

PRELIMINARY

ORDNANCE PAMPHLET No. 820

# 1

# 40MM ANTI-AIRCRAFT GUN

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40MM Machine Gun Mechanism . . . . .	Mark 1
40MM Machine Gun Mechanism . . . . .	Mark 2
40MM Machine Gun Mechanism . . . . .	Mark 1, Mod. 1
40MM Machine Gun Mechanism . . . . .	Mark 2, Mod. 1
40MM Gun Barrel . . . . .	Mark 1
40MM Sight . . . . .	Mark 3
40MM Sight . . . . .	Mark 4

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## DESCRIPTION AND OPERATION



OCTOBER 1943

**NAVY DEPARTMENT  
BUREAU OF ORDNANCE  
WASHINGTON, D. C.**

ORDNANCE PAMPHLET No. 820  
40MM ANTI-AIRCRAFT GUN

October 1943

1. Ordnance Pamphlet No. 820 provides a description of the construction and operation of the 40MM Machine Gun Mechanism, and descriptions of the gun barrel and sight. It also includes operating instructions and instructions for the care and maintenance of the gun.

2. Ordnance Pamphlet No. 820-A may be used where a less detailed pamphlet is desired.

3. This pamphlet supersedes Ordnance Data No. 3781, preliminary manual for the description and operation of the 40MM anti-aircraft gun. Ordnance Data No. 3781 should be destroyed. Ballistic Data for 40MM Guns are given in Ordnance Pamphlet No. 867.

4. Ordnance Pamphlet No. 820 is UNCLASSIFIED.



Rear Admiral, U. S. N.  
Chief of the Bureau of Ordnance

## **PREFACE**

This Ordnance Pamphlet, No. 820, applies to the following:

**40MM MACHINE GUN MECHANISMS,  
MARK 1 AND MARK 2,  
MARK 1, MOD. 1 AND MARK 2, MOD. 1**

**40MM GUN BARREL, MARK 1**

**40MM SIGHTS, MARK 3 AND MARK 4**

Standard Navy nomenclature is used herein, and is considered preferable to that used on drawings and in previous publications relating to these mechanisms.

