

7-5-44

MODEL 721 DEVELOPMENT

The first successful bolt action rifle to be manufactured in the United States was the Remington-Lee. The basic design of this arm was nearly identical with present day bolt action arms. In the Lee, the bolt head was separate from the bolt body, but this bolt head had locking lugs which locked in the receiver bridge in the same manner as modern bolt rifles. Soon after the Lee rifle proved satisfactory, many modifications of this action were brought out by European countries - some of these modified Lee's were made by Remington. All bolt rifles show the influence of the Lee rifle, and some show a very marked resemblance, such as the Austrian Marmlicher, the British Lee Enfield, the Krag-Jorgensen used by Denmark and later by the United States, the Belgian Mauser (1888), the French Lebel (1890), the first German Mauser (1888), the Russian Nagant, and others. Most of these modifications used a single column box much like the Lee. A few used a tubular magazine patterned after the Henry rifle, a Winchester, and the Remington-Keene, an unsuccessful bolt action which was manufactured before the Lee.

Then Paul Mauser, in 1898, developed a double column flash box magazine and further modified the Lee action for higher pressure smokeless powder cartridges. Incidentally, Paul Mauser did most of his development work here at Ilion. Following the development of the Mauser, practically all countries adopted this rifle, or modifications, for their standard military arm. The United States paid a considerable sum (after a lawsuit) for the 1903 Springfield modification.

The present commercial high-power bolt actions are also based on the Mauser. The M/720 Remington is the M/30 Remington with a few minor changes. The M/30 was brought out by Remington after the last World War to meet the demand for a high-power bolt action by the men who had been trained on the Springfield. It was merely a sporting version of the 1917 Enfield manufactured by Remington and Winchester during the last war, originally for the British as the Pattern 14 and finally as the 1917 for the United States. Many finished and partially finished parts were purchased from the Government.

Soon after the introduction of the Remington M/30, Winchester placed the competing M/54 on the market in a much wider variety of calibers. The M/54 was designed from the beginning as a sporting arm and with its selection in calibers took more than its share of the market. In 1936 Winchester revised the M/54 with a new and better trigger, a new safety (no better than the old one), a new bolt handle to allow a lower mounting of telescope sights, and a new and better stock. This rifle was the M/70. It captured a still larger share of the bolt action market.

A few years after the introduction of the M/70 Winchester, Remington introduced the M/720, a revision of the M/30, principally in locks. The M/720 continued to use the 1917 Enfield parts purchased after the last war. However, most of the parts which were near completion are used, and to produce M/720 rifles in any quantity it would be necessary to add tooling to pick up parts further back in process. High-spot tooling estimates indicate that the cost would be prohibitive.

The retail price of the basic M/720 and M/70 is now \$78.45. The price in 1939 was \$59.95 for the Remington and \$61.25 for the Winchester. Naturally, very few of these rifles have been sold to the average hunter. The average man would be foolish to pay \$60. or \$80. for a piece of equipment which he would use a maximum of two weeks out of the year. Those who buy the M/720 and M/70 either have

more money than the average, or are confirmed gun bugs who prefer bolt actions for their performance. Bolt actions have in the past been chambered for higher intensity cartridges than other types. Bolt actions have, in general, been more accurate than other types, presumably due to their stronger breeching.

Within limits, and other things being equal, a lower selling price means a larger volume of sales. This is adequately illustrated in the gun business by the Remington 500 Series, a class of low-priced bolt action .22-caliber rifles, the Winchester lever action M/94, and Marlin M/36, the only two commercial low priced repeating center fire rifles adequate for deer hunting. Another low priced center fire, no longer available in quantity, is the Government Krag for the .30-40 cartridge. The .30-40 is in a power class about midway between the M/94 - .30-30 and the Springfield .30-06. The Government disposed of a number of these Krags at the nominal sum of \$1.50, which explains the large volume of .30-40 cartridge sales.

