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DYNAMIC TESTS OF THE 30-ROUND MAGAZINE FOR THE M16A1 WHILE FIRING FROM THE M231 FIRING PORT WEAPON

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Time displacement records of the magazine spring for the M16A1, while firing from the Firing Port Weapon, were obtained to determine if excessive spring surge was causing a stoppage problem during testing at APG. Results of the tests show there was no excessive magazine spring surge in the 30-round magazine for the M16A1 when firing from the M231 Firing Port Weapon. The results show the stoppage problem was caused by faulty magazines.

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I. INTRODUCTION

During recent testing of the M231 Firing Port Weapon at APG, several instances were recorded where the last round jumped out of the magazine either while the bolt carrier was still moving rearward or had just started moving forward. This causes two potential safety problems. The first problem would be when the last round has jumped out and become partially chambered and the face of the bolt is held by the bolt latch. If the operator is unaware of this and loads a new magazine and attempts to fire, the tip of the first round might strike the primer of the partially chambered round and initiate it with the breech open. The second problem would be when the last round has jumped out and become partially chambered and the front of the bolt carrier is held by the bolt latch. As soon as the bolt latch is released, the bolt carrier comes forward and initiates the round in the chamber before the trigger is pulled.

At a M231 Engineering Meeting held at TECOM to discuss these problems, it was felt that the weapon might be causing excessive magazine spring surges which would allow the last round to jump out. To check this out BRL agreed to take Time Displacement records of the magazine spring while firing to determine if the weapon was causing excessive magazine spring surges. Similar measurements have been previously made on the M16A1 by BRL.

II. MEASUREMENTS

Photographic records were taken of the magazine during firing using a Time Displacement camera. Slots were cut in the side of the magazine and the lower receiver and a continuous record of vertical displacement versus time was recorded for the last few rounds in the magazine, the magazine follower, and several of the spring coils in the magazine. The slot was cut in the magazine between two guide grooves so that normal operation of the magazine was not affected by the slot. The magazine with the slot is shown in Figure 1.

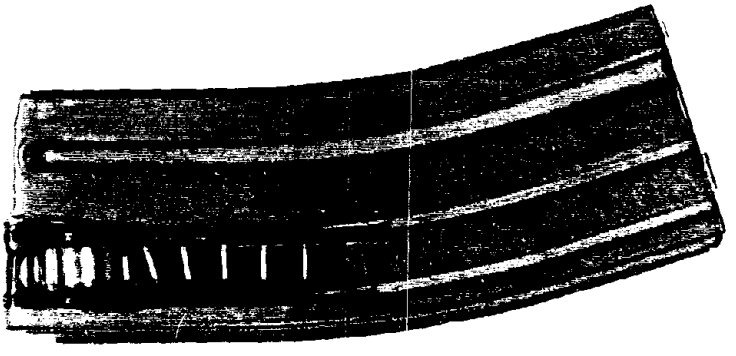

Figure 1. 30-Round Magazine with Slot

Records were taken of two magazines which had exhibited reliable operation during prior testing and also of one magazine which had exhibited poor performance in the latest tests. All magazines were manufactured by Adventure Line Mfg. Co. Inc. Records were taken using both versions of the M231 that were used in the latest tests. The weapons were fired from the same type of rigid ball mount used in the latest tests.

III. RESULTS

The results of the tests show that there is no excessive magazine spring surge taking place in any magazine or weapon to cause the last round to jump out of the magazine. Figure 2 is a record taken of a bad magazine which had the last round jump out and Figure 3 is a record of a good magazine which did not have the last round jump out.

Both Figure 2 and Figure 3 definitely show that excessive magazine spring surges are not present and, therefore, cannot be causing the last round to jump out of the bad magazine. The magazine spring motions recorded were similar to those of the M16A1 Rifle.

Since the records show the weapons were not causing the malfunctions, the next step was to perform a visual inspection of the good and bad magazines to try to find a reason for the last round jumping out of the bad magazine. As a result of this inspection, it was found that a combination of too great a distance between the magazine lips and a tilted follower were causing the malfunctions. The maximum tolerance between lips allows a 12.1 mm distance, but the bad magazine had a distance between lips of 12.4 mm.