York Safe and Lock Co.  
York, Pennsylvania

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## 40MM ANTI-AIRCRAFT GUNS

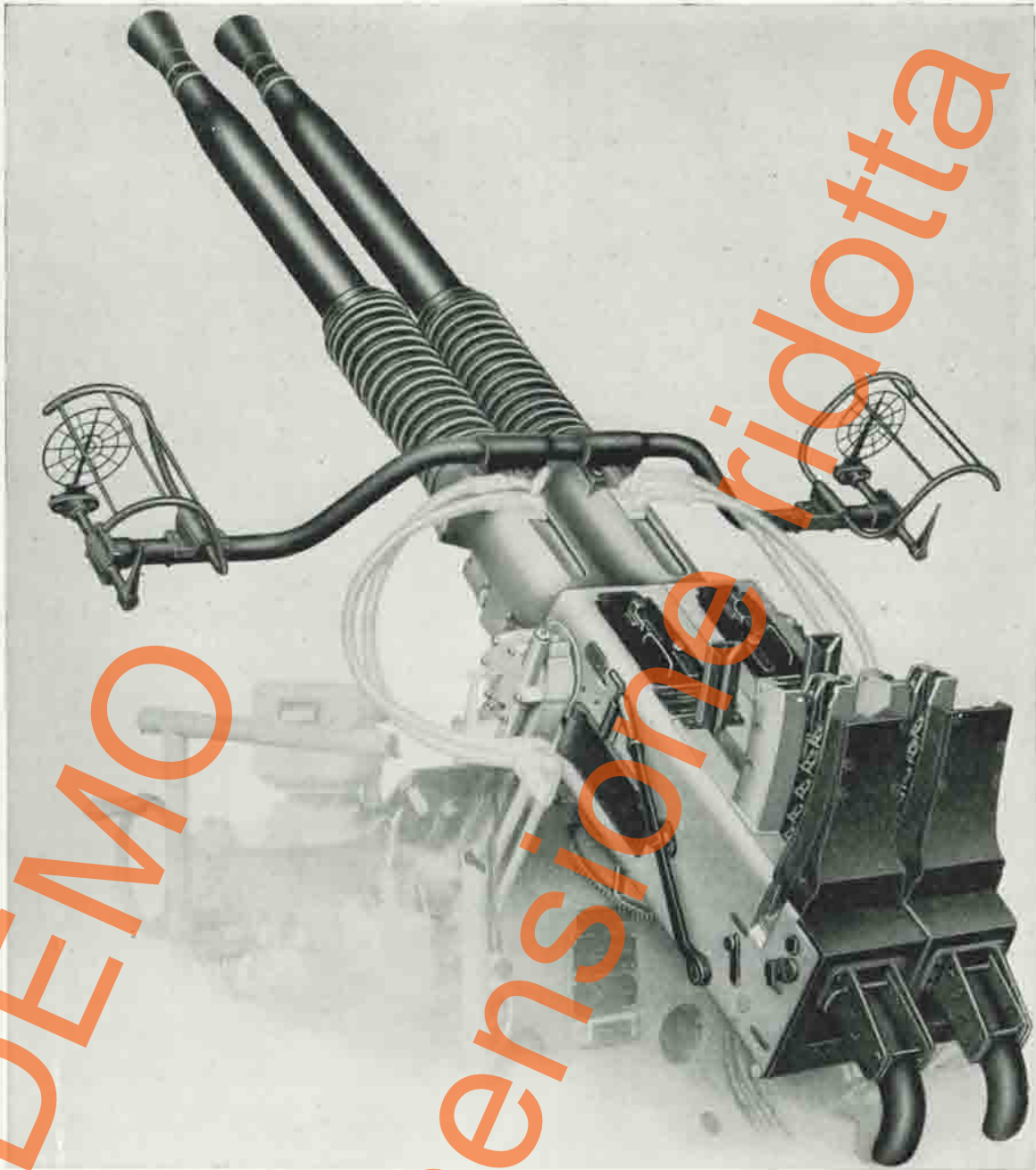


Figure 1

# Chapter I

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## INTRODUCTION

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The 40MM Antiaircraft Gun, Figure 1, consists of the machine gun mechanism, the gun barrel, and the sights. The 40MM Machine Gun Mechanisms are assembled in pairs. The left mechanism is designated **Mark 1 or Mark 1, Mod. 1**, and the right mechanism is designated **Mark 2 or Mark 2, Mod. 1**. The only differences between the two Marks of mechanisms are those required by the twin assembly. The only difference between the **Mod. 0 and Mod. 1** is that certain parts are not interchangeable between the two. 40MM Gun Barrels, **Mark 1**, are used with all mechanisms. The 40MM Sight, **Mark 3**, is used on the 40MM Twin Mount; the 40MM Sight, **Mark 4**, is used on the 40MM Quadruple Mount.

The design of these mechanisms and barrels is essentially that of the Swedish Bofors 40MM Antiaircraft Gun. The design provides for a rapid fire, recoil operated, automatic mechanism, with a maximum cyclic rate of approximately 160 rounds per minute.

# Chapter II

DESCRIPTION

## MECHANISM

OPERATION

### Part One—Description of Gun Mechanism

The 40MM Machine Gun Mechanism consists of five principal components. They are the **Slide Assembly**, **Breech Mechanism Assembly**, **Loader Assembly**, **Recoil Cylinder Assembly**, and **Barrel Assembly** (excluding barrel).

#### A. SLIDE ASSEMBLY

The slide, **Figure 2**, is a steel casing which positions and provides working surfaces for other parts of the mechanism. It has a trunnion, trigger

