6.3.5 WRITERS SEMINAR 1981

To: Clark Workman
Ilion Research

From: E. S. McCawley, Jr.
Bridgeport

Excellent!

PRESENTATION BY CLARK WORKMAN
AT WRITERS' SEMINAR
NOVEMBER 18-20, 1981

In past years at these seminars, it has been the responsibility of the Research Department to tell you about the engineering features of the new products that we are about to announce. This year our job is a little different. We have been asked to concentrate on some of the work we do to insure that Remington guns meet the highest performance standards. The video tape you are about to see was made in the Firearms Research Laboratory, and will show you some of the test procedures we use. If you have any questions, I will try to answer them for you after you have seen the tape.

The development of any product goes through eight basic stages. As this schematic diagram shows, a failure at any of these stages could send us back to the Test Lab or back to the drawing board. Starting with the idea, the development of a new product progresses through the design stage, followed by prototypes, laboratory test, field evaluation, release to production, pilot production models, and finally announcement to the trade. This is the point at which we normally give you your first exposure to a new product at one of these meetings.

To take you through all of the stages of this diagram would take more time than any of us would want to spend at one sitting. So today, we are going to concentrate on the laboratory test phase. More specifically, we are going to cover several of the test procedures we use to determine the performance of a product. Today, then, we will concentrate on three items:

our drop test procedures, the common fire control, and the ultimate strength of the Model 700.

For the sake of brevity, let's discuss the drop test procedure using products with the common fire control, combining the first two items. We will save the discussion of the 700 ultimate strength until last.

DROP TEST

One of the most important considerations in designing a firearm is the prevention of accidental discharge. For example, what happens if someone accidentally drops his rifle. In order to be able to test effectively for accidental jar-off conditions, we have developed a pendulum drop test procedure that enables us to consistently repeat a given set of impact conditions. This next sequence shows how the drop test procedure is applied.

Six different drop situations are tested. Muzzle, butt, top, bottom, left side, and right side. This subjects the internal gun mechanism to shock loads from all directions. A copper crusher is placed in an adapter and put into the chamber to check for firing pin indent. The drop height is determined to be equivalent to a vertical drop. The impact surface is a two inch maple plank bolted to a brick wall. After each impact, the action is checked to see if the firing pin marked the primer, and if the hammer was released by the sear.

Remington uses the same basic fire control in the 1100, 870, 552, 572, 7400, 7600, Model Four, and Model Six. We feel that this fire control could serve as a standard against which other similar action types are measured.

The series of drop tests you are seeing has been repeated countless times, all with the same results; no accidental discharge. This pendulum will test drop heights up to seven feet. How high should be go? At Ilion, the Research Design Section is located on the fourth floor. As an extreme test of this fire control's safety margin, we decided to throw it off the roof onto a macadam roadway. An 870 shotgun and a Model Four rifle were taken to the roof. Empty primed cartridge cases were loaded into the chamber. The safety switch was put into the off position. The guns were then thrown off the roof. First the 870, now the Model Four. As you can see, neither gun accidentally discharged.

MODEL 700

In 1971, a book titled "Bolt Action Rifles," written by Frank de Haas and ~~edited by~~ John Amber, was published. On page 249, this is what de Haas had to say:

> "The Model 721 Remington high powered bolt action rifle was introduced in 1948. In describing this new rifle and action in the March, 1948 issue of THE AMERICAN RIFLEMAN, the late Julian S. Hatcher flatly stated that it was by far the strongest and safest bolt action produced up to that time. Indeed it was! In this report, General Hatcher described the torture tests to which the Model 721 was subjected. At the time, the same tests were made on a high numbered 1903 Springfield, 1917 Enfield, and a military 1898 Mauser. The 721 was still going strong long after the Springfield, Mauser, and Enfield gave up, in that order. Time has proven Hatcher

to have been right, for in the more than twenty years following his statement, Remington actions based on the Model 721 design, such as our current Model 700, are still considered by many firearms experts as being the safest, if not the strongest actions made today."

