

*Remington Arms Co.
Research Department
Second Quarter
Progress Report*

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REMINGTON ARMS COMPANY

RESEARCH DEPARTMENT

SECOND QUARTER PROGRESS REPORT - 1980

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REMINGTON ARMS COMPANY
RESEARCH AND DEVELOPMENT
SECOND QUARTER PROGRESS REPORT-1980

HIGHLIGHTS

| | <u>Page</u> |
|--|-------------|
| • Extended Semiworks runs of .410 bore unbodies were successfully completed. Preliminary development of 20 gauge process tooling is in progress. | 1 |
| • Laboratory quantities of 20 gauge steel shot loads are being prepared for field testing by the U.S. Fish and Wildlife Service. | 2 |
| • Acceptance testing of the integral anvil battery cup press and die set is currently in progress. Development efforts continue toward demonstration of sensitivity and ballistics performance, and to provide a suitable method for covering the flash holes. | 2 |
| • Recent progress in defining the TLX process for more safely producing priming mixture shows encouraging results. | 3 |
| • Semiworks quantities of 21MM seismic ammunition continues to be produced and shipped to MAPCO, Inc. An improved firing pin design for the gun has been demonstrated. | 3 |
| • Two solutions to the Model 870 Competition Trap Shotgun locking block problem have been satisfactorily tested. Buffered pistons are being tested as a possible solution for rib failure. | 4 |
| • The malfunction rate has been reduced for Model 7400 magazine boxes. Wood processes for the Model 7400 and M7600 rifles have been resolved. | 5 |

HIGHLIGHTS (Cont'd.)

- | | <u>Page</u> |
|---|-------------|
| • Testing of Model XSG Shotgun is being resumed with a lower stressed action spring and a modified Model 1100 gas system. | 5 |
| • Accuracy tests on prototype models of the bolt action carbine gave good results. | 6 |
| • Auto-Drill Line startup is scheduled for late July. Initial emphasis will be on the chip and filtration system, followed by the machining line. | 6 |

REMINGTON ARMS COMPANY
RESEARCH AND DEVELOPMENT
SECOND QUARTER PROGRESS REPORT

AMMUNITION

New Unibody Shotshell Process

An annual cost reduction of one million dollars is expected to be realized through development of an improved one-piece plastic shotshell body process capable of producing the complete range of shotshell specifications.

An extended run of over 100,000 .410 bore bodies was completed with resulting good quality product. For more complete evaluation and testing, a plant assembly and loading run will be required for which trim and skive tooling is being fabricated and a hopper for feeding bodies to assemble, head and prime is scheduled for delivery in August.

Preliminary development of 20 gauge product is in progress. Two separate body designs are concurrently being considered. One design is a direct replacement for the current 20 gauge product with equivalent internal volume; however, this body exhibits an external visible ring at the bridge-to-wall junction point. The second body design uses a much lower bridge and does not have a visible ring; however, internal volume is somewhat greater, which could require redesign and make competitive wads non-interchangeable. This design has better appearance and uses less plastic. A short run of both bodies has been made, and testing of the product is currently underway.

Modification of the Semiworks equipment to allow operation at the proposed 80 parts per minute is scheduled for completion by July 1, and installation of the new die set is scheduled for the first two weeks of August. Completion of those changes will provide a Semiworks system which essentially duplicates the proposed production unit.

Design of the production prototype equipment continues on schedule. Fabrication orders on the body former have been placed and orders for the heatset unit and control system will be placed in early July. Production startup is anticipated by mid-1981.

Research Department

- 1 -

June 1980

20 Gauge Magnum Steel Shot Loads

In support of a proposed field testing program, the U.S. Fish and Wildlife Service, U.S. Department of Interior, has requested that Remington provide 10,000 rounds of 20 gauge "SP" magnum 7/8 oz. #4 steel shot ammunition. The purpose of that program is to gather lethality/cripping data on 20 gauge steel loads. Design of the product is complete and preparations are being made to manufacture the product in the Semi-works. The product will be available by mid-September. The field test is expected to extend over a period of several months during the 1980/1981 waterfowl hunting season.

Integral Anvil Battery Cup

The objective of this program is to develop an integral anvil battery cup to reduce primer manufacturing costs, improve consistency of primer quality and provide greater opportunity for process automation.

The Lachaussee press and die being purchased to produce this component are currently being tested at the vendor's plant. Acceptance will be based on an average equipment efficiency of 75% without jams, using both bare and cooper-plated low carbon strip steel. Approximately 500,000 components will be produced with each material.