Also, as Figure 4 shows, the magazine follower of the bad magazine is tilted at a steep angle with respect to the side of the magazine. Therefore, instead of the follower holding the last round tight against the side of the magazine, as in the good magazine, the round is forced away from the side of the magazine by the tilted follower, as shown in Figure 5. The result of this is that as soon as the bolt carrier moves over or attempts to strip this last round, the round literally jumps out of the magazine. In fact, it is statically impossible to push the last round out of the bad magazine without having it jump out.

Upon further investigation, it was found that the tilted follower was caused by a tilt of the coils of the magazine spring as shown in Figure 6. Due to some change in the manufacturing process, the magazine spring of the bad magazine was wound with coils that all tilted downward.

Tests were also performed to show that it was a combination of too great a distance between the magazine lips, and a tilted follower causing the malfunction in the bad magazine. A spring and follower from a good magazine were placed in a bad magazine housing with too great a distance between lips, and a spring and follower from a bad magazine were placed in a good magazine housing. In each case the magazine functioned reliably.

Another difference found between the good and bad magazines during inspection concerned the guides or grooves in the front part of the magazines. The tops of these grooves form inserts on each side of the magazine to lift the front end of the round and force the front end slightly toward the center as the round is stripped from the magazine. This prevents

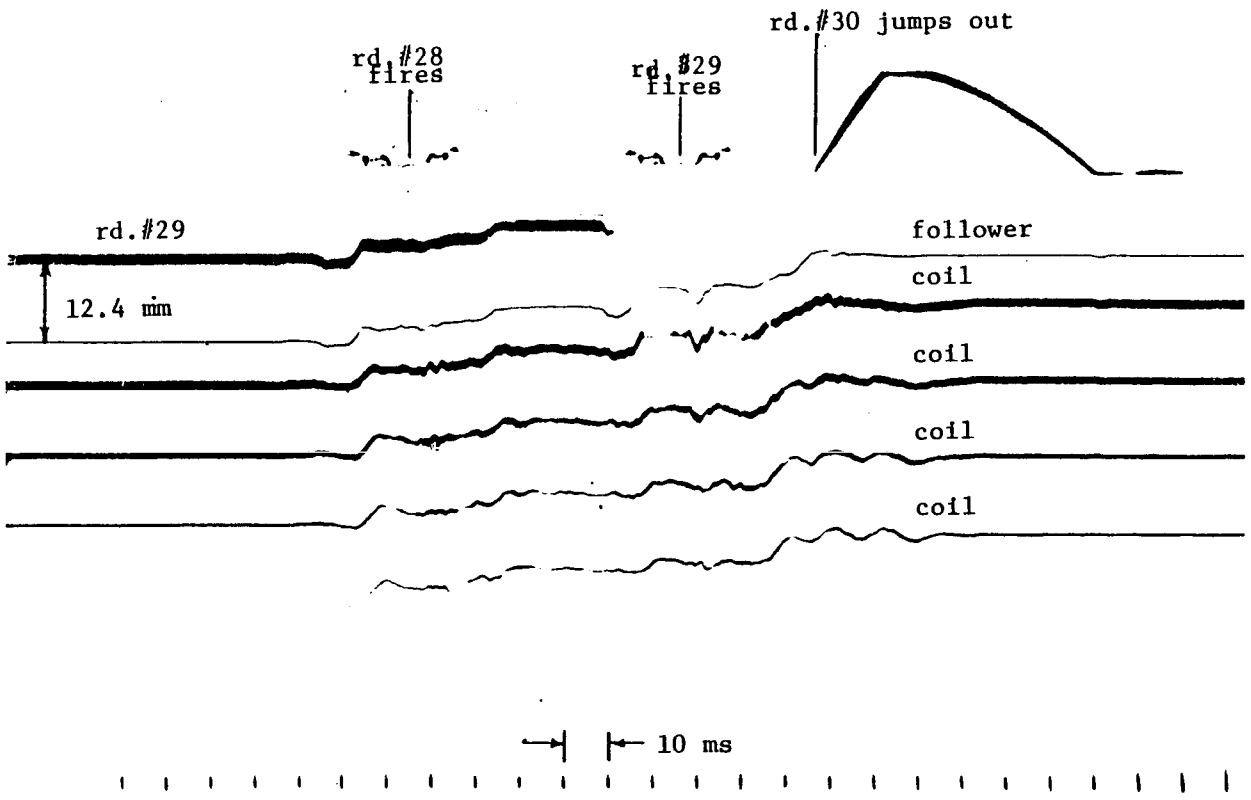

Figure 2. Vertical Displacement versus Time using Bad Magazine

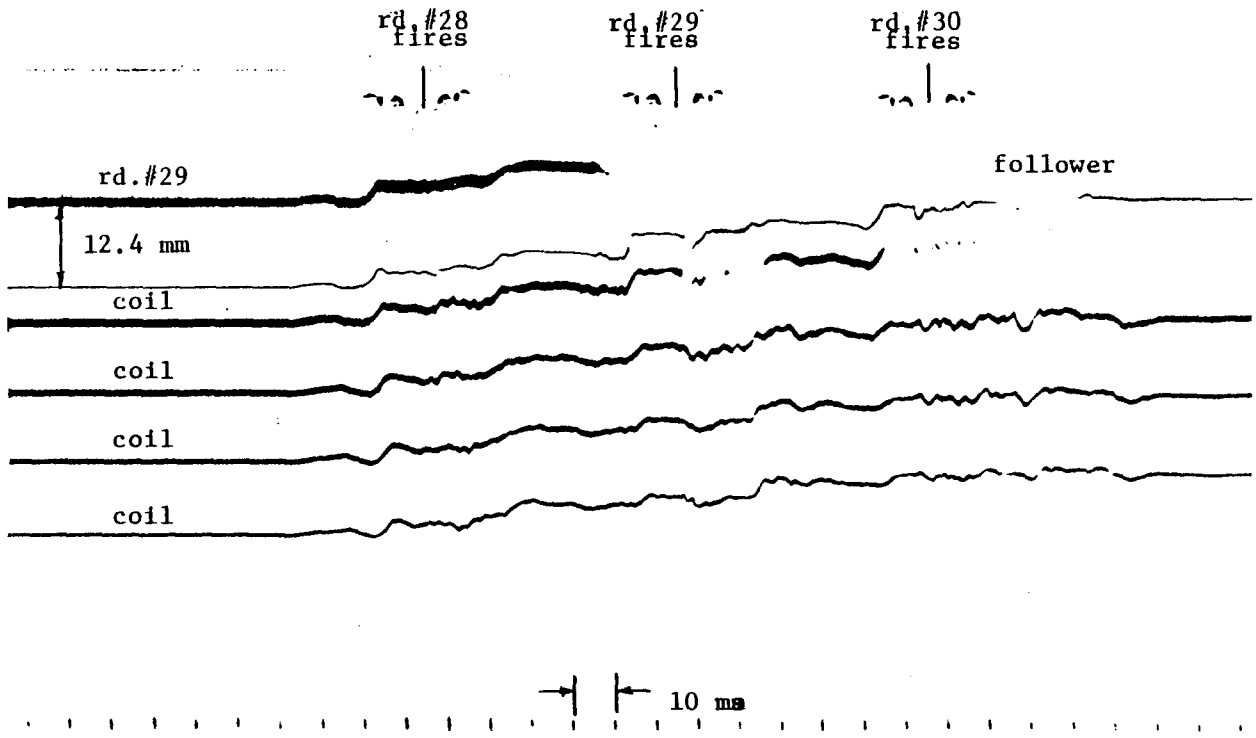

Figure 3. Vertical Displacement versus Time using Good Magazine

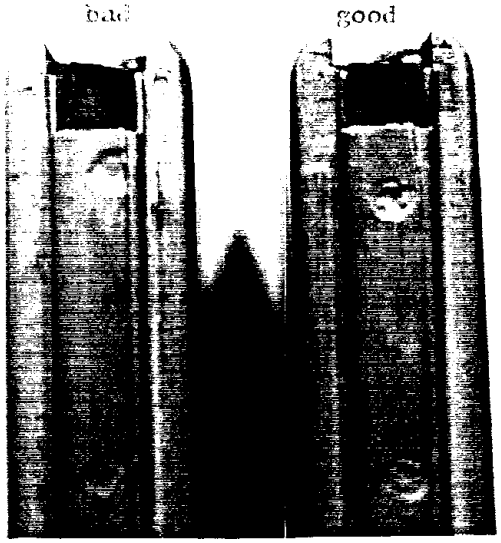

Figure 4. Tilted Magazine Follower

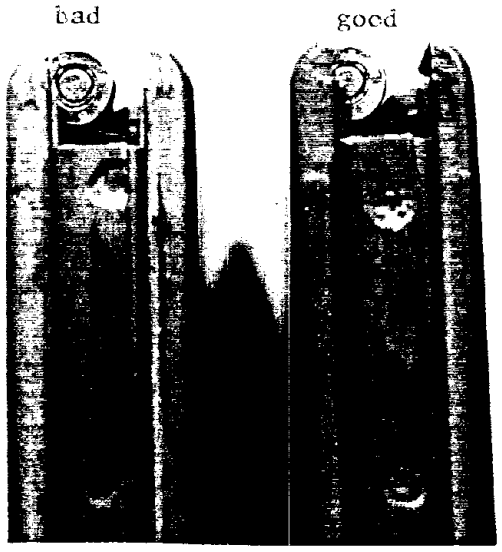

Figure 5. Effect of Tilted Follower on Last Round

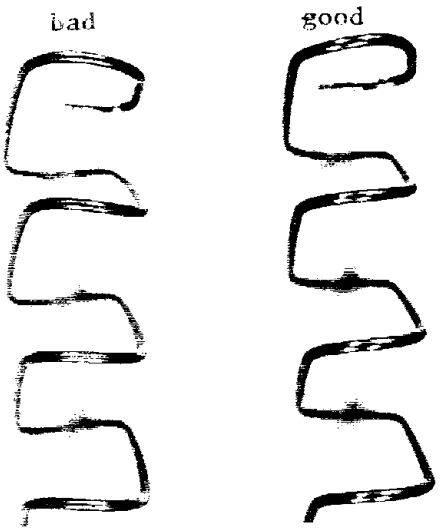

Figure 6. Tilted Magazine Spring Coils

the front end of the round from dragging over the forward edge of the magazine. The top of the grooves on the bad magazine was found to be too low to contact the round during stripping and was, therefore, no assistance in lifting or centering the round to prevent dragging of the round over the front edge of the magazine.

Also, with the top of the grooves too low, the front of the 29th round in the magazine is held up by the groove and the back of the round is tipped down. It is felt that this probably caused the bolt-override malfunction on the 29th round, which also occurred several times during the tests. In fact, there were no other bolt-override malfunctions other than on the 29th round.

Once the inspection had been completed on these samples of good and bad magazines, all of the magazines used in the recent tests at APG were obtained and visually inspected. Out of the 75 total magazines used in the tests, three had a combination of lips too wide and tilted followers, and all 75 had the grooves too low to contact the rounds during stripping. The three magazines with the combination of wide lips and tilted followers were the ones that were continually showing up in the tests with the last round jumping out.

IV. CONCLUSIONS

Based on the results the following conclusions were made:

1. There is no excessive magazine spring surge in the 30-round magazine when firing the M231 from a rigid ball mount.

2. The malfunction of the last round jumping out of the magazine during recent testing at APG was caused by three faulty magazines having a combination of lips too wide and tilted followers, and not by the weapons.

3. All of the 75 magazines used during recent testing at APG were also faulty in that grooves at the front of the magazine were not high enough to assist in lifting and centering the front of the round, and also probably caused the bolt-override malfunction on the 29th round.

V. RECOMMENDATIONS

Recommend that in the future, before any weapon testing takes place, the magazines used in the testing be completely checked out.