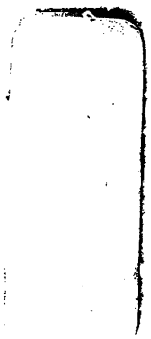
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WAR DEPARTMENT

TECHNICAL MANUAL

INSTRUCTION GUIDE

SMALL ARMS ACCIDENTS, MALFUNCTIONS, AND THEIR CAUSES

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TECHNICAL MANUAL
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WAR DEPARTMENT,
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INSTRUCTION GUIDE

SMALL ARMS ACCIDENTS, MALFUNCTIONS, AND THEIR CAUSES

U.S. Army

Prepared under the direction of the
Chief of Ordnance

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Section I

INTRODUCTION

1. PURPOSE AND SCOPE.

This manual is published as an instruction guide for the information of both using arms and ordnance maintenance personnel. It contains detailed information on accidents and malfunctions occurring in four commonly used small arms:

a. Browning machine gun, cal. .30.

b. U. S. rifle, cal. .30, M1903A1.

c. Automatic pistol, cal. .45, M1911.

d. Colt and Smith & Wesson revolver, cal. .45, M1917.

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Section II

BROWNING MACHINE GUN, CAL. .30

	Paragraph
Excessive headspace	2
Defective ammunition	3
Bore obstructions	4
Fractured firing pin	5

2. EXCESSIVE HEADSPACE.

In determining the cause of a small arms failure or malfunction a visual examination of the fired cartridge cases is most important. A frequent cause of ammunition failure is excessive headspace. Figure 1 exhibits typical effects of excessive headspace on fired cartridge cases.

a. Case No. 1 is that of a standard ball cartridge fired in a gun with standard headspace of 1.942 in. The appearance of this case is normal.

b. Cases Nos. 2, 3, and 4 are those of ball cartridges fired in guns having excessive headspace. The gun in each instance was undamaged. In each instance, note the deformation of the forward portions of the case: the lengthening of the first cone and shortening of the third. Such deforming of the case occurs only when the case lies to the rear of its fully chambered position.

(1) Case No. 2 exhibits the effect of ¼ in. excess headspace with ammunition loaded to standard pressures. Note the shortened third cone or case neck and the annular bulge formed on the first cone of the case immediately to the rear of the chamber.

(2) Case No. 3 is that of a standard ball cartridge fired in a gun having $\frac{3}{16}$ in. excess headspace. Note the separation of the case approximately ½ in. from the head, and the shortened third cone.

(3) Case No. 4 exhibits the effect of firing a high pressure cartridge in a gun having $\frac{3}{16}$ in. excess headspace. Note evidence of excessive headspace in the separation approximately ½ in. from the head of the case and in the shortened third cone. Note evidence of high pressure in the heavy marking of the case by the chamber wall and in the relative sharpness of the newly formed shoulder crest joining the first and second cones.

3. DEFECTIVE AMMUNITION.

a. Cartridge case with split neck. Figure 2 exhibits damage to gun from a round having a case with split neck.

(1) A live round with a split case neck was chambered in the gun. For some reason the bolt was retracted, extracting the case,

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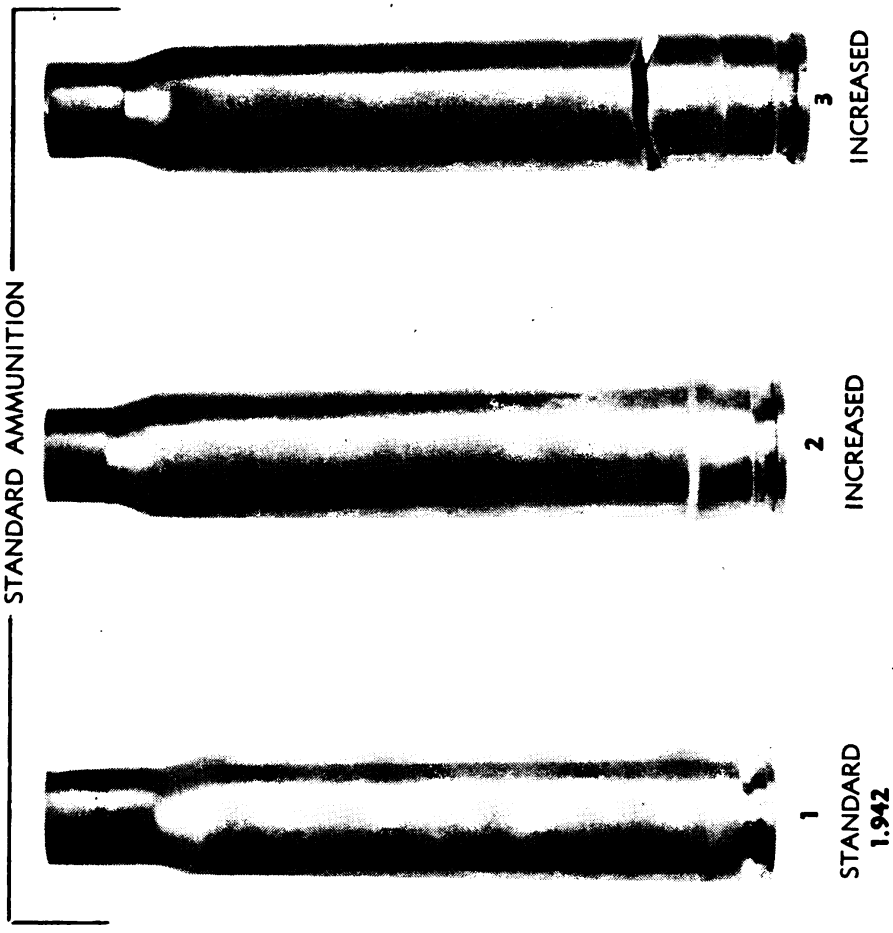


Figure 1—Effects of Excessive Headspace, Cartridge Cases, BMG, Cal. .30

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BROWNING MACHINE GUN, CAL. .30