Product development using components previously supplied by the vendor has been encouraging. Primer sensitivity has been demonstrated with product assembled at both Bridgeport and Lonoke. SPL2-6 shells using these primers have also passed the off-center sensitivity test. Ballistics performance for a variety of shotshells loaded with experimental primers has been successfully demonstrated on a limited basis. Primers containing about .95 grains of 1024 nitrocellulose containing primer mixture are suitable for 12 gauge nitro mag and steel shot loads; however, battery cup deformation was incurred in testing at elevated temperatures. Sample primers with reduced pellet weights have been made for evaluation with .410 bore loads and as component primers for use with ball powders.

Efforts to develop flash hole covering techniques have centered on the use of paper. Experimental tests, using .004" and .008" thick paper, indicate more consistent primer detonation pressures result from use of .008" thick paper; however, the value of this consistency to improved ballistic performance has not been demonstrated. An experimental die for inserting paper into the integral anvil battery cups has been made and is being tested. The die will be used to make larger samples of product for further evaluation.

Research Department

- 2 -

June 1980

TLX Priming Mixtures

The purpose of this program is to improve primer manufacturing safety by developing a priming mixture which is less sensitive to detonation during the manufacturing process.

Recent experimental samples of rim fire TLX priming mixture have contained nitrocellulose to take up excess moisture and improve charging characteristics. Using 4% nitrocellulose and an increased mixing time, the mixture has been successfully processed and passed critical product evaluation tests. Drop tests, ballistics and accuracy results were comparable to the standard control mixture and a trickle shaker inspection showed a normal level of priming defects. The experimental mixture showed good compatibility with the high-speed rim fire shell inspection machine, and to date, 7500 rounds of ammunition have been fired in function and casualty pistols with no misfires. This mix has been tested under mass detonation conditions and found to be insensitive to detonation of a #8 blasting cap at various stages of the mixing cycle. Additional tests are currently in progress to confirm the acceptability of this mix prior to scheduling a plant scale run.

AMMUNITION/FIREARMS

21MM Seismic System

An 8 gauge cartridge and gun system, designated 21MM seismic, is being developed for MAPCO, Inc. for use in seismographic exploration work. The ammunition is being developed with an electrically detonated primer in Bridgeport, and the firing system for that product is being developed in Ilion.

A total of 72,000 rounds of ammunition were warehoused in June, essentially completing the initial 100,000 round commitment to MAPCO, Inc. Semiworks production rates of 50,000 per month are forecast from July through September. Output rate will be increased to 250,000 per month beginning in October, upon completion and startup of the manufacturing process equipment.

Recent ammunition process improvements have resulted in increased output, yield and product quality. To reduce defects caused by short circuits, the primer cup lead angle was reduced to allow the insulator to be inserted with less shearing and deformation; to reduce misfires caused by arcing between the contact button and primer cup, the diameter of the button was reduced; to improve button fabrication and tool lineup, the

Research Department

- 3 -

June 1980

21MM Seismic System (Cont'd.)

strip feed unit was rebuilt; and a reduction in the number of plates and a modification to the primer support cup have improved reliability and output of the primer charging and assembly operations.

With respect to the gun, two types of retractable firing pins have been designed and tested. These include an inertia retract model and a cam operated automatic retract model. Testing of these designs has involved firing of both loaded rounds and empty primer cases. The inertia retract model fired 7,898 rounds and experienced 75 misfires. The automatic retract model fired 5,255 rounds, experiencing a total of 159 misfires. Because of the more favorable misfire ratio, the inertia retract model has been selected for production.

FIREARMS

Model 870 Competition Trap Shotgun

The Competition Trap Shotgun is a special, single shot version of the Model 870 with a gas operated recoil reduction system added. It was previewed at the Grand American Handicap Trap Shoot last August and announced in December, 1979.

Two standard locking blocks that were shotpeened and two of a new design with increased cross sectional area below the locking notch have been endurance tested to 25,000 rounds without any cracks. Testing continues with 10,000 rounds fired on a standard locking block that has directed shotpeening in the notch area.

Vent rib breakage and loose posts continue to be incurred. Decreasing the bore diameter from an overbore to the standard bore did not reduce the problem. Investigation of the brazing process indicates good production manufacturing control. Strain gauge measurements of the vent rib during shooting have been started. Competition trap barrels with the present piston recoil system have been compared with the Model 1100 barrel and its recoil system. Initial results indicate over twice as much strain on the Competition Trap vent rib as on the Model 1100 vent rib when the recoil system returns to battery. A piston with a buffer will be tested to see how much that stress level can be reduced on the Competition Trap barrel.

Research Department

- 4 -

June 1980

Model 870 Competition Trap Shotgun (Cont'd.)