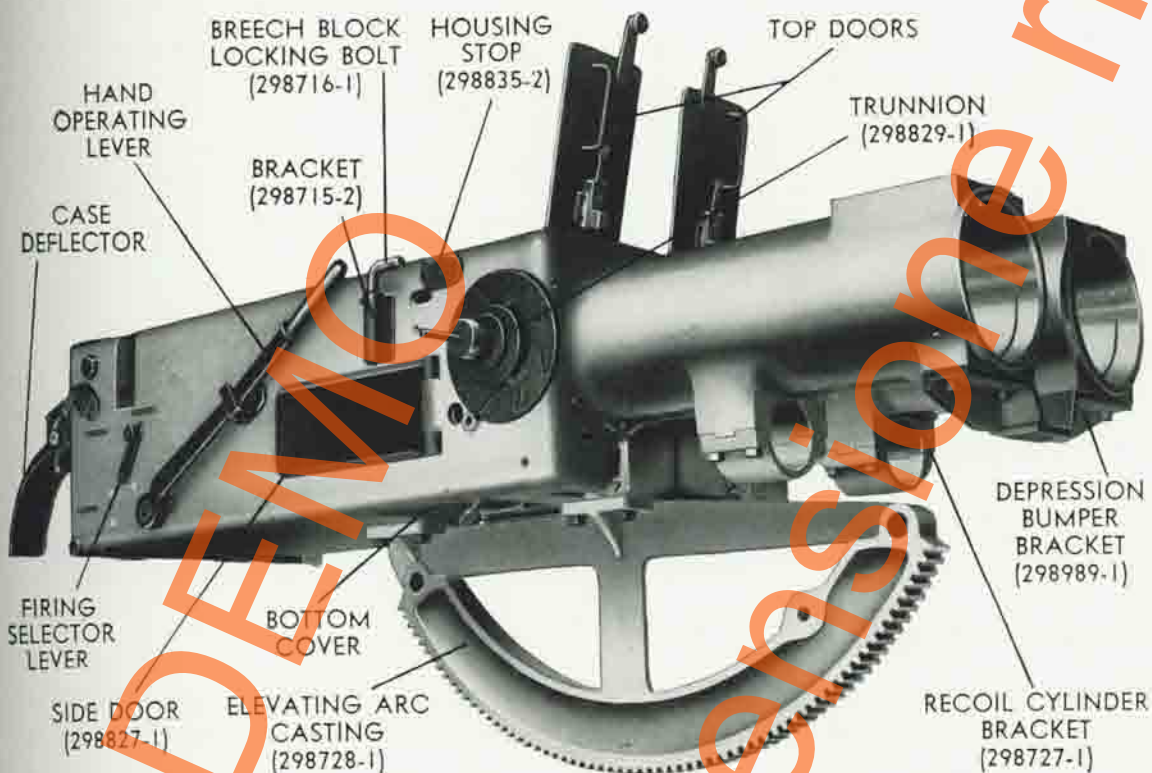


Figure 2

mechanism, hand operating mechanism, top, side, and rear doors, bottom cover and extractor release lever. A Mark 1 and a Mark 2 Mechanism are bolted together and are supported at the trunnions, one on the left side of the Mark 1 Mechanism, and one on the right side of the Mark 2 Mechanism. An elevating arc is attached to the bottom surfaces of the slides.

## TRUNNION DIAGRAM

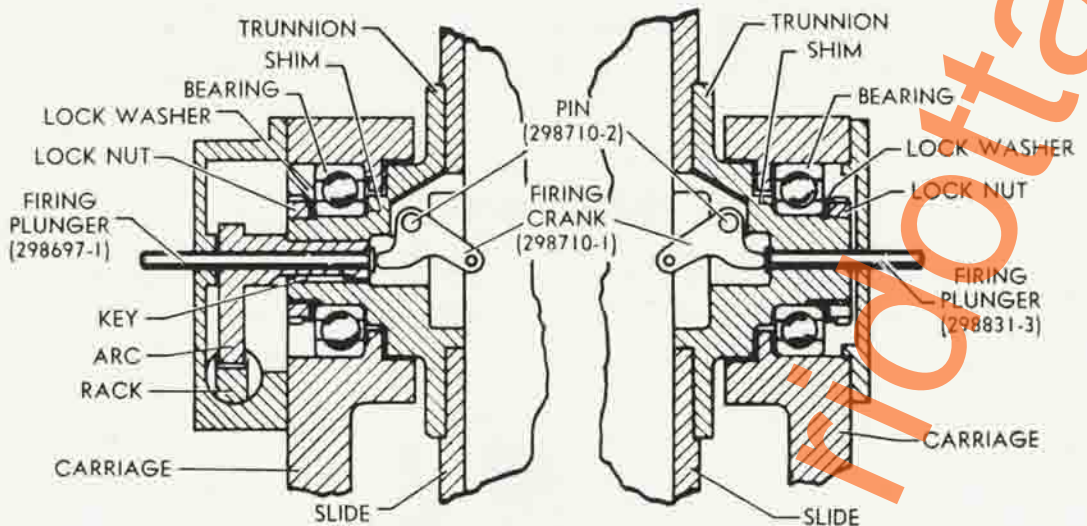


Figure 3

The trunnion on the left is part of the Mark 1 Mechanism, the one on the right is part of the Mark 2 Mechanism.

### 1. Trunnion

The trunnion, **Figure 3**, contains the firing plunger and crank of the trigger mechanism. The trunnion of the Mark 1 Mechanism is provided with a gear sector to transmit gun elevation to the firing cut-out mechanism of the mount.

### 2. Trigger Mechanism

The trigger mechanism, **Figure 4**, is on the left side of the Mark 1 Mechanism on the right side of the Mark 2 Mechanism. It is operated by the firing plunger in the trunnion. The trigger is a vertical arm, pivoted near its center, and is located inside and at the rear of the slide, where it contacts and controls the movement of the rammer control spindle arm of the loader. The trigger is operated by a pawl on the firing lever. Motion of the trigger and firing mechanism is limited by the cam on the firing selector lever shaft, as shown in **Figure 5**. When the firing selector lever is at SAFE, motion of the trigger mechanism is prevented by the firing selector cam. When the selector lever is at AUTO FIRE, the trigger can be maintained in the firing

position by the trigger mechanism. When the selector lever is at SINGLE FIRE, motion of the trigger mechanism can be sufficient to permit the pawl to trip and thus release the trigger. The trigger returns to its non-firing position after releasing the trigger catch lever in the loader. Thus in SINGLE FIRE the firing mechanism must be restored to its non-firing position before the trigger can again be operated.