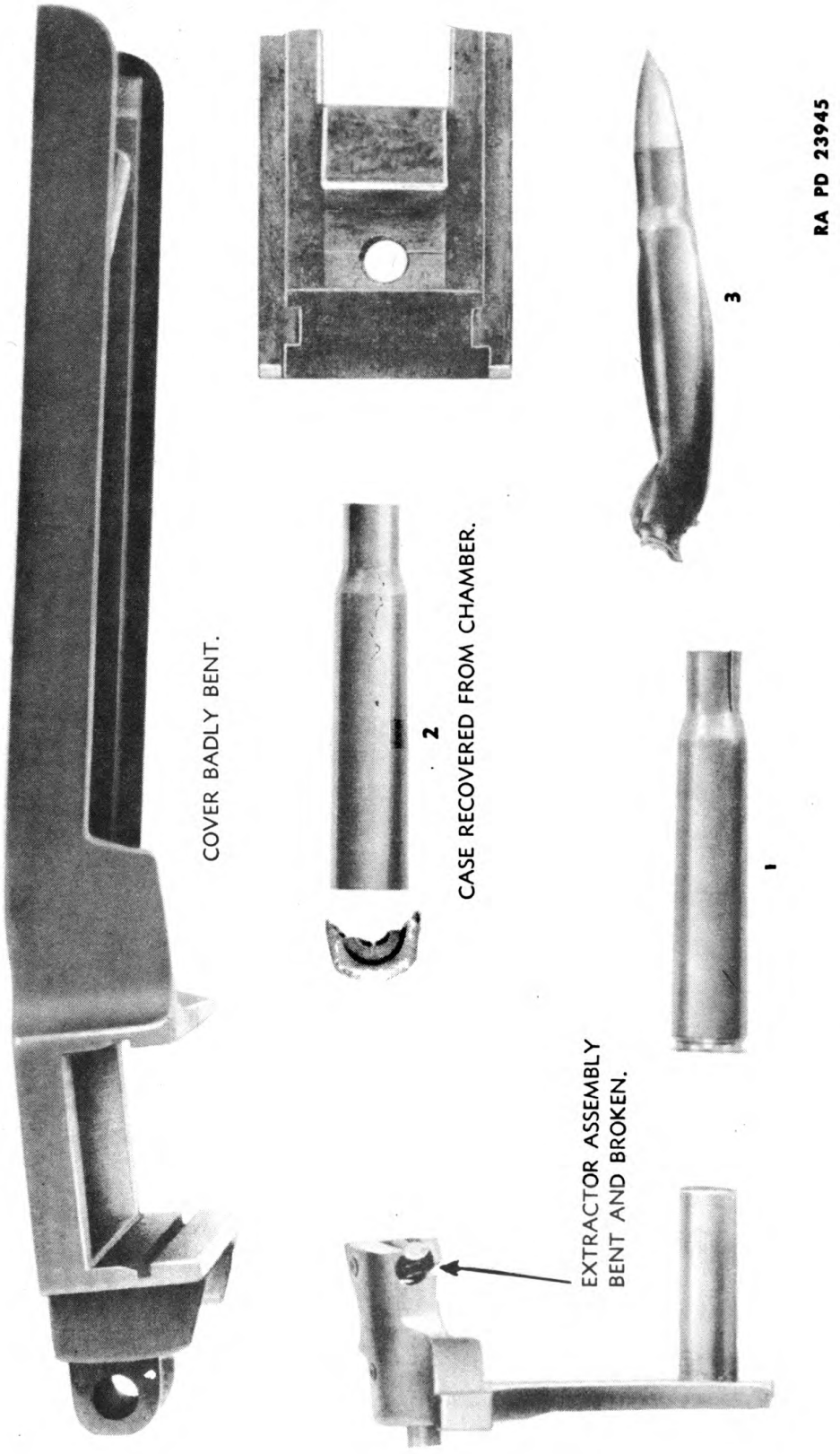


Figure 2 — Damage Caused by Round Having Split Neck, BMG, Cal. .30

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but leaving the bullet in the chamber. The extracted case was ejected and a second live round chambered. When the chambered cartridge was fired the case ruptured. This explosion ignited the cartridge lying directly above in the feedway, rupturing the case and releasing additional gases into the action.

(2) Damage to the gun is shown clearly in the photograph. Note the bent cover and the bent breech lock cam. Observe the impressions on the cartridge case from the walls of the chamber. The extraction of a live case which left the bullet in the barrel is indicated further by the presence of unburned powder grains in the action.

b. Hangfire. Figure 3 exhibits damage to gun resulting from a hangfire.

(1) In an attempt to clear the defective round from the gun, the action was retracted by hand sufficiently to unlock the breech bolt and begin extraction of the round from the chamber. At this point in the operation the delayed ignition of the defective round occurred. The resulting explosion separated the case head from the case body. The escaping gases bent the cover of the gun upward.

(2) Cartridge No. 1 is a normal cal. .30 live round. No. 2 exhibits the deformed case body of the chambered round. Note the shortened third cone. No. 3 exhibits a damaged round which, at the time of the explosion, lay in the feedway.

c. Excessive pressure. Figure 4 exhibits damage to a gun caused by firing a high-pressure cartridge.

(1) A cartridge which develops excessive pressure will rupture the head of its case. Typical damage to the gun is shown in figure 4. Note broken extractor and bent cover.

(2) In all instances of high breech pressure the fired case will be heavily marked by the walls of the chamber.

(3) Accidents of this type should be attributed to a cartridge developing excessive pressure only after careful examination of the gun and fired cases shows no other cause.

4. BORE OBSTRUCTIONS.

a. General. An obstruction in the bore immediately forward of the chambered round may rupture the head of the cartridge case (fig. 5). An obstruction in the long middle portion of the bore may bulge the barrel at the point of the obstruction. If the resistance is sufficiently great the bulge may become a rupture. An obstruction near the muzzle may bulge or split the barrel at the point of the obstruction.

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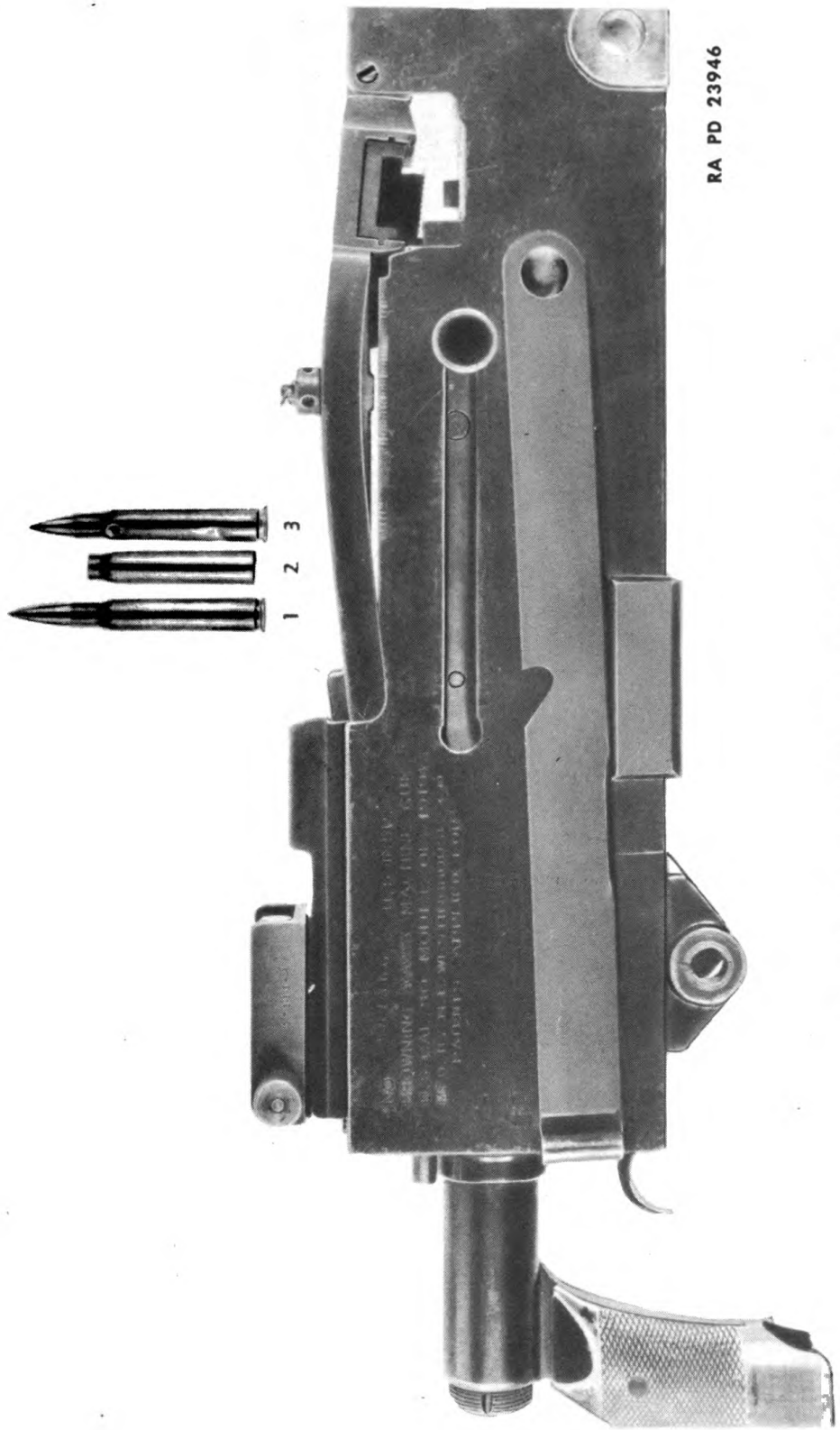


Figure 3 — Damage from a Hangfire, BMG, Cal. .30

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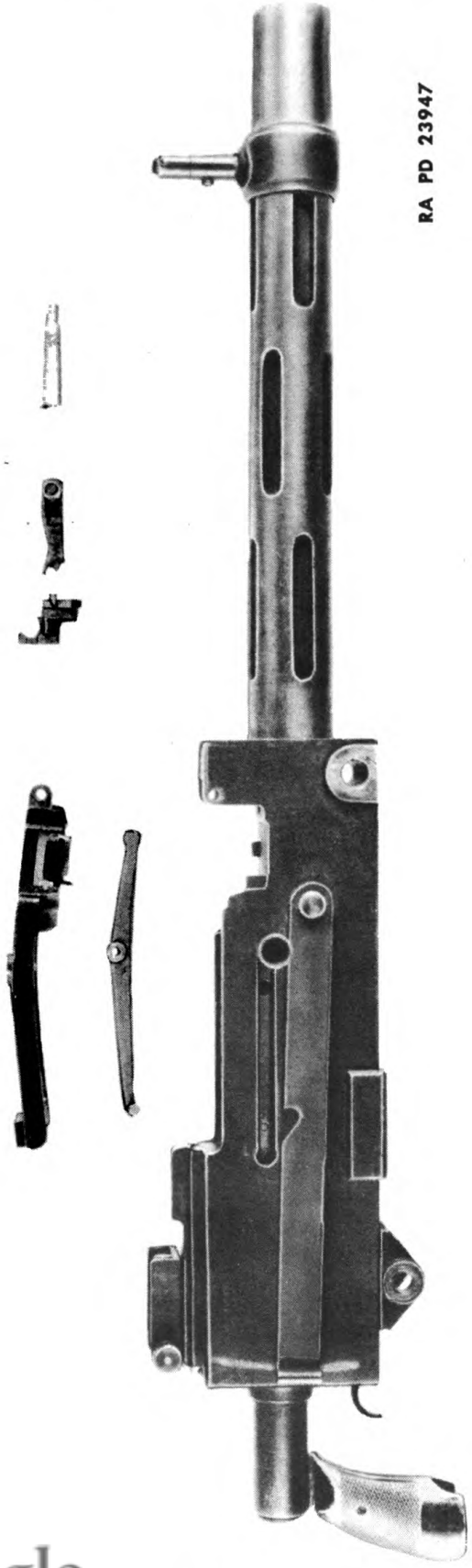


