool setting specifications on the production shell press, the first 3" RXP® shells were produced in late January.

In February, a limited press run produced 9.5M corrugated shells at full press speed from one row of tools with no difficulties encountered. Special length extruded slugs were used.

More recently, it was demonstrated that with minor tool and press adjustments, standard 2-3/4" PTL slugs can be successfully processed into 3" bodies. Using two rows of tooling, a preliminary press run produced 1.8M 2-3/4" shells from one row and a like number of 3" shells from the other row, using standard 2-3/4" slugs obtained from Production. An extended shell press run is scheduled and will be followed up with experimental runs at AH&P and loading. Goal completion for this work, including product testing, is April 1.

7mm-08 140 Gr. Bullet (Secant Ogive)

A Remington designed 7mm-08 140 grain bullet is being designed to replace the Hornady bullet currently being used in production with the objective of offering improved ballistics performance through a secant ogive profile.

Downrange ballistics data for tangent versus secant ogive bullet profiles was forwarded to Marketing for review. Marketing responded that the tangent ogive bullet profile gave insufficient performance characteristics, and that the more difficult design of a secant ogive profile would be necessary.

Secant ogive bullet forming dies were tested and found adequate for first forming. Second forming punches and dies were designed along with a final forming punch and forwarded to Bridgeport for fabrication.

308 Win 55 Gr. PSP "ACCELERATOR"

Bridgeport test results on cartridges from the January experimental run were satisfactory. Production remains scheduled for March.

8mm Rem Mag 250 Gr. PSP

Marketing agreed to cancel this project and delete it from the 1980 Development Schedule. A closing report summarizing progress to date has been issued.

357 Super Magnum

Five thousand shells, 0.20" longer than standard product, have been processed through pierce and prime. One thousand shells were shipped to Bridgeport for load development work. Lonoke Ballistics experimented with thirteen powders and achieved 1908 fps instrumental at 50,700 CUPS with 158 grain bullets and 23.5 grains of WC680. This was in a 10" unvented barrel.

Primer Improvement

A number of product and process design changes were developed to address performance deficiencies with current shotshell primers. These changes will be phased into production at Bridgeport and Lonoke during 1980.

The Bridgeport Plant has produced 750,000 cups and anvils. Anvil to battery cup assembly for the open flash hole version primer is in progress and assembly of the covered flash hole version will be started early in March. First results from the assembly operation indicate excellent quality but a lower than standard production rate. The new assembly process will be studied to establish where time is being lost.

Evaluation of an in-line assembly process for producing covered flash hole primers is in progress. A revised process utilizing EDM has been used to provide more precise hole location in the anvil shaker plate. A set of 735 hole anvil to battery cup assembly plates, now being fabricated, should be available in early March and a trial run through the indexing primer assembly press is expected to be completed by the end of March.

FIREARMS

Model 1100 LT-20 Limited

Trial and Pilot guns were tested with satisfactory results. A successful field test with 8 boys and girls, ages 10 to 14, was also completed. The guns were accepted and approved for production.

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Model 7400 - 7600

Twelve Production Model 7400 rifles consisting of a selection of 30-06, 270 and 7mm Exp. Rem. calibers were successfully tested for bolt velocity verification.

Receiver marking drawings are being prepared for the designation of Model 4 and Model 6. Drawing transmittals will be made once location has been approved by Marketing.

Satisfactory production samples of the base grip cap have been made on a single cavity die.

Bolt Action Carbine

Five barreled actions for each of four calibers will be ready for assembly the first week in March. The latch system on the floor plate has been redesigned to eliminate latch releasing during firing. A prototype model has been made and preliminary testing indicates satisfactory results. Additional prototype testing will be conducted.

Model 700 Bolt Lock

A number of bolt lock designs that provide the shooter with the ability to load and unload his rifle with the safety in the ON position have been developed. Four prototypes of different configuration have been fabricated. Design revisions are being made to improve aesthetics.

Integral Ejector

Tooling modifications have been made to support the outside of the barrel to reduce the bulge in the area of the LT-20 ejector. Four prototype barrels have been fabricated for testing. A total of 60 rounds has been fired through each barrel.

Rivetless Extractor

Satisfactory testing on the small caliber rivetless extractor without anti-rotation projection has been completed. Drawings are being finalized for transmittal to Production.

All tooling to coin anti-rotation projections into the M788 Regular, M700 Reg.L.H., M700 Mag. and M700 L.H. bolt heads will be completed in mid-March.

Auto Drill Line

The fabrication of the system is near completion. Vendor run-off is expected the first week in March. System installation and start-up at Ilion is estimated to be late April.

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New Owner Manual Format

The final draft version of the M700 Owner's Manual has been approved by Legal and Marketing Department. The draft will be reviewed with Smart Communications, Inc. and final artwork and printing completed.

JRA:mf
Enclosures

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GENERAL

PERSONNEL

	<u>2/29/80</u>	<u>1/31/80</u>	<u>2/28/79</u>
Exempt	56	59	75
Nonexempt	23	23	29*
Wage Roll	<u>20</u>	<u>23</u>	<u>39</u>
Total	99	105	145**

*Does not include L.S.E.

**Includes Abrasive Products

AGREEMENTS

None

REPORTS

None

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P A T E N T S

Summary of Activity

FEBRUARY 1980

Applications Filed

FIRING PIN BLOCK FOR FIREARM WITH
A ROTARY BREECH BOLT
(Kast/Eddy/Carter)

D-209

ABSTRACT: A major safety feature of Model 7400 and 7600 rifles. The bolt carrier forceably retracts the firing pin inside the bolt face prior to unlocking the action, and continues to block the firing pin in a retracted position until relocking is completed. Thus, the rifle cannot be discharged with the bolt unlocked, even if the firing pin spring is broken or missing, or the firing pin is bent and jammed.

FIRING PIN BLOCK FOR FIREARM HAVING
A RECIPROCATING BREECH BOLT
(Bauman/Kast)

D-232

ABSTRACT: A major safety feature of the XSG shotgun. The slide block positively retracts the firing pin inside the bolt face prior to unlocking the action, and blocks the firing pin from protruding until the action has been relocked.

MAGAZINE SPRING RETAINER AND CAP
DETENT SYSTEM
(Kast/Young)

D-233

ABSTRACT: The detent mechanism for the aluminum magazine cap in the XSG shotgun. A plastic retainer/detent, located in the magazine tube, is used for two purposes. It retains the magazine spring in the magazine tube when the cap is removed and it uses the magazine spring force to detent the magazine cap by means of interacting teeth in the retainer/detent and in the cap.

Patents Received

ARMORED METAL TOOLS
(Dawson)

D-40-A

DENMARK

Patent Issued 2/11/80; Patent Rec'd. 2/26/80.

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