Two systems are being evaluated to retain the barrel in the receiver. One system uses the standard Model 870 magazine cap and guide ring fastened to the barrel ahead of the gas cylinder. This system works satisfactorily. The second system uses a positive locking detent system mounted on the barrel retaining sleeve. A model of this system will be tested.

Model 7400 Autoloading and Model 7600 Slide Action Centerfire Rifles

The Model 7400 and Model 7600 rifles were developed as replacements for the current Model 742 and Model 760, and are scheduled for announcement in December, 1980.

Five Model 7400 - Cal. 30-06 rifles have been fitted with heavy wall magazine boxes. Testing shows a reduction of about 1% in the malfunction rate (3.5% to 2.5%). Work is continuing to reduce the stem override malfunction which occurs on the last round out of the box. The trapped shell malfunction has been reduced by changing the configuration on the face of the ejector.

The wood processes have been resolved. Approval has been given for the Model 7400-7600 stocks and fore ends, and the Model Four fore end. The press form process has been approved except for the checkering.

Production firing pins, shot peened by Metal Improvements, have been dry cycled over 10,000 cycles and are satisfactory.

Model XSG Shotgun

New autoloading and slide action shotguns are being developed. The objective of the program is to replace the Model 1100 autoloading shotgun and the Model 870 slide action shotgun with improved versions which will be lighter in weight. The guns are being designed simultaneously to take advantage of common parts for reduced manufacturing costs.

Four prototype guns have been used in the development and testing of the improved autoloader (XSG). A total of 45,000 rounds have been fired in the four guns and weaknesses have been uncovered in the locking system and action bar/slide block assemblies. Two new locking systems are being built. Barrel assemblies are completed and locking blocks and slide blocks are now in fabrications. Preliminary testing of one earlier

Model XSG Shotgun (Cont'd.)

version XSG model, updated with new action bar assembly and a longer round wire action spring, has begun. A square wire action spring is on order, with delivery expected in July.

Bolt Action Carbine

The carbine is a short barreled, bolt action, centerfire rifle that is under development as a replacement for the discontinued Model 600.

Five models are being assembled with a new bolt lock and powder metal latches for the floor plate. They will be function tested with one gun, continuing on for endurance testing. Accuracy tests on prototype models in all calibers gave averages below 2.7 inches for three 5-shot groups. Seventeen rifles in 7mm-08 caliber have been assembled, tested and shipped for field testing.

A version of the experimental gun using the Model 700 barrel contour has been prepared and presented to Marketing, who have requested that this contour be used on the final design. Preliminary cost estimates have been prepared, and alternate designs of 11 items are being reviewed for potential to reduce product cost.

Auto-Drill Line

The present method of preparing shotgun barrel blanks for the swaging machines is difficult to control and requires an unacceptably high degree of technical and engineering support. A process has been developed to replace it utilizing proven machining methods and completely automatic part handling.

Startup of the new process is scheduled for late July. Initial emphasis will be placed on the chip and filtration systems, with the machining line to follow. There is some concern over the adequacy of machine lubrication as furnished. A detailed study is currently in progress to define modifications, if found necessary. Also, quoted drill head deliveries could result in a short supply in early 1981. Negotiations with the supplier are in progress to determine if the situation can be improved.

STATUS - PRODUCT DEVELOPMENT

AMMUNITION

30 Caliber "Accelerator" Sabots

Due to the problem of excessive sprue lengths on molded polycarbonate sabots, the use of Lexan® 141 is being considered as a direct replacement for Lexan® 191. During a recent experimental molding run at the vendor's plant, this polyethylene-free material totally eliminated the excess sprue lengths on molded product. In order to determine the compatibility of this polycarbonate resin with the single base powder (DuPont 4198) used in our 30 cal. "Accelerator" products, long-term storage and harsh environment testing are presently underway. Early results are showing positive indications of compatibility, but further testing is required. This program is scheduled to be completed in December, 1980.

7mm BR Remington Case

Cartridge and chamber drawings in the SAAMI format were completed and submitted to Ilion and Lonoke for approval. A fully-dimensioned product case drawing was also prepared for use in completing tool design for this item. The experimental run on this product is planned for November, 1980.

7mm-08, 140 PSP Secant Ogive Bullet

Downrange velocity measurements to 200 yards were made on hand made secant ogive bullets. The ballistic coefficient of the bullet was found to be .393, slightly superior to the .384 value of the Hornady bullet currently loaded in production ammunition. Additional quantities of this bullet will be produced on plant equipment in August for more extensive evaluation.

357 Super Magnum

The cartridge case product drawing has been completed, and drawings for both solid and vented test barrels are now being prepared for Ilion. A testing program is being defined to evaluate performance of this ammunition in the new revolver being developed by Ruger. Two prototype revolvers for this work are expected to be received in July.

