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REMINGTON ARMS COMPANY, INC.

NEW PRODUCTS RESEARCH

SECOND QUARTER PROGRESS REPORT -- 1984

June 26, 1984

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AMMUNITION HIGHLIGHTS

Ammunition Highlights (Cont'd.)

Shotshell Products (Cont'd.)

Centerfire Products

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AMMUNITION

New Unibody Process

The New Unibody Shotshell Process is being developed to provide a single process for all shotshell gauges. It has been designed to substantially increase process tolerances and yield, and simultaneously improve product quality.

8 Gauge

Based on the successful completion of testing on more than 500 hand headed, hand loaded 8 ga. magnum product, all new tooling (heading stems and cavity punches) required to implement this process on Simplex AH&P equipment was released and fabricated. Additionally, the addendum to the 8 ga. technical data package detailing the recent AH&P improvements has been completed and issued. A sizable quantity of 8 ga. bodies and all AH&P tooling are on hand for a Trial & Pilot run which will be set up when Lonoke production schedules permit.

10 Gauge

A body has been produced in Semi-works that is dimensionally correct. Volume appears to be more than adequate and may require a shorter loaded length depending on the powder selected using the existing wads.

Initial attenpts to establish ballistics for the 10 ga. mag load have indicated that the current powder, Unique 60, may not be acceptable for use in the Rotary Cam shell. This is not unusual when changing from a dry molded basewad to a plastic basewad or unibody shell, but additional work will be required to qualify a suitable powder. Fortunately quite a few powders currently used in production are in the same quickness range as Unique 60 so many potential replacement powders are available. No significant delay in schedule is anticipated due to this development.

12 Ga. 2-3/4" Smooth Target Body

Recently completed testing of the 12 ga. target body (no suck-in) confirmed the superiority of this body compared to our current product especially in reloading.

In this testing 400 rounds of machine assembled and primed target bodies were fired for function and casualty at the temperature extremes in non-standard guns without a single failure. In standard reloading the Rotary Cam product averaged in excess of 20 reloads when reloaded with any current Remington, Federal or Winchester component wad and in severe reloading met the Research standard by exhibiting body cutoff indices of less than 60 in all cases, (minimum of 14 reloads for 10 bodies without a body cutoff).

In preparation for an upcoming run of 150K blue Rotary Cam target bodies, for the Remington Target Load Test program, tooling to produce this body has been fabricated or modified and is available. Currently slugs are being extruded on Research equipment with the body former run scheduled to be complete prior to month's end. This schedule could be revised pending a review of a bulge observed in this body using the new "Figure 8" target load wad.

16 Gauge

Bodies made with an experimental extrusion punch utilizing a multiple angle taper to decrease the tapered wall thickness in the body have been characterized and found to lower the critical wall thickness by nearly 3/16". (critical wall thickness = (body O.D. - wad O.D.)/2). This increase in body I.D. will eliminate the tendency toward head cutoffs because of tight wad fit that prompted this redesign. It also allows greater flexibility for all wad columns used in the 16 ga. product line.

Testing of this new body will commence after completion of redesign work to the heading stem to correct primer seal deficiencies encountered with the original stems.

20 Gauge

Smooth bodies for the target load are currently being made in Bridgeport with good quality. These bodies are being shipped to Lonoke for use in target loads. With the exception of the magnum and steel shot loads, all other loads have now been commercially loaded in this body.

A low incidence of head pull-offs at 150°F in a non-standard gun was observed in the Buck loads. A revision to the heading stems at AH&P is in progress similar to the approach for the 12 ga. 3" LV product to improve the primer seal.

28 Gauge

Product from one station of the production body former has successfully passed all applicable Research testing. Because

the product was hand headed, compared to the more critical factory headed, testing was under more severe conditions (.010" oversized chamber and .015" excess headspace. Tools to run a full quadrant have been prepared but the heatset unit for this quadrant is down. The required spare parts are not due until the first week of August.