Remington decided that a new center fire rifle was needed to compete in price with the Winchester M/94. Its only requisite was that it should be a right-hand operated high-power rifle, but not a lever action. Considerable time and thought was given to the different types of actions, such as the straight pull bolt, a spring returned straight pull, and conventional bolt actions. It was decided that the conventional bolt action is most readily adapted to low cost manufacture. The real reasons for the high cost of the present models is that they were not originally designed for low cost manufacture and the parts are not processed in the simplest and lowest cost manner.

In the design of the M/721, and all other guns, the questions which must be continually asked are:

- 1) What simple method of manufacture can be used to make the part?
Can it be (a) screw machined; (b) blanked and formed; (c) simple machine cuts?
- 2) Is the part designed so it can be made with the fewest number of operations?
- 3) Can the part be made with standard tools?
- 4) What is the largest tolerance which can be allowed on each dimension to give satisfactory functioning, endurance, and appearance?

Considering separately each major part necessary for a bolt action rifle, what can be done to reduce the cost of manufacture through design alone?

The Stock contributes so much to the appearance and to the handling qualities and is tied down so thoroughly by convention that very little can be done by design alone to reduce the manufacturing cost. Cost reduction on the Stock must be done mainly by process changes, including new methods and new machines. Some reduction in cost can be made by making sure that the smallest number of simple cuts are used for inletting and by making sure that the new methods and new machines will work on the Stock as designed.

Barrel - The barrel is also mainly a process problem.

Receiver - By studying the high-power bolt action receiver, it was found that approximately twenty (20) machining operations would produce a receiver which would meet the requirements; the M/721 was designed accordingly. When these

twenty operations are compared with more than 100 used on the M/720 and the Springfield, it will be seen that a major cost reduction results.

Bolt - At first glance the bolt looks like a pretty tough problem. The extractor and ejector can be changed, but the main part of the bolt must remain much the same as previous types. It is usually taken for granted that a reduction in the number of parts will reduce the cost. This is not always the case, because several simple parts may be fastened together in some manner to make a quite complicated part. This was done on the M/721 bolt. The original complicated one-piece bolt was broken up to make four comparatively simple parts - the bolt head, bolt body, bolt handle, and ball. These parts can be made with screw machines, plus a few relatively simple milling machine operations, and can be brased or welded together by new methods to make the finished bolt. The ejector and extractor had already been simplified for use in the M/760 pump action. The ejector consists of a spring-loaded plunger, such as is used in the M/81. The extractor is essentially a snap ring which engages the notch in the cartridge rim.

Fire Control - The conventional high-power bolt action fire control usually consists of a sear and trigger and actuating springs. The sear and trigger have in the past been forged and milled to the proper shape, as were practically all small parts. The trigger release, which resulted from the design of these parts, was very poor, usually resulting in a length of pull from 1/8" to 1/4", depending on whether you asked for a single-stage or a double-stage pull. This was necessary from the safety standpoint when this type of release was used. Winchester recognized this fault and corrected it by using a blocked sear type in the M/70. In this type the trigger blocks the sear into contact with the cocking piece. When the trigger is pulled, the block is removed and the force of the main spring cams the sear away, allowing the firing pin to fall. A similar mechanism is used in the M/721.

The parts in the M/721 fire control are all blanked and formed, except pins, screws, and springs. Screw adjustments are provided which eliminate filing and fitting in assembly.

Other Parts - The remaining essential parts - the magazine, cartridge follower, trigger guard, safety, and bolt stop are blanked and formed. The cartridge feeding surfaces are formed on the magazine in place of profiling them in the receiver, as in previous bolt actions.

The relative strength of the M/721 is greater than either the M/720 or the M/70, having approximately 20 percent greater locking area than the M/720 and 40 percent greater area than the M/70.

The estimated commercial cost of the M/721 is \$20.16. At 8% profit to Remington the retail price would be \$40.00. The M/720 commercial cost on the same basis, but not including tool amortisation, would be \$67.00, resulting in a retail price of \$133. to return an 8% profit to Remington.