Figure 4—Damage from Firing Cartridge with Excessive Breech Pressure, BMG, Cal. .30

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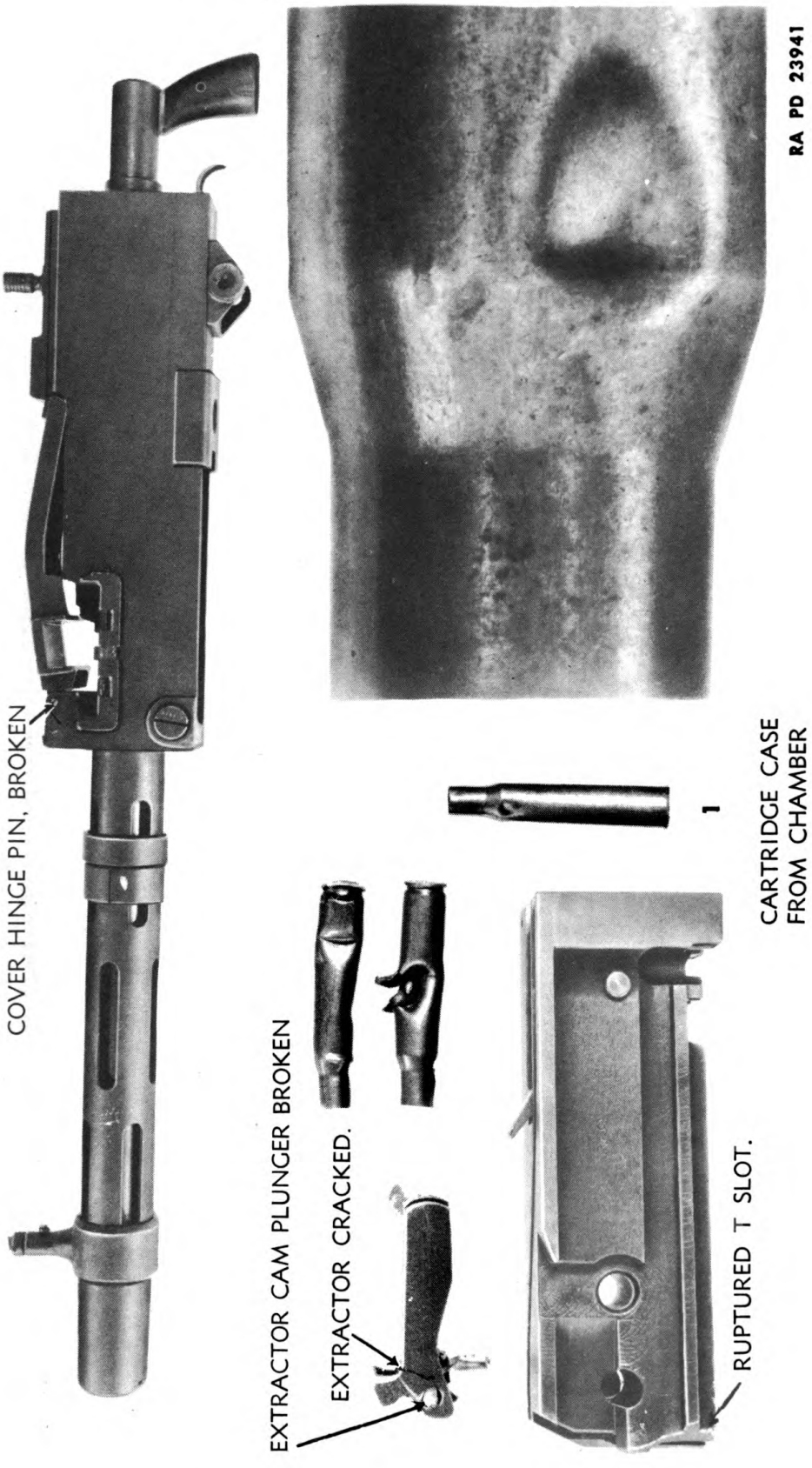


Figure 5 — Damage from Firing with Obstruction in Bore, BMG, Cal. .30

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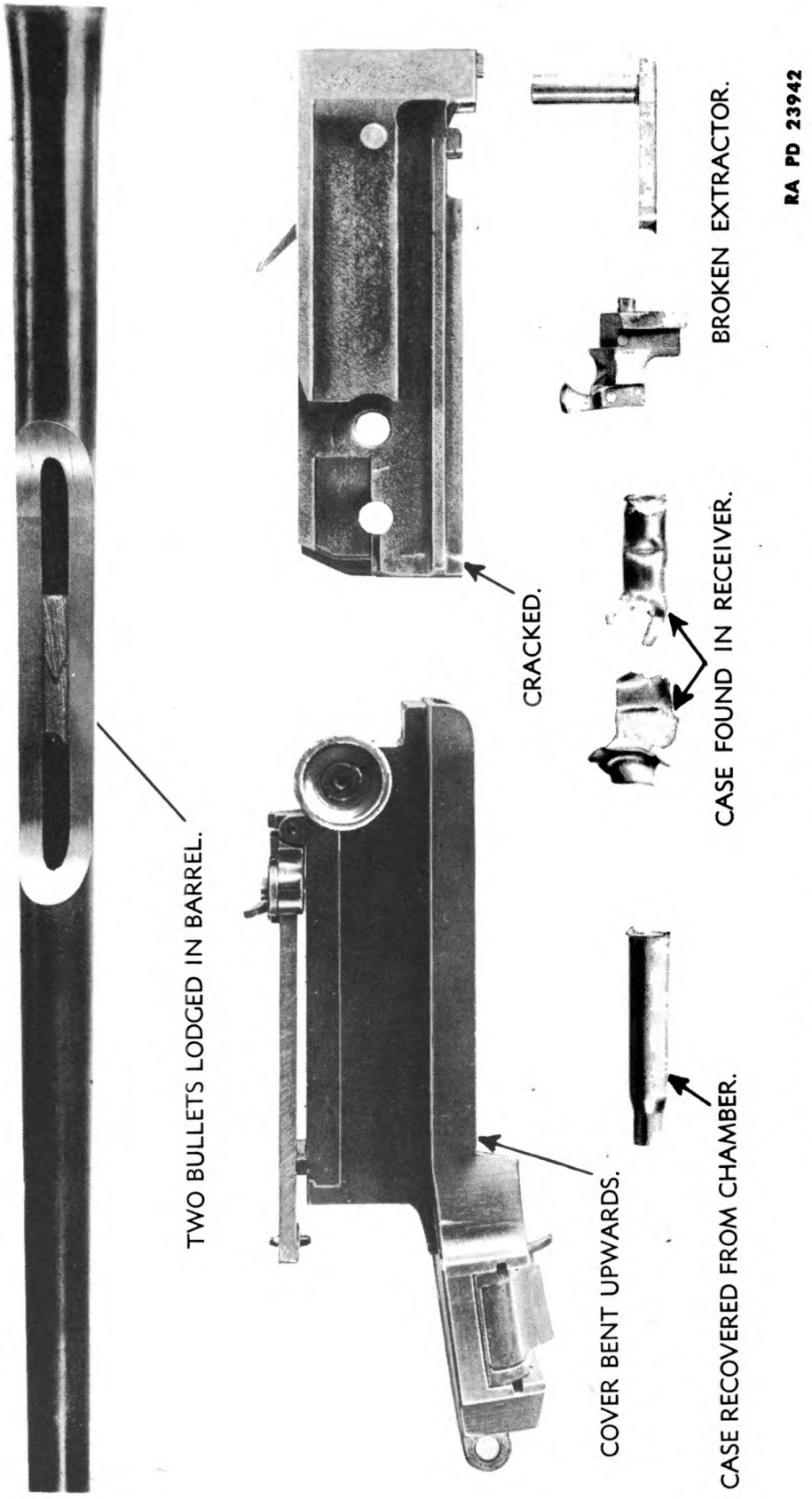
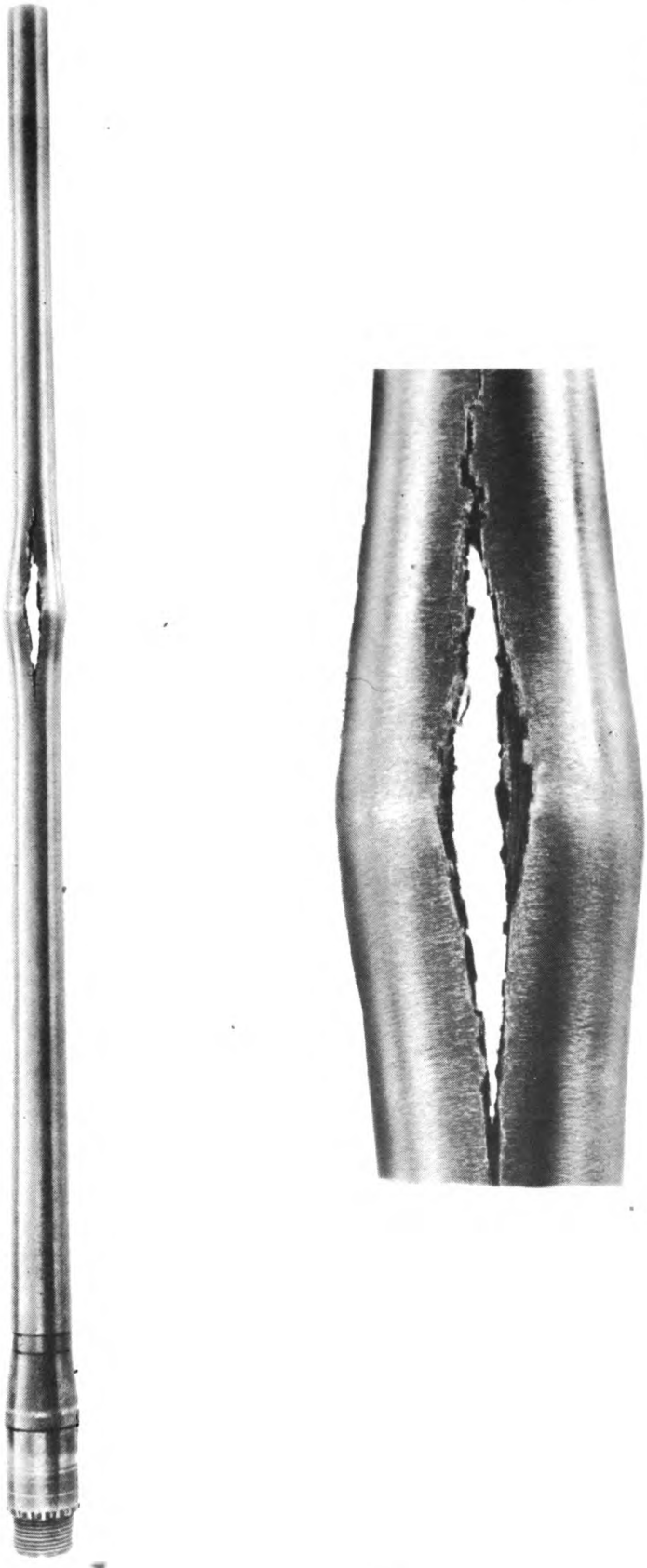