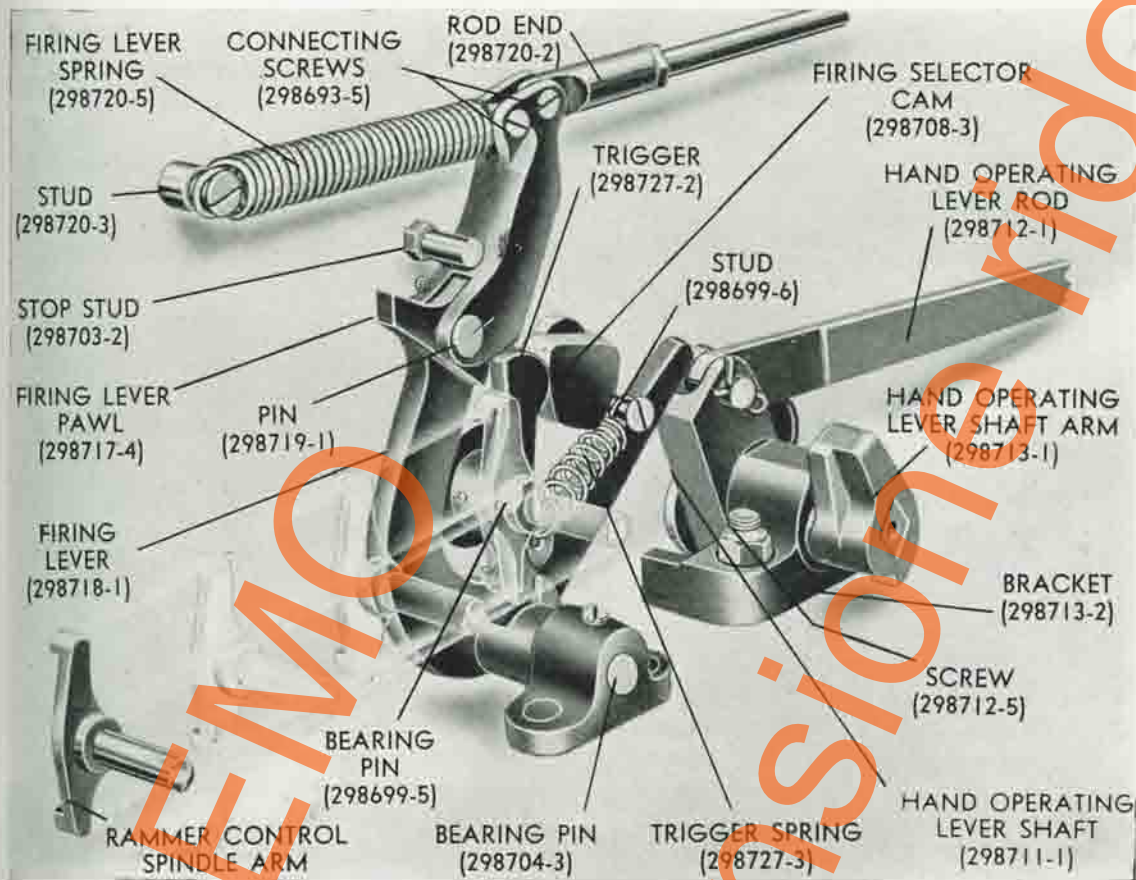


Figure 4

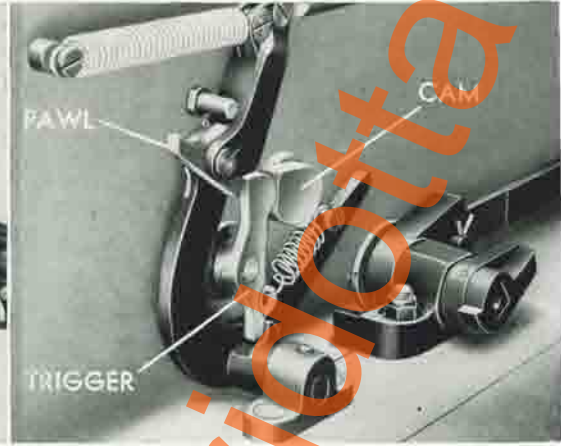
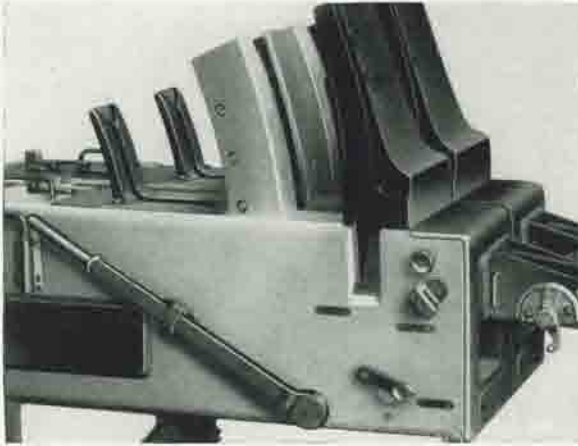
Phantom positions of the rammer control spindle arm show how it contacts the trigger when the loader is placed in the slide. The position of the hand operating lever shaft is shown when the hand operating lever is in the rear catch bracket.