In the Research Department, we are proud of that testimonial and now, 33 years later, we believe that General Hatcher's statement is still accurate. In a few minutes, we will show you why we feel that way.

I'm sure all of you are familiar with Remington's three rings of steel. To refresh your memory, this schematic diagram illustrates them. The breech bolt extends forward beyond the leading edge of the locking lugs. This permits the bolt to rest inside of a counterbore in the face of the barrel. The benefits of a counterbored bolt are not fully realized without this projection. Its importance will be seen later. Around these two rings of steel is a third ring, the receiver. Nested neatly ~~inside~~ the bolt head is the extractor. While all of these features, as you see them here, play an important role in the strength of the rifle, this extractor is the least understood of all elements. Everyone seems to want to apologize for it. We do not. Later, we will show you why.

It is generally understood that the most important objective in preventing a rifle from coming apart is to prevent the high pressure gases from getting back into the ~~action.~~ In the 700, this is accomplished in two important ways:

1. Precision, close tolerance fits between the elements of the system, and
2. Complete unbroken encirclement of the cartridge head by the bolt counterbore.

When a high pressure round is inadvertently fired, the cartridge brass flows into any opening or recess and squirts through like a thick syrup. When the cartridge case fails, the high pressure gases follow through any available opening, destroying the action. The 700 bolt shroud prevents this from happening by acting like the Dallas Cowboys' flex defense -- it bends, but does not break. As pressure is applied inside the shroud by the brass, the shroud reverberates and seals against the counterbore in the barrel before a major portion of the gas can leak by.

Here, you see examples of the various types of breech bolts in use today. Each of them, compared to the Model 700, has one or more basic differences in their breech design from the standpoint of maximum strength:

1. No counterbore.
2. No mating counterbore in the barrel.
3. Slotted shroud for the extractor.

And, speaking of extractors, let's take a look at a typical cross section of modern extractors. These range in shape and size from the current Remington extractor, that appears to be small and weak, to the extractor designed by Paul Mauser back in the 1800's that appears to be big and strong. These two extractors shown side by side look almost like David and Goliath.

However, size alone can be deceptive. What is needed is a way to show the relative extracting capabilities of one versus the other. After a lot of head scratching, one of our engineers suggested a tug-o-war between David and Goliath. The best way to demonstrate the pull strength of the various extractors was to pit one directly against the other. The vehicle chosen for this test was the tensile machine in the Plant Metallurgical Lab. This machine is used routinely to test samples of the steel we use to manufacture our rifles and shotguns. It has a large dial that records, in pounds, the amount of force necessary to pull on a sample until it fails.

A two-headed steel rod was made with an extractor groove in each end. The rod is the same diameter as a 30-06 cartridge head. Adapters were screwed into the bolt plug recess in each bolt so that the bolts could be clamped into the tensile machine. The two-headed rod was then inserted into the face of each breech bolt and the whole assembly was put into the tensile machine. This procedure gives a direct relationship between the pulling power of each type of extractor. As you can see, the Remington extractor won this battle as it does every time.

Now that we have shown you that the performance of the Remington extractor is what counts, not its size and have refreshed your memory on three rings of steel, we are going to demonstrate how effective the 700 action is in protecting the unsuspecting shooter from high pressure failure. To do this, a series of high pressure tests were conducted. A super proof load of 52.4 grains of 4198 powder in a 30-06 cartridge, behind a 220 grain bullet was loaded and tested. A few rifles failed the test. To build

even more pressure, additional bullets were lodged in the bore ahead of the super proof load. A super proof load plus one additional bullet eliminates every action except the 700. We added another, and another, and still another, and the 700 is still intact, but you will never get it open. At this point we gave up. The following high speed motion pictures, taken at 16,000 frames per second, show you what happens when a super proof load plus four additional slugs are fired in a competitive bolt action rifle. The rifle shown is of foreign manufacture but every bolt action model we tested, except the Remington Model 700, came apart under these conditions.

Before we end this tape, I want to make it perfectly clear that we are not trying to say these other rifle actions are unsafe under normal conditions. Used intelligently and without the presence of a highly abnormal situation, they are more than strong enough for their intended purpose. What we're talking about is a degree of safety margin under abnormal conditions. Here, there's no question about which action provides the widest margin of ultimate strength -- the Model 700 Remington.