Figure 6 — Damage from Firing with Bullet in Bore, BMG, Cal. .30

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Figure 7—Damage from Firing with Hard Object Lodged in Bore, Barrel, BMG, Cal. .30

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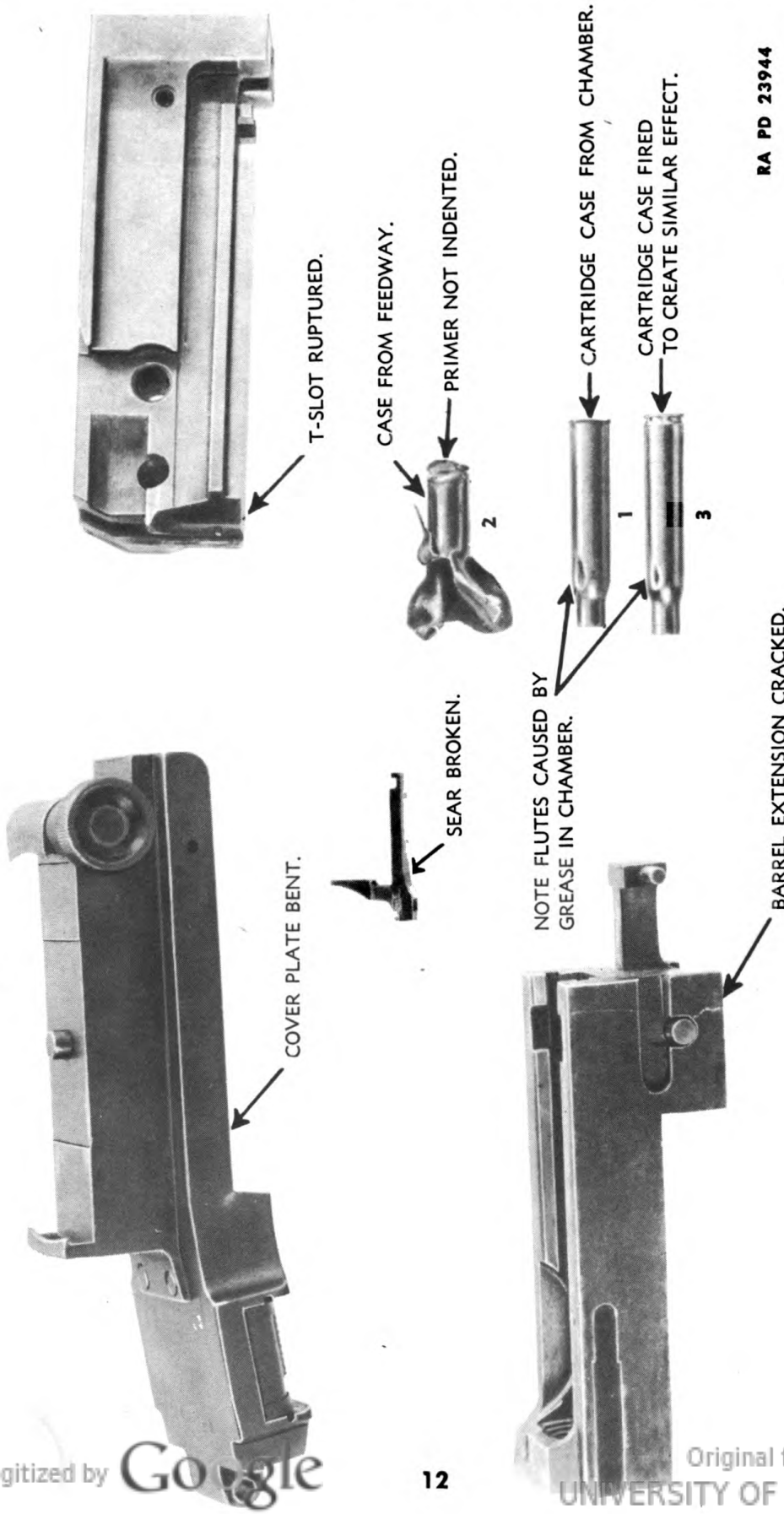