Based on the successful testing, the Technical Data Package is being prepared and should be issued during the week of June 25th. The data included in this package may be revised based on the results of full quadrant operation or machine AH&P and loading by the Plant.

.410 Bore

Approximately 45,000 2-1/2" and 40,000 3" bodies have been produced in an experimental run. Testing of hand headed and loaded 2-1/2" product with brass caps has been completed with no failures. Testing of the 3" product with steel caps is underway.

Tooling for the production machine is currently on order. About 75% of these tools are being made in-house to expedite delivery. All tooling should be on hand by the end of July.

"Premier" Shotshell

Competitive shotshell products with buffered and/or hard copper plated shot have acceptance among upland game and waterfowl hunters. Marketing has requested a similar line of products to maintain our competitive position.

12 Ga. - 1-7/8 oz. "Premier"

We have been unable to load a satisfactory powder/primer combination. Factory loaded product using both Hercules 369(new) and Expro #4092 with Federal 209 primers have predicted maximum pressures after four days storage of:

	-20°	R.T.	+150°F	Velocity (RT)
Hercules 369	14.7 ksi	12.4 ksi	16.9 kpsi	1160
Expro #4092	14.6 ksi	13.9 ksi	16.4 kpsi	1234

The -20°F pressure rise is due to powder fracturing. Federal primers were selected because they yield the most consistent performance at all temperatures. We suspect this is due to their primer mix which uses basic as opposed to normal lead stifnate. They also shellac their primer as a moisture barrier.

Currently, the Expro product looks more desirable because the velocity/pressure ratio is more favorable. A second loading is planned the week of July 2nd to determine if satisfactory pressures can be obtained.

Both Expro and Hercules powders are high nitroglycerine propellants (35%). Hercules and Expro have been informed of our results. Hercules is working on a lower nitroglycerine, thinner flake powder. A visit to Expro is planned for June 26th to discuss powders to suit our requirements.

Powder from Kimera-Oy has arrived on site and Bofors powder is en route.

12 Ga. 1-5/8 oz. "Premier"

Load development work is proceeding. Federal 209 primers are being used.

20 Ga. 1-1/8 oz & 1-1/4 oz "Premier"

Load development work is proceeding. Hercules reports promising results with SS365, but we have not received powder.

"Premier" Centerfire

Competitive centerfire rifle products with superior ballistics, accuracy and cosmetics have gained acceptance among long range game hunters. Marketing has requested a similar line of products to maintain our market position.

Bullet Performance

The key to obtaining good downrange ballistic performance is bullet profile. The optimum profile is a secant ogive with a small meplat (nose diameter). Remington currently produces bullets with tangent ogives and meplats of .100" diameter. On the first trial run on factory equipment of secant ogive bullet dies the correct bullet ogive was achieved with a meplat of .080". The goal is a meplat of .050" diameter. A second trial run scheduled for the week of June 25 will use modified dies to help achieve this goal.

Mush performance on these bullets was poor. In order to improve mush a .015" deep external cut was made .200" in length from the nose. The table below shows the results of this test using 169 gr. flat base secant ogive bullets in gelatin at muzzle and 250 yd. velocities (two shots per sample).

Sample	Vel.	Penetration to shock cavity	Shock Cavity Length	Mush Dia.	Retained Weight
Control 180 gr.PSPCL	2150	1.5"	7"	144%	76%
	2700	.5	8"	210%	66%
169gr.Secant Nose Cut	2220	1.2"	7"	190%	80%
	2700	1.0"	8"	210%	67%

Tooling design revisions are in progress. Other options being investigated to improve mush are tapered wall jackets and 0% antimony lead cores.

The "bullet" program originally developed for the Apple computer has been converted to our new HP9816 which reduces the run time by 75%.

Case Polishing

A work request has been approved for Fred Schmidt, ETL, to investigate methods of chemically polishing centerfire brass cases. Samples have been produced by R. H. Miller with an exceptionally bright surface finish.