11/13/81

W R I T E R ' S S E M I N A R

In past years, it has been the responsibility of the Research Department to tell you about the engineering features of the new products we are about to announce. This year our job is a little different. We have concentrated on safety. The video tape you are about to see was made in the Firearms Research Laboratory and will show you some of the test procedures we use. If you have any questions, I will try to answer them for you after you have seen the tape.

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For the sake of brevity, we will delete discuss the drop test procedure using products with the common FireControl, combining the the first two items. We will save the discussion of the 700 ultimate strength until last.

DROP TEST

One of the most important ~~safety~~ considerations in designing a firearm is prevention of accidental discharge. ~~What~~ For example, what happens if someone accidentally drops his rifle, ~~for example~~. In order to be able to test effectively for accidental jar off conditions we have developed a pendulum drop test procedure that enables us to consistently repeat a given set of impact conditions. This next sequence shows how the drop test procedure is applied.

Six different drop ~~orientations~~ situations are tested. Muzzle, butt, top, bottom, left side and right side. This subjects the internal gun mechanism to shock loads from all directions. A copper crusher is placed in an adapter and put into the chamber to check for firing pin indent. The drop, that height is determined to be equivalent of a vertical drop. The impact surface is a two inch maple plank bolted to a brick wall. After each impact, the action is checked to see if the firing pin marked the primer and if the hammer was released by the sear.

Remington uses the same basic fire control in the 1100, 870, 552, 572, 7400, 7600 Model Four and Model Six. We feel that this fire control could serve as a standard against which other similar action types are measured.

The series of drop tests you are seeing has been repeated countless times, all with the same results; no accidental discharge. This pendulum will test drop heights up to 7 feet. How high should ~~we~~ they go? At Ilion the Research Design Section is located on the fourth floor. As an extreme test of this fire control's safety margin we decided to throw it off the roof onto a macadam roadway. An 870 shotgun and a Model Four rifle were taken to the roof. Empty primed cartridge cases were loaded into the chamber. The safety switch was put into the off position. The guns were then thrown off the roof. First the 870. Now the Model Four. As you can see, neither gun accidentally discharged.

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> "The Model 721 Remington high powered bolt action rifle was introduced in 1948. In describing this new rifle and action in the March, 1948 issue of THE AMERICAN RIFLEMAN, the late Julian S. Hatcher flatly stated that it was by far the strongest and safest bolt action produced up to that time. Indeed it was! In this report General Hatcher describes the torture tests to which the Model 721 was subjected. At the time the same tests were made on a high numbered 1903 Springfield, 1917 Enfield and a military 1898 Mauser. The 721 was still going strong long after the Springfield, Mauser and Enfield gave up, in that order. Time has proven Hatcher to have been right for in the more than 20 years following his statement Remington actions based on the Model 721 design are still considered by many firearms experts as being the safest, if not the strongest, actions made today."

In the Research Department we are proud of that testimonial and now, 33 years later, we believe that General Hatcher's statement is still accurate. In a few minutes we will show you why we feel that way.

All of you are familiar with Remington's three rings of steel. To refresh your memory, this schematic diagram shows you what it means. The breech bolt extends forward beyond the leading edge of the locking lugs. This permits the bolt to rest inside of a counterbore in the face of the barrel. The benefits of a counterbored bolt are not fully realized without this projection. Its importance will be seen later. Around these two rings of steel is a third ring, the receiver. Nested neatly inside the bolt head is the extractor. While all of these features, as you see them here, play an important role in the strength of the rifle, this extractor is the least understood of all the elements. Everyone seems to want to apologize for it. We do not. Later we will show you why.