### 3. Hand Operating Mechanism

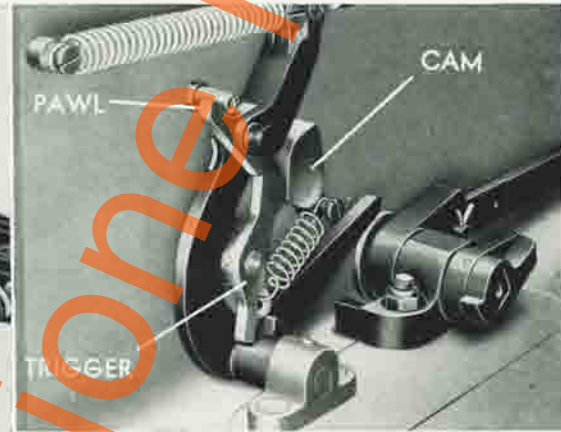
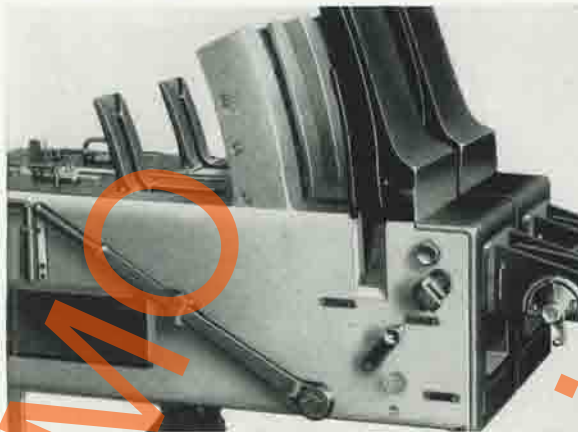
The hand operating mechanism, located on the same side of the slide as the trigger mechanism, provides the means for performing manually the operations required to prepare the gun for firing, operations which are otherwise accomplished automatically during recoil and counterrecoil. It



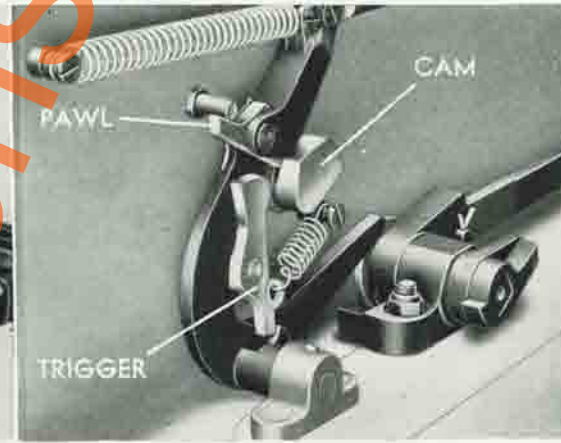
### FIRING SELECTOR LEVER POSITIONS



Lever set on SAFE.



Lever set on AUTO FIRE.



Lever set on SINGLE FIRE.

Figure 5

consists of the external hand operating lever and associated internal linkage. The arm on the hand operating lever shaft, **Figure 4**, operates the cocking mechanism of the loader. A projecting lever of the shaft is pinned to the hand operating rod, which engages the toe of the breech mechanism outer crank to cock the breech mechanism. The lever also provides an interlock with the trigger mechanism to prevent firing when the hand operating lever is in the rear catch bracket.

#### 4. Top Door

The top door, **Figure 6**, when open, disengages the barrel lock, **Figure 7**, and rotates the safety catch arm of the housing into position to engage a stop on the slide. This door must be left latched open when the barrel assembly is not in place, to prevent possible rearward movement of the housing.

However, **the top door must always be latched closed before firing**, in order to disengage the safety catch arm from the stop, thus preventing damage to the mechanism.



Figure 6

The top door, when open, disengages the barrel lock.