Figure 8 — Damage from Firing with Grease in Chamber and Bore, BMG, Cal. .30

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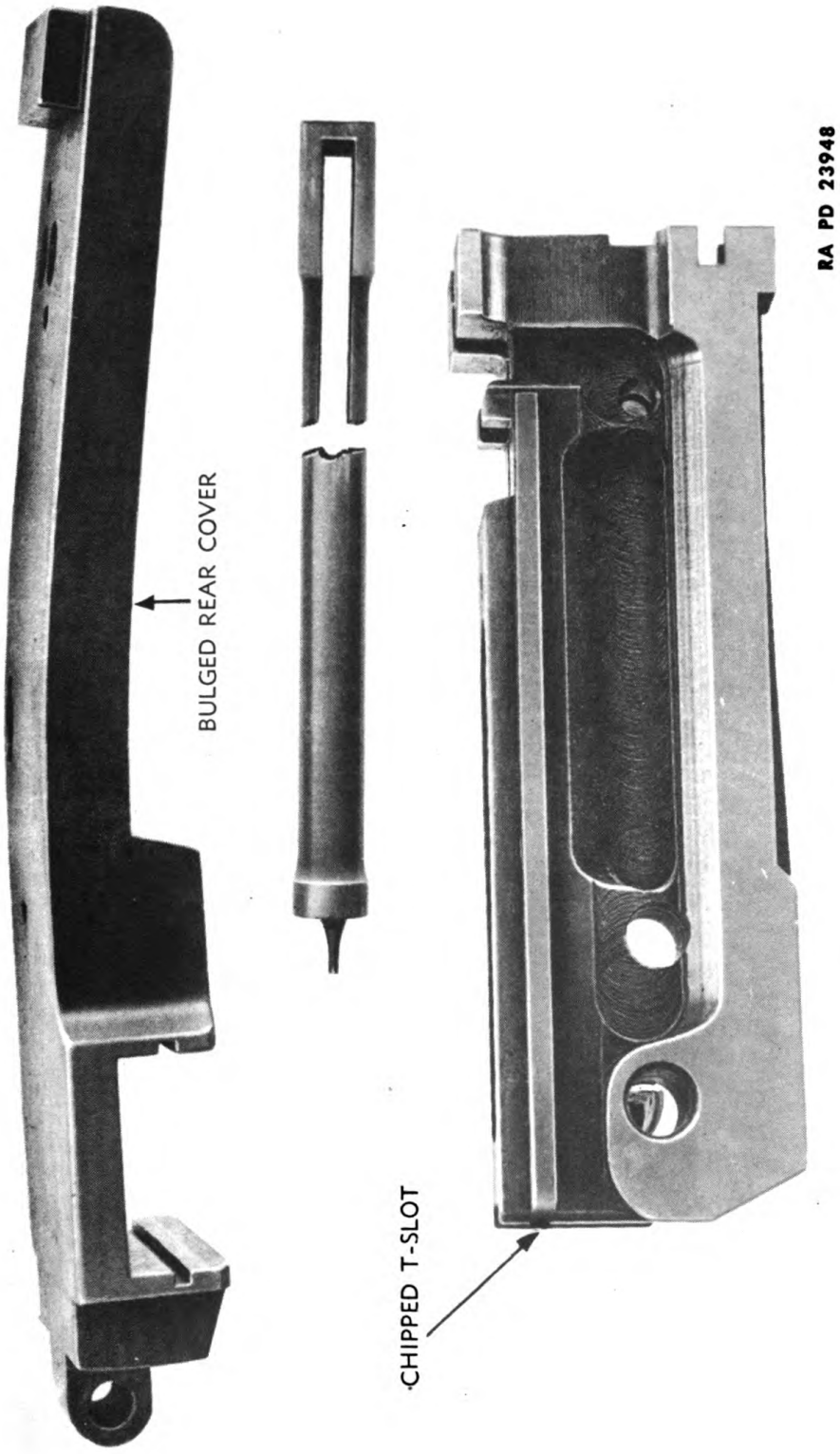


Figure 9 — Damage from Fractured Firing Pin Causing Premature Ignition, BMG, Cal. .30

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b. Bullet. A bullet lodged in the bore immediately forward of the chambered cartridge will rupture the head of the cartridge case (fig. 6). A bullet lodged in the middle portion of the bore ordinarily does not rupture the fired case. The case may show signs of high pressure. Ordinarily, the rupture of the case head of the chambered round will ignite the cartridge lying directly above in the feedway. Typical damage from these explosions consists of a fractured T-slot, a cracked or broken extractor, and a bent cover.

c. Grease.

(1) Grease or heavy oil in the chamber invariably produces a flute in the fired case (fig. 8). Note the characteristically elongated and radially contoured shape of these flutes. Case heads will show some indications of high pressure.

(2) Damage to the gun which commonly results from firing with grease in both chamber and breech end of bore is shown in figure 8. The high pressure ruptures the case head, releasing the powder gases into the action. Note fractured T-slot, cracked barrel extension, and bent cover.

5. FRACTURED FIRING PIN.

Figure 9 exhibits damage to gun caused by premature firing of incoming round by fractured firing pin. This typical accident was caused by fracture of the firing pin during counterrecoil. The firing pin spring drove the firing pin point prematurely into the primer of the incoming round. The explosion of the cartridge chipped the T-slot and bent the cover upward.

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Section III

U. S. RIFLE, CAL. .30, M1903A1

	Paragraph
Examination of fired cartridge cases	6
Defective ammunition	7
Oversize ammunition	8
Bore obstructions	9
Premature explosion	10
Defective metal	11

6. EXAMINATION OF FIRED CARTRIDGE CASES.

Figure 10 shows typical examples of cal. .30 cartridge cases which were subjected to various abnormal firing conditions.

a. No. 1 is the head of a cartridge case subjected to a breech pressure of 75,000 lb per sq in. Observe flattening of the primer cup. A pressure of 75,000 lb per sq in. ordinarily will form an annular bulge on the case immediately forward of the thick head section.

b. No. 2 shows the effect on the case head of a pressure of 98,000 lb per sq in. Such breech pressure enlarges the primer pocket, releasing the powder gases into the action of the rifle. The force of these escaping gases is sufficient to shatter the midportion of the stock, bulge the walls of the magazine outward, bend the floor plate, damage the bolt head, and blow the extractor from the bolt.

c. Nos. 3 and 4 show the effects on fired cases of extremely high breech pressure developed by fast burning powder. These cartridges were loaded with a bursting charge for experimental purposes. In figure 3 note depth of impressions formed on exterior of case from tool marks in the walls of the chamber.

d. No. 5 exhibits the appearance of the case of an 8-mm German cartridge fired in the cal. .30 rifle. This cartridge may be identified by the four crimp marks evenly spaced around the mouth of the case. Excessive breech pressure is developed by the resistance of the oversize (0.317 in. diam) 8-mm bullet.

e. No. 6 exhibits the fired case of a guard cartridge which developed excessive breech pressure. Note the ruptured head and the identification grooves in the wall of the first cone.

f. No. 7 shows the case of a normal round fired in a barrel with grease in the chamber and breech end of bore. Grease or heavy oil in the chamber invariably produces a flute in the forward portion of the first cone of the case. Note the elongated and radially contoured shape of the flute. Observe the ruptured case head.

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Figure 10—Examples of Cartridges Fired Under Abnormal Conditions, Rifle, Cal. .30, M1903A1

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g. No. 8 shows the case of a high pressure cartridge fired in a barrel having a longitudinal seam in the walls. Note evidence of excessive breech pressure in the ruptured case head. The longitudinal separation of the case followed a similar separation of the walls of the chamber.

h. No. 9 shows the effects on the case of extremely high breech pressure and excessive headspace. Note evidence of excessive headspace in the separation near head of the case. Evidence of excessive pressure is found in the ruptured case head, and in the depth of the impressions formed on the exterior of the case by tool marks in the walls of the chamber.

i. No. 10 shows the effects of a normal breech pressure of 49,000 lb per sq in. on the head of a soft cartridge case. The first cone of a soft case will be heavily marked from any tool marks in the wall of the chamber. The enlargement of the primer pocket releases the powder gases into the action, damaging the rifle as detailed in paragraph 6 b above.

j. No. 11 exhibits the effect on the case of firing a cartridge with an excessive bullet pull in a chamber coated with COMPOUND, rust-preventive. Note the separation at the second cone and the expanded case head.

k. No. 12 shows the head of a cartridge case with punctured primer. This primer cup shows no indications of high pressure. Compare the radius at the edge of this primer with that of the primer shown in No. 1. When neither the primer nor the fired case show evidence of high pressure, a punctured primer usually indicates a thin primer cup. Occasionally there is a small flash hole in the case.