Research Department

- 7 -

June 1980

FIREARMS

Model 700 Bolt Lock

The objective of this development is to give the shooter the capability to open and unload his firearm with the safety in the "On Safe" position. In order to do this, the operation of the bolt lock and the safety have been designed to operate independently of each other.

An aesthetically acceptable lever has been designed and will be tested in conjunction with the bolt action carbine. Final cost estimates are being prepared by Industrial Engineering. Testing is planned to start the first week in July.

Integral Ejectors

Currently the ejectors in the Model 1100 12 gauge and 20 gauge shotguns are spot welded to the barrel extension and machined to size. A process has been developed to form the ejector as an integral part of the barrel extension. Three operations will be eliminated as well as the ejector pin and result in a more durable ejection system. Tooling to coin ejection surfaces into 12 gauge, 16 gauge and standard 20 gauge barrels has been developed and transmitted to Production. Savings of over \$60,000 per year will be realized by this procedure.

Rivetless Extractors

These new centerfire extractors in small, regular and magnum sizes will replace the troublesome riveted types. Part cost will be reduced, a number of bolt head operations eliminated, and gun reliability and ease of replacement will be improved.

All three extractor sizes have been tested and approved for introduction in all centerfire rifles. Drawings of extractors and bolt head modifications have been transmitted to Production. Regular and magnum extractors require an anti-rotation projection in their respective bolt heads in order to prevent them from rotating out of position. Tooling to coin the anti-rotation projections is being developed for all center-fire bolt heads in both right and left hand configurations. Tooling for the Model 700 regular caliber and Model 7400-7600 bolt heads is complete and the parts are in production.

Research Department

- 8 -

June 1980

STATUS - PROCESS DEVELOPMENT

AMMUNITION

3" 12 Gauge "RXP" Shotshell

It was previously demonstrated that with tool modifications and press adjustments, standard slugs extruded for 2-3/4" product could be successfully processed into 3" bodies. A Perkins press run was made and 30,000 slugs were successfully processed into bodies at full speed using one row of tooling. The bodies were assembled/headed and primed, and a quantity were production loaded (SP12HMAG-00BK). Product acceptance testing is now in progress with completion expected in August.

FIREARMS

ASEA Manipulator

Rifle and shotgun receivers are rough and finish polished by a labor intensive hand process. ASEA, Inc., an industrial manipulator manufacturer, demonstrated the technical capability of automatically polishing Model 742 and Model 760 receivers utilizing their industrial robot. Updated economics project a \$70,000 per year savings at a 26% ROI. These figures reflect the additional expenditure of \$6,500 for the Schaevitz LVDT repositioning system to overcome the tolerance problem in receiver panel polishing. The vendor was visited to review the system design and timing. Delivery is anticipated in September, 1980.

Laser Welding

Model 1100 and Model 870 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 \$30,000 per year at a 38% ROI.

Metallurgically sound welds of the 1018 slide blocks were obtained by ETL. Welding tests of the powder metal slide blocks and the 8620 slide blocks are in progress. Sample completion and subsequent functional testing has been delayed until July, 1980 due to laser startup problems and vacation schedules at ETL.

Research Department

- 9 -

June 1980

P A T E N T S

Summary of Activity

JUNE 1980

Applications Filed

PERCUSSION FIRING MECHANISM FOR INDUSTRIAL GUNS (Palmer/Rowlands) D-236

ABSTRACT: The hammer and sear profiles are so formed that they cooperate to automatically cock and fire the gun as the breechblock closes. The timing of hammer release is easily adjustable to compensate for wear.

FIRING PIN RETRACTOR MECHANISM FOR ELECTRICALLY-FIRED GUNS (Palmer) D-237

ABSTRACT: To protect the tip of the firing pin from damage as the breechblock slides open, it is retracted by a cam-actuated lever engageable with the yoke, and is returned to firing position only when the breechblock is fully reclosed.

RECOIL-OPERATED FIRING PIN RETRACTOR FOR ELECTRICALLY-FIRED GUNS (Rowlands) D-241

ABSTRACT: The firing pin tip is retracted by inertial movement of a weight upon firing the gun. As a safety feature, the gunner must manually release a latch to return the firing pin to its firing position.

Patents Received

AMMUNITION PRIMING MIXTURES (Kenney) D-161 CIP CANAI

Patent Issued 5-20-80; Patent Recd. 6-20-80

ABSTRACT: This is our "TLX" priming mixture.

Inventions Reports

Ilion:

MECHANICAL FIRING PIN RETRACTING MECHANISM FOR ELECTRICALLY FIRED GUNS IT-296

Research Department

i

June 1980