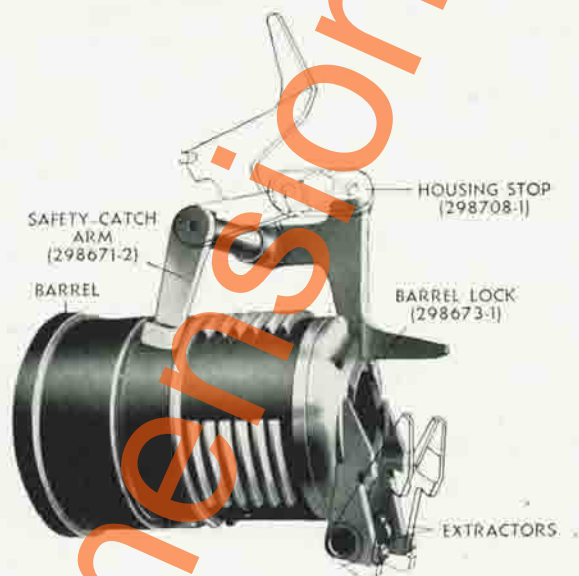


Figure 7

The barrel lock is shown in both open and closed positions.

## SIDE DOOR CAM ACTION

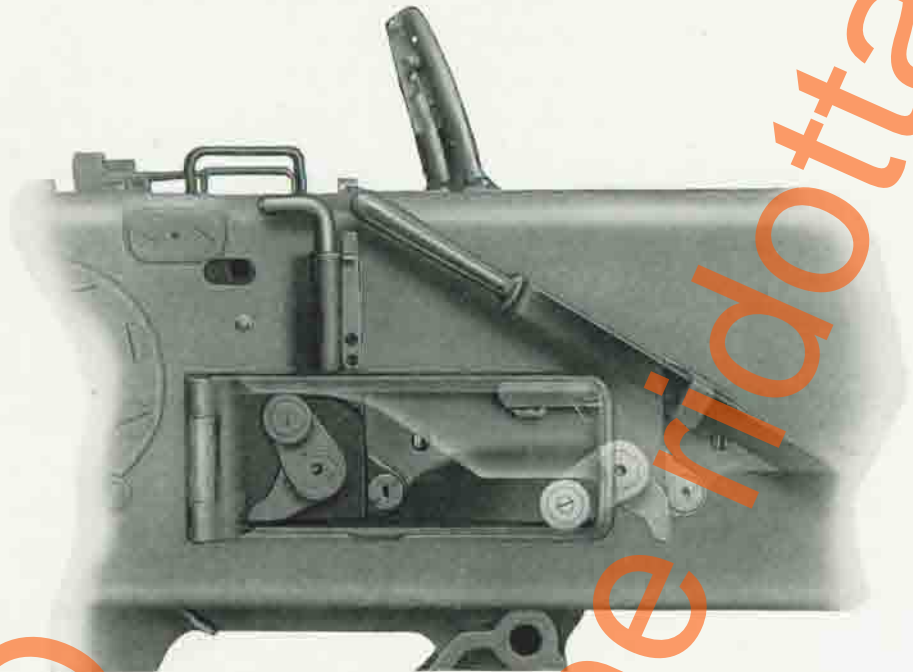


Figure 8

This transparent view shows the action of the cam surface of the side door on the outer crank. The crank is shown at the start and finish of its travel during recoil.

### 5. Side Door

The side door has a cam surface shown in **Figure 8**, to provide for the rotation of the outer crank of the breech mechanism during recoil.

This door must be opened to remove the breech block, closing spring and cranks from the housing. However, **the side door must always be locked closed before firing**, so that the breech block will be lowered during recoil. Otherwise the breech block will be rammed into the front of the loader causing serious damage.

### 6. Rear Door

The rear door, **Figure 9**, has an opening to permit the recoil of the rammer tray and ejection of empty cases, and to facilitate removal of live rounds from the tray. It opens to permit removal of the loader and housing assemblies