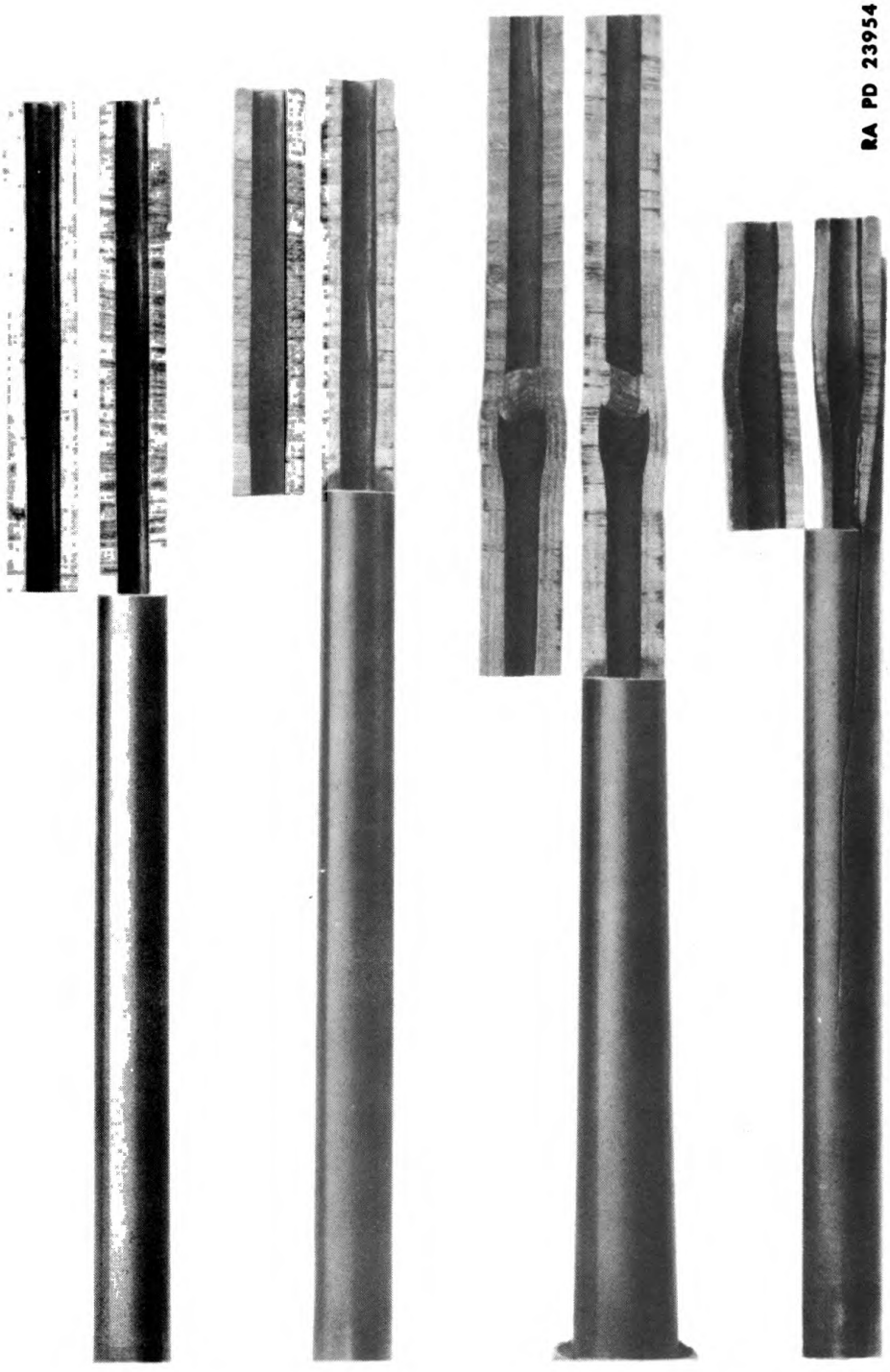
7. DEFECTIVE AMMUNITION.

Figure 11 shows typical damage to rifle from firing a high-pressure cartridge. Note the fractured bridge of the receiver, the bent ejector and magazine floor plate. Observe the ruptured head of the fired case and the depth of the impressions formed on the exterior of the case from tool marks in the walls of the chamber. In an excessive pressure burst, brass from the ruptured case is always plated along the exterior of the bolt.

8. OVERSIZE AMMUNITION.

Figure 12 shows typical damage to rifle from firing an 8-mm German cartridge. This cartridge may be identified by the four crimp marks evenly spaced around the mouth of the case. Note the fractured bridge of the receiver, the bent extractor and ex-

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Figure 14—Damage Caused by Firing with Obstructions in Bore, Rifle, Cal. .30, M1903A1

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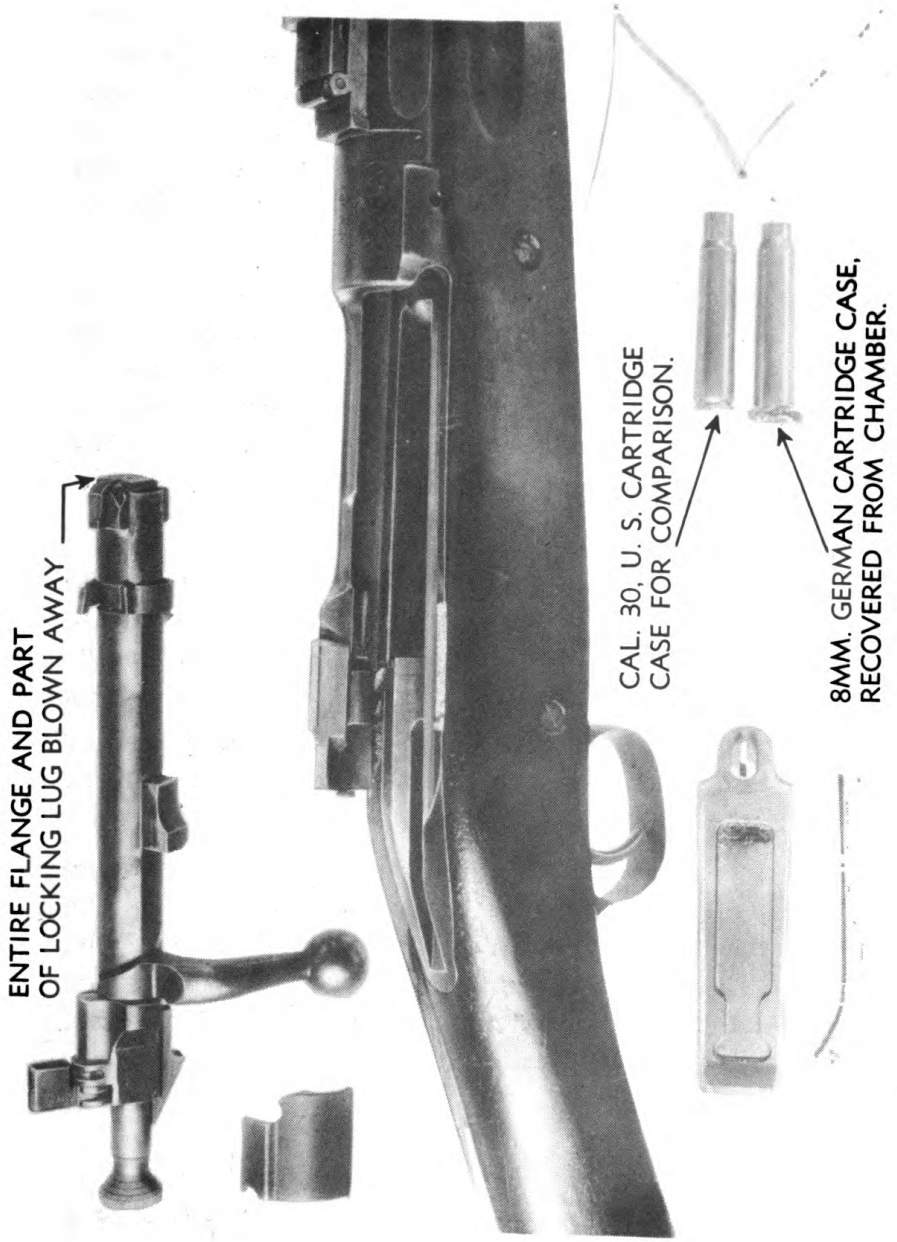


Figure 12—Damage Caused by Firing 8-mm German Cartridge, Rifle, Cal. .30, M1903A1

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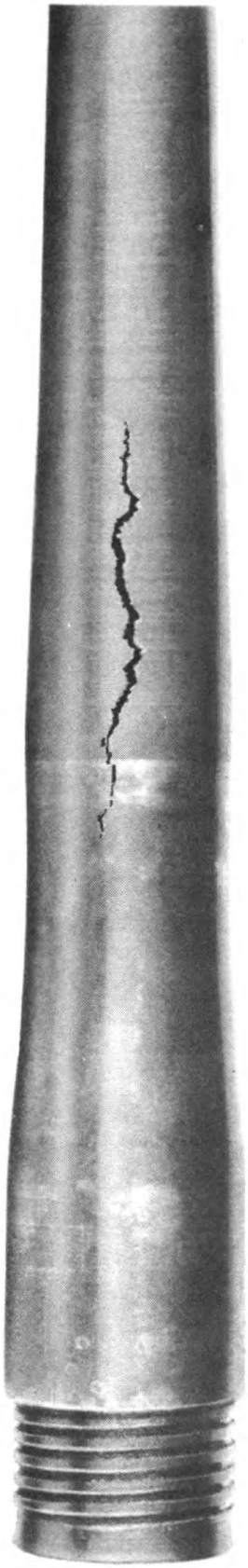
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Figure 20—Damage from Firing with Barrels Subjected to Excessively High Temperatures, Rifle, Cal. .30, M1903A1

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Figure 21 — Damage from Firing Barrels Subjected to Excessively High Temperatures During Formation of the Blank, Rifle, Cal. .30, M1903A1

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b. The resulting explosion ruptured the head of the cartridge case, releasing the powder gases into the action of the rifle. Note the fractured firing pin rod, the broken bolt handle, the bent extractor, extractor collar, and floor plate. Observe the ruptured cartridge case with shortened third cone.