It is generally understood that the most important objective in preventing a rifle from coming apart is to prevent the high pressure gases from getting back into the action. In the 700 this is accomplished in two important ways --

1. Precision, close tolerance fits between the elements of the system,

and

2. Complete unbroken encirclement of the cartridge head by the bolt counterbore.

When a high pressure round is inadvertently fired, the cartridge brass flows into any opening or recess and squirts through like a thick syrup. When the cartridge case fails, the high pressure gases follow through any available opening, destroying the action. The 700 bolt shroud prevents this from happening by acting like the Dallas Cowboy's flex defense -- it bends but does not break. As pressure is applied inside the shroud by the brass, the shroud ~~obturates~~ constricts and seals against the counterbore in the barrel before a major portion of the gas can leak by.

Here you see examples of various types of breech bolts in use today. Each of them, compared to the Model 700, has one or more basic differences in their breech design from the standpoint of maximum strength:

1. No counterbore
2. No mating counterbore in the barrel
3. Slotted shroud for the extractor

And, speaking of extractors, let's take a look at a typical cross section of modern extractors. These range in shape and size from the current Remington Extractor, that appears to be small and weak, to the Extractor designed by Paul Mauser back in the 1800s that appears to be big and strong. These two extractors shown side by side look almost like David and Goliath. However, size alone can be deceptive

What is needed, is a way to show the relative extracting capabilities of one versus the other. After a lot of headscratching one of our engineers suggested a tug-o-war between David and Goliath. The best way to demonstrate the pull strength of the various extractors was to pit one directly against the other. The vehicle chosen for this test was the tensile machine in the Plant Metallurgical Lab. This machine is used routinely to test samples of the steel we use to manufacture our rifles and shotguns. It has a large dial that records, in pounds, the amount of force necessary to pull on a sample until it fails.

A two headed steel rod was made with an extractor groove in each end. The rod is the same diameter as a 30'06 cartridge head. Adapters were screwed into the bolt plug recess in each bolt so that the bolts could be clamped into the tensile machine. The two headed rod was then inserted into the face of each breech bolt and the whole assembly was put into the tensile machine. This procedure gives a direct relationship between the pulling power of each type of extractor.. As you can see the Remington extractor won this battle as it does everytime.

Now that we have shown you the Remington extractor ~~isn't really such a weak sister~~ not its equal and have refreshed your memory on 3 rings of steel, we ~~must still demonstrate~~ are going to demonstrate how effective the 700 action is in protecting the unsuspecting shooter from high pressure failure. To do this a series of high pressure tests were conducted. A super proof load of 52.4 grains of 4198 powder in a 30'06 cartridge behind a 220 grain bullet was loaded and tested. A few rifles failed the test. To build even more pressure, additional bullets were lodged in the bore ahead of the super proof load. A super proof load plus one additional bullet eliminates every action except the 700. We added another, and another, and still another, and the 700 is still intact, but you will never get it open. At this point we gave up. The following high speed motion pictures, taken at 16,000 frames per second, show you what happens when a super proof load plus 4 additional slugs are fired in samples of other bolt action rifles in use today. The rifle shown is of foreign manufacture but every bolt action model we tested except the Remington 700 came apart under these conditions.

Before we end this tape, I want to make perfectly clear ~~to all viewers~~ that we are ~~in no way~~ not trying to say that these * ~~competitive products are not safe. Used intelligently and with common sense they are adequately safe for their intended purpose. But, when you get right down to cases, there is no question about which action provides the widest margin of ultimate strength -- The Model 700 Remington.~~

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CBWorkman:T
11-12-81

Herb

CBC Single

870 SC

700 BDL 6MM

1100 Skeet

Refurbished 870

This scale model is here today for you to examine after the meeting.

This is A 5 to 1 Functional SCALE MODEL of ONE VERSION of The COMMON FIRE CONTROL being Used in The drop TEST. We use The SAME BASIC FIRE CONTROL in The 870, 1100, 552, 572, 7400, 7600, model 4, [redacted] AND ModeL 6. We Feel That This FIRE CONTROL COULD SERVE AS A STANDARD AGAINST Which OTHER SIMILAR ACTION TYPES ARE MEASURED.