## REAR DOOR

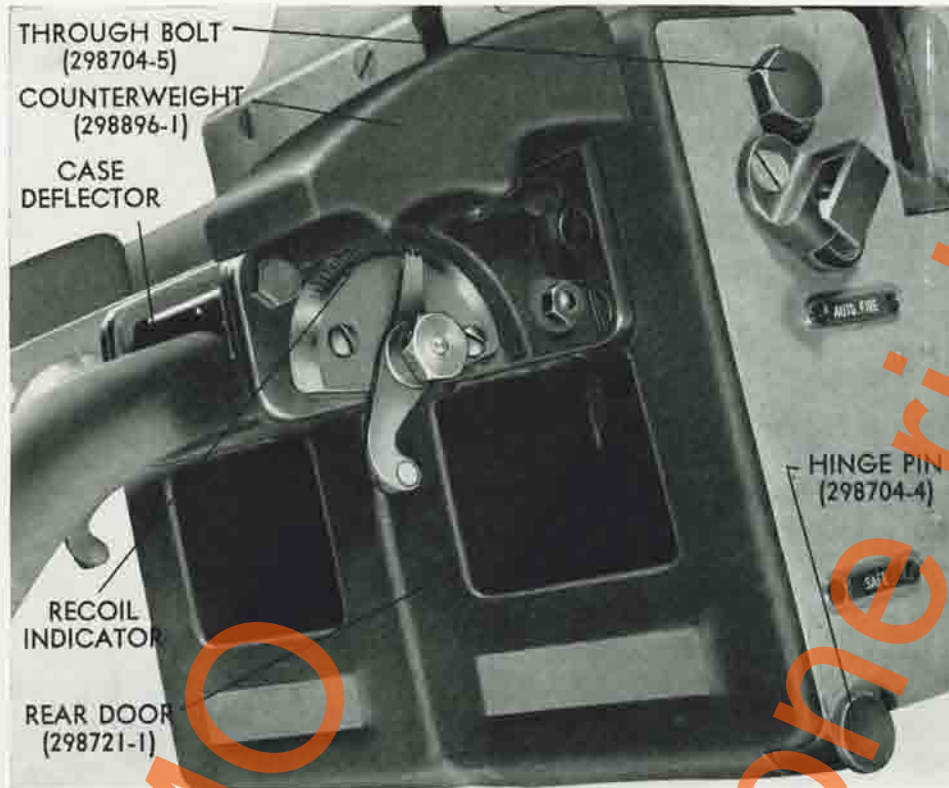


Figure 9

To this door are attached case deflector brackets on which are mounted the case deflector, counterweights, and recoil indicator. This indicator measures the length of recoil, being contacted by the rear of the tray in recoil. It must be reset by hand.

### 7. Bottom Cover

The bottom cover provides access to the breech mechanism and permits removal of the breech block and associated parts.

### 8. Extractor Release Lever

The extractor release lever, located in the bottom of the slide, provides for manually releasing the extractors from the breech block.

## B. BREECH MECHANISM ASSEMBLY

The breech mechanism assembly consists of a housing assembly, breech block assembly and associated operating parts, and is a recoiling part of the gun mechanism.

### 1. Housing Assembly

The housing, **Figures 10, 11, and 12**, is a rectangular steel block with projecting bronze-covered bearing strips which ride in corresponding guides in the slide. The housing is provided with an interrupted thread for attaching the breech end of the barrel. The barrel lock is pivoted in the top of the hous-

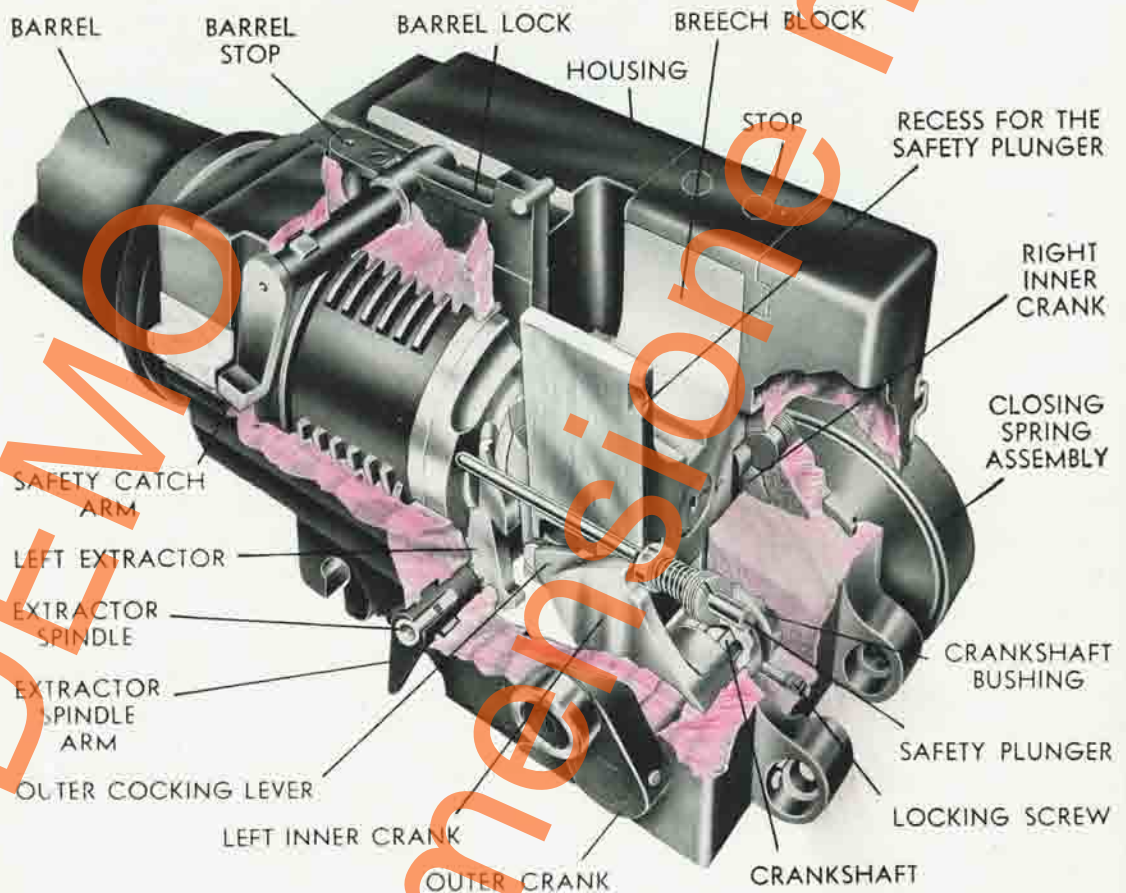
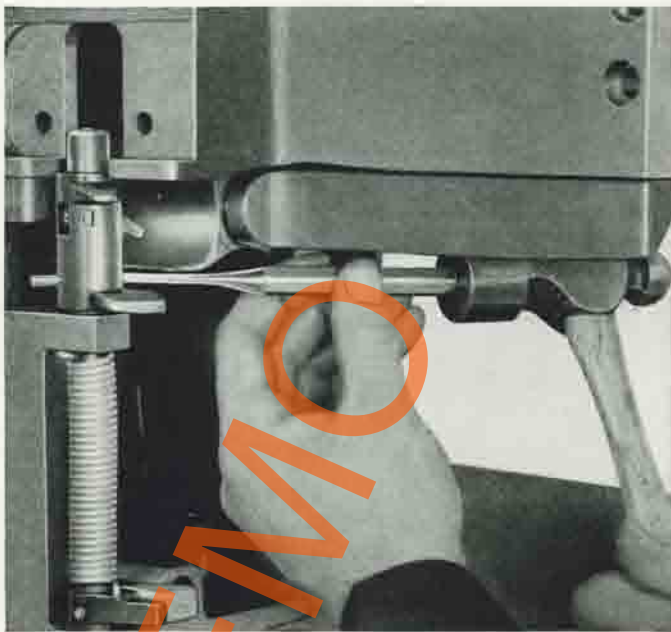