11. DEFECTIVE METAL.

Figures 19, 20, and 21 exhibit typical damage from firing normal ammunition in a rifle with defective metal in receiver or barrel.

a. In figure 19 note that the head of the fired case shows no expansion, indicating that the cartridge causing the rupture developed normal breech pressure. Observe the regularity of the edges of the separated pieces of both receiver and barrel. Fractures with this appearance indicate brittle steel.

b. In figures 20 and 21 observe the dark and coarse appearance of the barrel structure. The steel in these barrels was damaged by excessively high temperatures during the formation of the barrel blank.

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Section IV

PISTOL, AUTOMATIC, CAL. .45, M1911

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Defective metal 14

12. DEFECTIVE AMMUNITION.

Figure 22 shows typical damage to pistols caused by firing a round which developed excessive pressure from a double charge of powder.

13. BORE OBSTRUCTIONS.

a. Figure 23 exhibits typical damage to pistol from firing a normal round with grease in the chamber and breech end of the bore. The breech pressure developed was sufficient to rupture the head of the cartridge case, releasing the powder gases into the action. Note the bulged housing and the damaged top round from the magazine.

b. Figure 24 exhibits typical damage caused by firing a normal round in a barrel with a bullet in the bore. Bullets may lodge in the bore when fired from a cartridge containing damp powder. In these instances some of the powder grains will be unburned. Figure 25 shows darkened, unburned powder grains adhering to the base of the lodged bullet. Observe the long split in the barrel, and the two bullets recovered from the bore.

14. DEFECTIVE METAL.

a. Figure 26 shows typical failure of a barrel caused by fatigue of the metal from long usage. Note the evidence of the wear on the muzzle half of the barrel.

b. Figure 27 shows damage to the breech end of the barrel when the metal has become fatigued from long usage. Note the coarse structure of the metal at the break.

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Figure 22—Damage from Firing Round Which Developed Excessive Breech Pressure from Double Charge of Powder, Automatic Pistol, Cal. .45, M1911

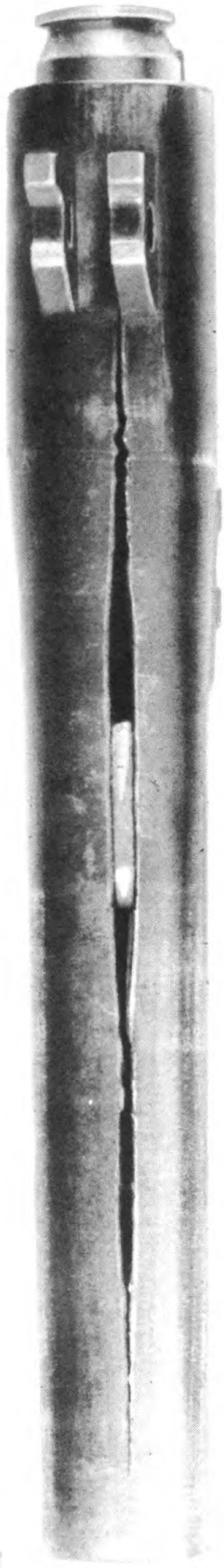
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Figure 23 — Damage Caused by Firing with Grease in Chamber and Bore, Automatic Pistol, Cal. .45, M1911

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Figure 24—Damage Caused by Firing with Bullet Lodged in Bore, Automatic Pistol, Cal. .45, M1911

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PISTOL, AUTOMATIC, CAL. .45, M1911

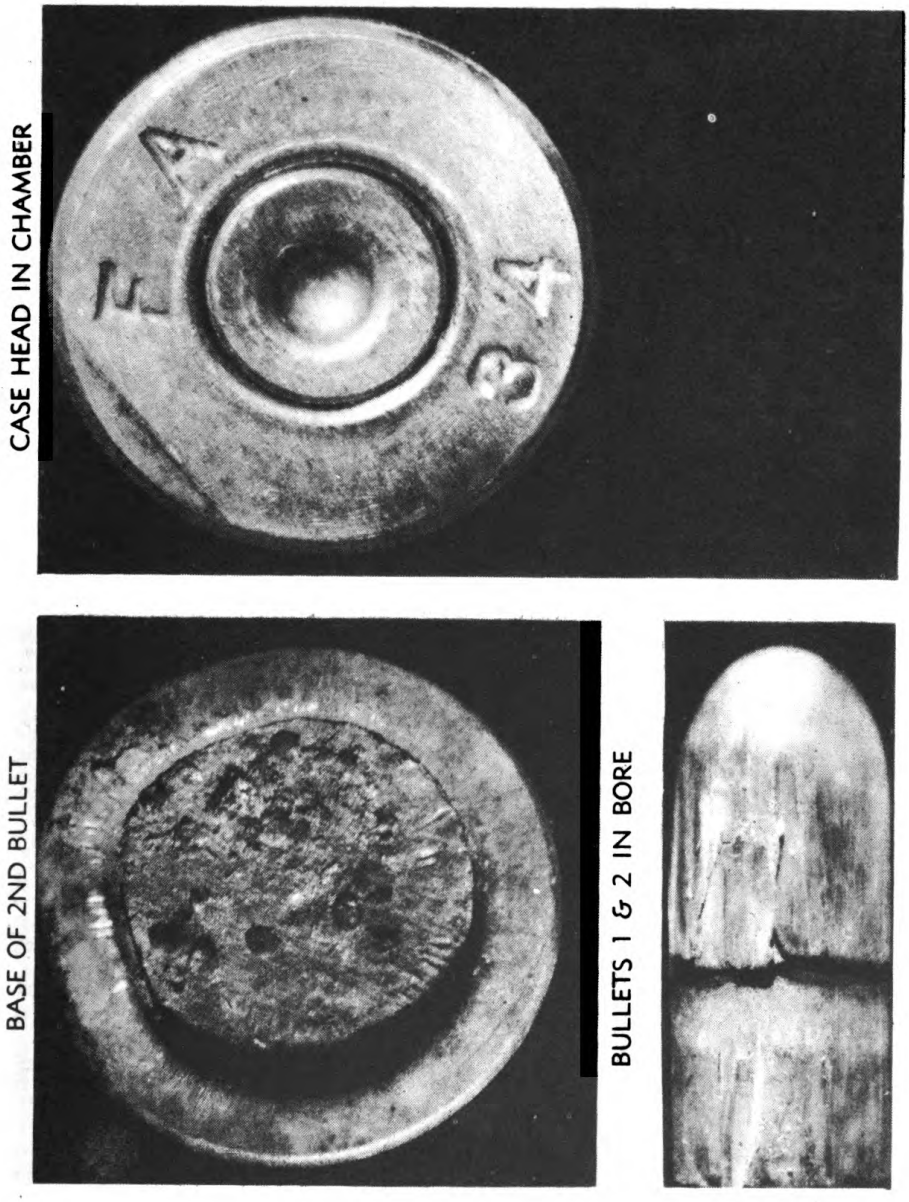
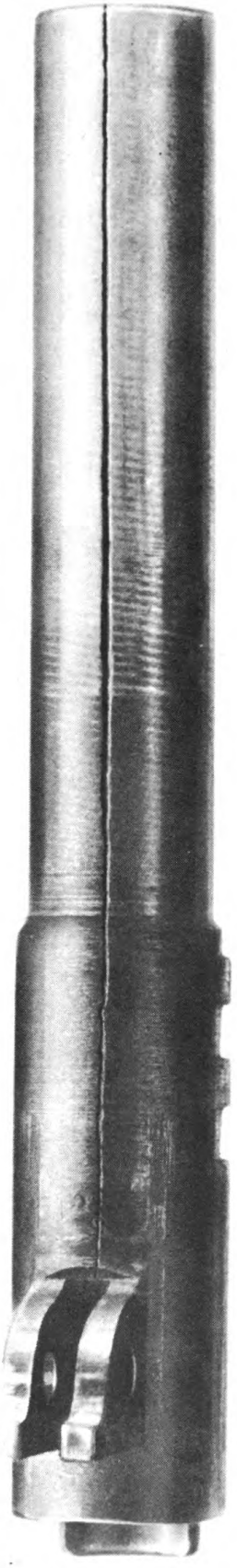