A plant demo/experimental run is tentatively scheduled for July 10 and work has been started to mechanically prepare the equipment (heating coils installed and drip pans made). F. Schmidt has indicated that the test could be delayed by one week or postponed to September pending his involvement with the Lake City Task Force. He will confirm by July 5.

Remington Target Loads

Marketing has developed a program to introduce the Remington Target Load in all target gauges during the summer of 1985. Previous to the formal introduction, however, extensive field testing of the products in blue bodies is planned. The technical elements for all target gauges have been determined and are as follows:

- Smooth, green Rotary Cam Unibodies (yellow in 20 ga.)
- #209 Primer (reduced pellet weight in .410)
- New RTL wad (12 gauge only)
- Brass caps (including .410 and 28 gauge)

A critical item in the overall RTL program is the new wad. Based on a Marketing request the candidate wad was originally designed for the component trade and features a flared shot pouch for ease of reloading. A wad mold to produce 30MM/yr. has been ordered by Lonoke and production from this mold is expected to begin in August 1984. However, as a factory loaded component, this wad will present considerable feeding problems at the duplex loaders. Redesign of the pouch section to minimize the flare will reduce these feeding difficulties and this effort is presently underway.

A new set of mold tooling has been designed, fabricated and installed in a Bridgeport Semi-works molding machine. Although startup difficulties have been encountered due to hydraulic problems with the machine, approximately 250 wads with a straight shot pouch and a full bridge support disc have been molded. Load development with the new wad has proceeded with good ballistics and reloading results. Patterns are equal to the "RXP" wad. The remainder of this sample has been sent to Lonoke for a preliminary determination of feeding performance at the duplex loaders. Molding is presently underway in the Bridgeport Semi-works one cavity tooling to supply Lonoke with 5-10M factory load wads for an experimental loading run.

Because of the long lead time required to obtain factory loaded wads in sufficient numbers, Bridgeport ARD has requested Purchasing to expedite the purchase of a new 24 cavity production mold. If the mold is ordered in June, production wad quantities can be expected in November 1984. Modifications to the duplex loader feed units can be made during this interim period, if required.

Hand loaded bodies using this wad shows a .004" bulge where the wad interferes with the taper on the body I.D. Alternatives are being reviewed to eliminate this problem. They are reducing the obturating skirt diameter or lowering the taper in the body. We expect to have timing and cost of these alternatives by July 2nd.

Steel Shot 20 Ga. 1 oz. Load

Steel shot is mandated in some waterfowl areas. Previously steel shot loads utilized a dry molded asbestos basewad. Asbestos use has been eliminated to avoid environmental contamination in the manufacturing operation. Development of loads in the New Unibody is requiring both new wads and load development.

Marketing has requested development of this product to match competition, however, a 1 oz. payload in the New Unibody shell is not possible due to internal volume limitations. A 15/16 oz. payload can be obtained but this is not competitive with the Winchester and Federal 1 oz. offerings. After review with Marketing, it was agreed to develop the 15/16 oz. payload.

After reviewing the design alternatives a straight fin shot container with a molded-in slit was selected which minimizes the fin gap at the slits.

An outside vendor, Automatic Injection Molding, Inc. of Berkeley Heights, New Jersey was selected to fabricate a one cavity mold and supply 10M experimental wads with a maximum slit gap of .015". AIM has delivered 200 wads for our preliminary evaluation before the full 10M molding run is made. Although the wads have not been test fired, visual and dimensional evaluation indicates that the shot container wads are satisfactory. AIM designed the tooling to produce wads with a novel, angled slit design which should further help to minimize slit gap.

ABC Primer

The ABC (integral anvil) battery cup has the potential of significantly reducing costs through automation and improving quality through assured anvil positioning.

Testing using the original three flash hole design indicated a potential for blown anvils with some primer mixes. Experimental four flash hole primers have successfully maintained mechanical integrity but anvil point height has been difficult to obtain.

