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Ilion, New York
May 7, 1975

TO: W. E. LEEK

FROM: J. P. LINDE

SUBJECT: EVALUATION OF THE BOLT ACTION RIFLE SAFETY MECHANISMS
M/580s, 788, 600 and 700

This investigation was instituted when a Model 600 was returned from Texas by a customer who in the process of unloading his gun moved the safety lever from the on safe to off safe position (so the bolt could be actuated) and the gun discharged. Upon further investigation of the incident it was determined that he had pulled the trigger with the safe in the on position. It was also determined that some Model 600s could be tricked by putting the safety lever in an intermediate position half way between on safe and off safe, pulling the trigger, releasing the trigger, push the lever to the off safe position and the gun will fire.

Model 600

The M/600 safety is a blocked sear design. The safety lever rotates a cam under the sear, lifting the sear off its contact with the trigger-connector. The trigger then can be pulled with no effect to the sear or firing pin assembly. In the guns in question it was found that they had inadequate sear lift on both the on safe and intermediate positions. The sear lift is the amount of clearance generated between the trigger-connector and the sear. The lifting action of the cam on the safety lever takes place when the safety lever is rotated to the on safe position. On the guns in question there was very little clearance between the sear and trigger-connector. Thus when the trigger was pulled in a certain way when the gun was on safe, the connector would not return with the trigger. In this case the safety cam is preventing the gun from firing, thus when the safety is moved to the fire position the gun will discharge.

The initial production remedy was to swage the cam on the safety lever to provide greater lift on the sear. The greater lift provides a bigger clearance between the trigger connector and sear when the gun is in the on safe condition. The trigger can be pulled without any fear of the connector failing to return due to inadequate lift. The final inspectors, assemblers and customer repair people were reinstructed on what to look for. A test has been added at assembly to check for the sear lift from the safety actuation by use of a shim stock.

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The guns are being checked to give at least .008 inches min. lift between the trigger-connector surface and the sear.

The holes on the fire control housing on some of the samples tested were out of control. Corrective action is being taken.

Proposed Design and Process Changes

Design

1. The safety levers have been redimensioned to give better manufacturing control of critical dimensions.
2. The dimensions on the safety lever cam were changed to give greater lift on the sear and maintain the lift longer when the safety is moved from "on safe" to "off safe".
3. The fire control housing will be changed to be common with the Model 700. It has two separate side plates which are riveted together, while the 600 has a folded assembly. The M/700 housing has a heat treated side plate with the detent hole, which gives more positive safety. The folded assembly is not heat treated and the detent holes wear and become less positive.
4. The sear has to be altered to eliminate a potential interference with the rear housing assembly pin.

Process

1. A production gage has been designed and is being built which will measure the sear lift due to the safety lever operation before the fire controls are assembled to the gun.
2. An inspection hole has been added to the new design safety lever so the cam form and its position on the safety lever can be readily inspected in purchase parts inspection.

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Test Program - M/600

The current M/600 being manufactured with the swaged safety levers are being tested. They are shot with live ammunition at the start of the test to check their function. The amount of sear lift from the safety operation is measured before the start of the test as well as the force to put safe on and off. The guns are being dry cycled safe on-safe off and cock and dry fire to 50,000 cycles each. The sear lift is being measured every 5,000 cycles to determine how wear affects the sear lift over the life of the gun. The wear on the detent system, trigger connector and sear surfaces also will be checked. The test is being duplicated in a dry and oiled (WD40) condition on the trigger mechanism.

The testing will be duplicated for the redesigned fire control. From this and the original testing it is being determined the minimum safe sear lift for new guns. This report will be followed by the test report.

Status of Design Change

The design has been determined and all drawings have been completed. Design test confirmation is under way. The new drawings have been submitted to P.E. & C. for estimating purposes and the appropriate vendors contacted. As soon as the design test is satisfactorily completed the drawings will be transmitted.

Proposed Future Plans - M/600 & 700

A design investigation will be started to determine the feasibility of changing the safety design from a blocked sear system to a blocked firing pin system. The benefits of a three position safety also are being investigated.

The spring force on the detent system on the M/600 & 700 varies due to the leaf spring design, which can vary the safety operating force. The design will be reviewed to see if the system can be altered to give a more constant operating force.

Model 788 and 580 Series

The problem came to light in February when the design was changed from a blocked trigger system to a blocked sear system similar to the 600 and 700 design. This design change was instituted to standardize parts in these guns with the 540 Series, to eliminate a high scrap operation, and to obtain a more positive safety.

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Corrective Action Being Taken Continued

5. The assemblers will use a feeler gage to measure sear lift to make sure a minimum lift is maintained.
6. The safety lever hold down screw has been deleted. The pin with the retaining ring presently used in the pivot pin will be used instead of the screw. The alteration was made after it was determined under some conditions the screw could back out and bind the safety operation.
7. The cut in the bottom of the M/788 receiver for safety lever clearance has been altered in the proposed design to eliminate any potential interference with the safety lever which could block the safety operation.
8. An inspection hole will be added to the M/788 fire control housing so the sear lift can be visually checked.

Test Program - M/580 Series and 788

Production guns with ground triggers are being tested to make sure there will be no field problems with the powder metal surfaces wearing down with usage. These guns are being tested in the following way.

1. The 580 Series are being shot to 20,000 rounds and dry cycled safe on - safe off to 400 cycles.
2. Another gun will be dry cycled to 50,000 safe on - safe off cycles and 50,000 cock and fire cycles.

The new design is being tested by swaging out and recutting the safety lever to the new dimension. The gun test will include;

1. One gun will be shot 2,000 times, with 500 safe on - safe off cycles, the sear lift being measured every 500 rounds as well as the safe on - safe off actuation load.
2. One gun will be cycled to 50,000 safe on - safe off cycles, and 50,000 cock and dry fire cycles.

These tests will be repeated with the design changes as they become available.

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Model 788 and 580 Series Continued

When the problem appeared all the parts involved in the safety mechanism were measured to determine why there was insufficient sear lift. The following items were found:

1. The powder metal trigger was out of tolerance. Powder Metal has been contacted.
2. The safety lever dimensioning did not tie the critical dimensions together.
3. The holes in the trigger housing were not to locational dimension.

Corrective Action Taken to Maintain Production

1. The triggers were ground to provide more clearance when the safety was operated.
2. The gaging technique was established to measure the sear lift with the safety operation when the gun is assembled.
3. All the assemblers were reinstructed on what to look for -- proper lift and can the gun be tricked.

Corrective Action Being Taken

1. Correct the parts out of gage and establish controls.
2. Redimension safety levers for both the 580 Series and 788 to tie the critical surfaces together. The vendor has been contacted on what surfaces are critical and how they can best be maintained.
3. The dimensions on the safety lever were altered to give greater lift to insure in all tolerance conditions there is adequate lift with an allowance for wear.
4. Process Engineering is designing a gage to measure the sear lift from the safety lever operation to insure that the fire control will have adequate lift before it is assembled to the gun.

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Future Program

1. The 540 Series fire controls will be altered to reflect the changes made in the M/580 and 788 fire controls.
2. The sear pin will be looked into as one backed out in testing. This is presently a substitute pin and will be changed to a spirol pin as soon as the testing can be completed on the new pin. When the solid pin backed out after about 20,000 cycles it resulted in a fire on safe condition. The pin slipped out of one side of the housing, letting the sear slip down. When the safety was positioned to the on safe position there was inadequate lift, so if the trigger is pulled it will become trapped ahead of the sear. When the safety is moved to the fire position the gun will discharge.

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