Figure 25—Ammunition for Automatic Pistol, Cal. .45, M1911

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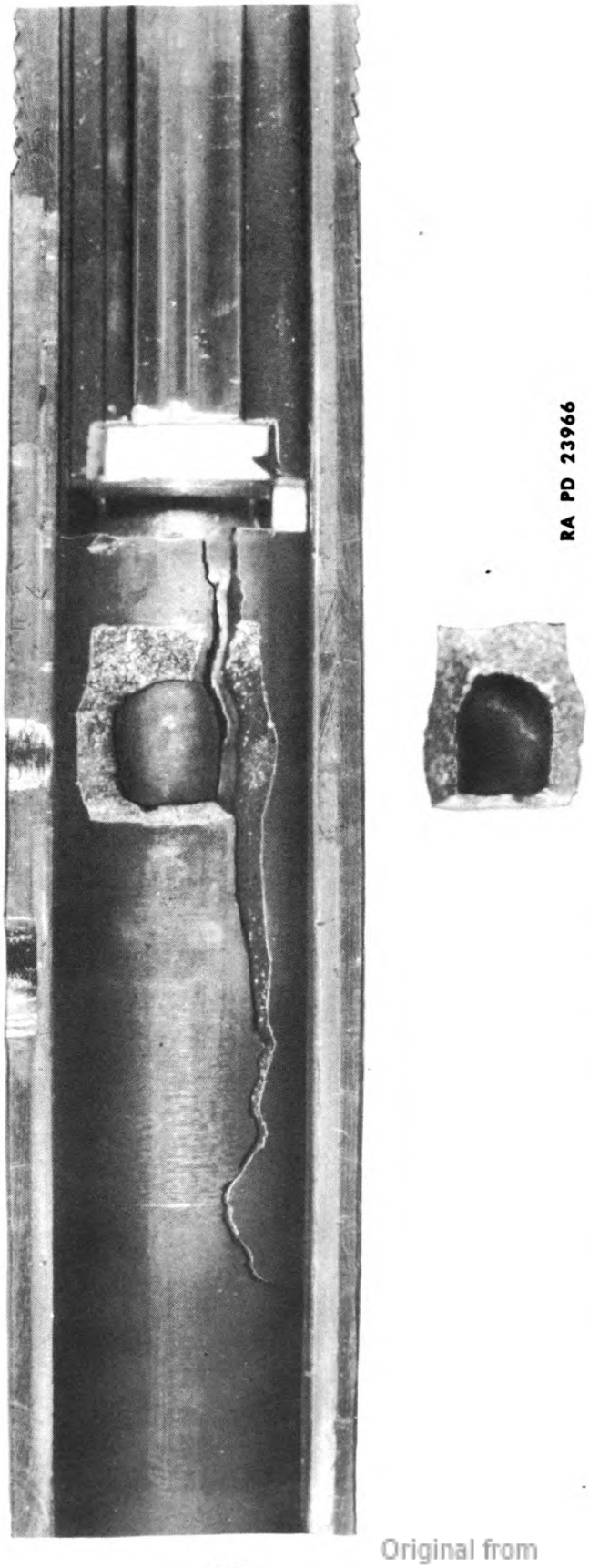


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Figure 26—Failure of Barrel Caused by Fatigue of Metals, Automatic Pistol, Cal. .45, M1911

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Figure 27—Damage to Breech End of Barrel Caused by Fatigue of Metal from Long Usage, Automatic Pistol, Cal. .45, M1911

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Section V

COLT AND SMITH & WESSON REVOLVER, CAL. .45, M1917

Paragraph

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Bore obstructions 16

15. DEFECTIVE AMMUNITION.

Figure 28 exhibits typical damage from firing a round containing a double charge of powder.

16. BORE OBSTRUCTIONS.

Figure 29 exhibits typical damage from firing a normal round in a barrel with a bullet lodged in the bore. Bullets may remain in the bore when fired from a cartridge containing damp powder. Observe, in all three instances, the bulge produced at the point of the obstruction, and the split in the barrel.

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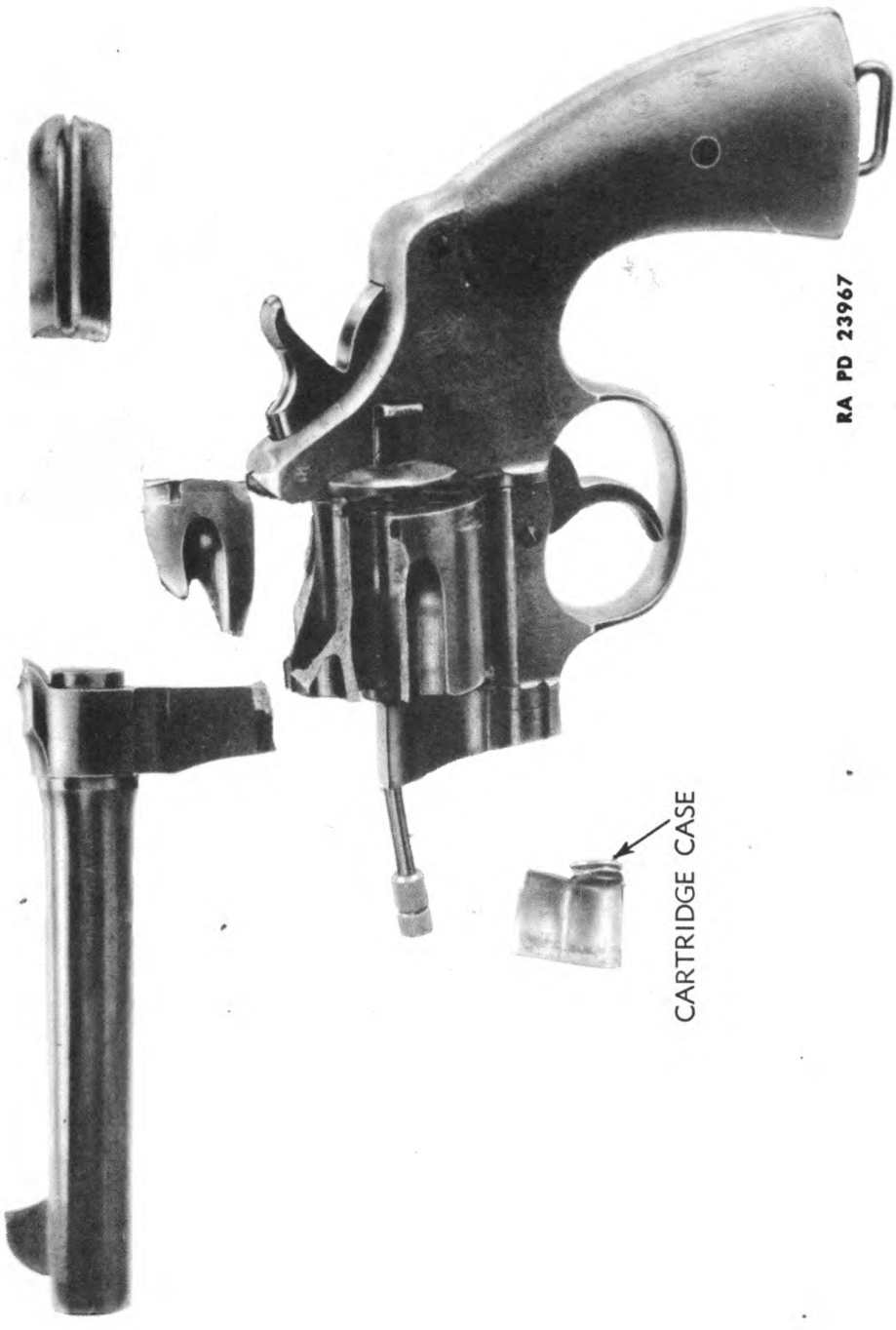


Figure 28 — Damage from Firing Double Charge of Powder, Colt Revolver, Cal. .45, M1917

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Figure 29—Damage from Firing with Bullet Lodged in Bore, Smith & Wesson Revolver, Cal. .45, M1917

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Section VI

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17. EXPLANATORY PUBLICATIONS:

a. Machine guns

Browning machine gun, cal. .30, HB, M1919A4, ground.. FM 23-45
Browning machine gun, cal. .30, M1919A4 (mounted in combat vehicles) ..... FM 23-50
Browning machine gun, cal. .30, M1917..... FM 23-55
Browning machine gun, cal. .30, M2, aircraft, fixed and flexible ..... TM 9-205
Browning machine gun, cal. .30, all types..... TM 9-1205

b. Rifles

U. S. rifle, cal. .30, M1903..... FM 23-10
Rifle, U. S., cal. .30, M1903 and M1903A1..... TM 9-1270

c. Pistols

Automatic pistol, cal. .45, M1911 and M1911A1..... FM 23-35
Pistols and revolvers..... TM 9-1295

d. Revolvers

Colt and Smith & Wesson revolver, cal. .45, M1917..... FM 23-36
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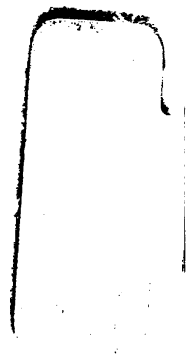
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