Modifications to the 1st anvil point die were refined to give a good outside anvil point profile but sectioned anvil tips indicated some changes to the 1st anvil point pin were needed. Modifications were made to the standard anvil point pin with good results and a sample of approximately 2000 battery cups was run before turning the machine back to production. The anvil heights of this sample are at .037" which is at the edge of a .034" to .037" spec. Design of modified 2nd and 3rd anvil pyramid dies is almost complete. These dies are expected to be ordered the first week of July with delivery in four weeks.

Brass Plated Steel

Recent developments in brass plating technology may offer Remington a cost advantage. Currently caps are made from unplated steel which are brass plated after half-heading.

Quotes for brass and copper plated steel have been received from Thomas Strip Steel Co. An economic feasibility study will be requested comparing the use of brass pre-plated steel vs. our existing process which uses a cuprodine finished steel with a post plating operation.

Copper Crusher/Transducer Correlation

Copper crushers have traditionally been used in the ammunition industry for measuring chamber pressures on centerfire cartridges. A study was initiated by ARD to determine if a correlation existed between copper crushers and conformal transducers. Transducers would reduce cost and could potentially improve the reliability of pressure measurements.

It was concluded that no correlation exist. The study found two components of force that contribute to crusher deformation may vary widely depending on the loading specification. Also, the crusher does not represent the actual chamber pressure. ETL, as part of the final phase of the cartridge case basics study, has been investigating the rupture strength of our cases. Information from this study will be used to set transducer pressure specifications. An implementation plan will be developed with Production following completion of ETL's program.

Research Consolidation

Ammunition and firearms Research will be consolidated at the Ilion, N.Y. site. Construction of range facilities at Ilion has commenced and is scheduled for completion by mid-August.

Equipment and furnishings in Bridgeport have been inventoried by room and designated "transfer to Ilion" or surplus. Tentative equipment and furniture layouts for the new Ilion facility have been completed. Surplus equipment and furnishings have been offered to all Remington groups.

Consolidation of Research Central Ammunition files have essentially been completed with the exception of the Hall of Records. The Technical Library has also been consolidated with surplus books being offered to local schools. Excess and experimental explosives and powders have been disposed. Chemicals have been collected into a central location for sorting and disposition.

Consolidating firearms, ammunition, and assorted test jigs and fixtures in the Test Lab is in progress. A list is being compiled on equipment requiring disconnect. Packing of portable equipment has begun.

WLT

WHColeman/WLT/mf

NEW PRODUCTS RESEARCH

PERSONNEL

REMINGTON ROLL

	Actual 5/31/84	Actual 6/30/84	Forecast 12/31/84
Exempt			
Ammunition Research	9	9	8
Firearms Research	28	—	33
Total Exempt	37		41
Non-Exempt			
Ammunition Research	8	7	6
Firearms Research	12	—	12
Total Non-Exempt	20		18
Wage Roll			
Firearms Research	16	—	17
Total Wage Roll	16		17
Total New Products	73	—	76

RESEARCH PERSONNEL AS OF JUNE 29, 1984

BRIDGEPORT DIVISION

Exempt	9	Non-Exempt	7	Wage Roll	0

Cole, Wm. T.	Alexander, Bruce R.
desJardins,Chas.F.,Jr.	Buccitti, Dominick C.
Dwyer, John M.	Champine, Barry M.
Garrett, Thelma B.	Frauenberger, Marion O.
McDonald, A. Daniel	Green, Jeffrey R.
Peterkin, Vinton A.	Raimundo, John A.
Simpson, Wm. R.	Suhy, Frederick A.
Sroka, Leon R.	
Tomek, Warren L.	

TOTAL BRIDGEPORT PERSONNEL: 16

Note: S. Montefusco (Bpt.) Non-Exempt, transferred to Sorvall, Newtown, CT as of 6/4/84