TELEX

TO: J. P. GLAS
AO Building
Bridgeport

November 12, 1981

The attached write-up with minor changes will be used on the video tape I plan to show at the Writer's Seminar. We will be able to show the sequence of blown up rifles in such a way as to prevent the viewer from positively identifying the brand and model number. Any change you would like to make would be appreciated as soon as possible since I will not be able to edit the tape after Saturday, November 14th.

Clark B. Workman

CBW:T
Attach.

Start

At we have
The Remington Arms ~~Company now~~ a proud history of safety performance. At the Firearms Manufacturing Plant in Ilion, New York, we hold world records for safety performance that are recognized by the National Safety Council. Our management has made it very clear, that we will not expose our employees to any unsafe working conditions.

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This Safety Attitude not only extends to our employees, it is also of primary importance when we develop products for our customers to use.

There are over fifty formalized tests a product must pass before we consider it ready for manufacturing. Over half of those tests are directly related to safety. Today we will show you a few of them.

DROP TEST

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1. ~~Precise~~ Close, close tolerance fits between the elements of the system,
   and
2. Complete unbroken encirclement of the cartridge head by the bolt counterbore.

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demonstration it

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CBWorkman:T
11-12-81

TEST	SAFETY	FUNCTION	ENDURANCE	PERFORMANCE
1. Proof	X			
2. Chamber Cast	X			
3. Head Space	X			
4. Accuracy - Life				X
5. Stability of Center of Impact				X
6. Trigger Pull		X		X
7. Interchangeability Test - Cost	X	X		
7a. Interchangeability Test - Performance	X	X		
8. Firing Pin Protrusion & Indent	X	X		X
9. Safety Mechanism Shock Test	X			
10. Bolt Opening Test - Progressive				X
10A. Bolt Opening Test - Initial				X
11. Take Down Inspection	X	X	X	
12. Standard Live Fire Test - Manual		X		X
12A Standard Live Fire Test - Auto		X		X
13. Standard Dry Fire with Dummy Ammo		X	X	
14. Standard Dry Fire without Dummy Ammo		X	X	
15. Wet & Dust Test	X	X		
16. No Lubrication Test	X	X		
17. Cold Test - -20 -		X		X
17A. Cold Test - Ice -		X		X
18. Field Test - (Simulated)		X		X
19. Oiled Case Test	X			
20. Defective Ammunition Test	X			
21. Competetive Ammunition Test		X		X
22. Safety Mechanism Function Test	X			
23. Bolt Lug Shear Test	X			
24. Outdoor Live Firing Test - Different Positions		X		
25. Safety Sear Mechanism Test	X			

Test	Safety	Function	Endurance	Appearance
26. Take Down Screw Shock Test (Special)				
27. Jar off Test	X			
28. Follow Down Test	X	X		
29. Bolt stop Release Test		X		
30. Emergency Position Live Fire Test		X		
31. Safety Operation Test	X	X		
32. Follow up Test (Safe unload)	X	X		
33. Gun Furniture Test				X
34. Heavy Fore End Test			X	
	19	21	4	13
Special Tests				
1. Bolt Velocity		X	X	
2. Endurance			X	
3. Vibration	X			
4. Ultimate Strength	X			
5. Predictable Mis use	X			
6. Dangerous Combinations	X			
	4	1	2	0
Total	23	22	6	13

Super Proof w/ Weakened Case 3-23-73 20 rounds 788 & 700

(Smith & Larson Super Proof + 1 bullet – Failed
M/70, Mark V, Savage 110, & Smith & Larson. – Failed)

Win M/70 Super Proof + 1 sling – catastrophic failure
BSA – 1 Super Proof + 1 sling – catastrophic failure
788 – 1 Super Proof + 1 sling – cat fail.
Weatherby mk V 1 Super + 4 slugs – cat failure

M700

The Model 700 is the strongest Bolt action Rifle currently manufactured. That is a pretty big statement to make.

Japanese Arisaka
~~1903 Springfield~~
M70 Winchester
M98 Mauser
1917 Enfield
Shultz an Larson
Weatherby Mark V
Savage 110
BSA
788
Ruger 77
Browning BBR
S&W 1500
M70 XTR

Bolt Action Rifles Page 249 - 250