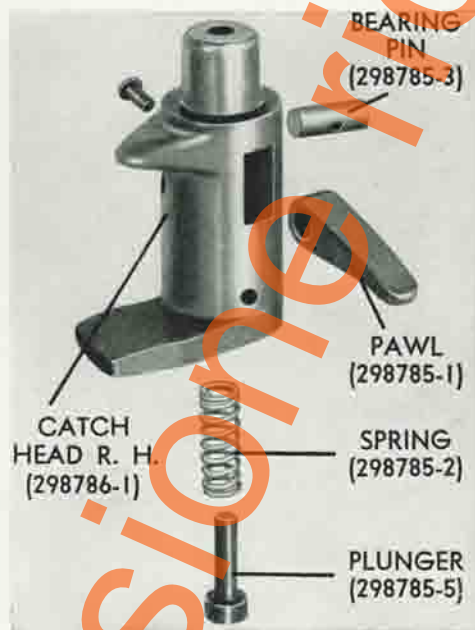
Figure 10

Broken open housing shows the relationship of the parts of this assembly.

- (1) Remove the catch head bracket.
  - (a) Remove the cotter pins and the castellated nuts.
  - (b) Tap out the retaining screws and remove the bracket.
- (2) Remove the catch head.
  - (a) File off the riveted ends of the taper pin.
  - (b) Rotate the catch arm and insert a block between it and the casting to place the catch head taper pin in position to be driven out. Drive out the taper pin, **Figure 64**.
  - (c) Remove the catch head.



**Figure 64**  
Removing the catch head.



**Figure 65**  
Catch head.

- (3) Remove the catch arm, spring and spindle.
  - (a) Tap the taper pin out of the catch arm.
  - (b) Raise the spindles and remove the catch arm and the spring.
  - (c) Remove the spindle through the bottom.
- (4) Disassemble the catch head, **Figure 65**.
  - (a) Remove the retaining screw and the bearing pin.
  - (b) Push out the pawl, the plunger and the spring.

**11. Removal and Disassembly of the Trigger Mechanism**

To remove and disassemble the trigger mechanism it is first necessary to remove the loader.

- a. Loosen the firing lever assembly.
  - (1) Remove the firing lever spring stud.
  - (2) Unhook the trigger spring from the trigger and its stud.
  - (3) Remove the connecting screws and the firing lever spring.
- b. Remove and disassemble the firing lever.
  - (1) Remove the lock screw, and tap the bearing pin out of the bracket.
  - (2) Remove the lever assembly from the slide.
  - (3) Remove the cotter pin, bearing pin, pawl plunger, and the spring from the firing lever.
- c. Remove the firing plunger and crank assembly.
  - (1) Remove the pivot pin, and dismount the crank assembly.
  - (2) Remove the firing plunger from the inside of the slide.
- d. Disassemble the crank assembly.
  - (1) Remove the cotter pin, the clevis pin and the crank.
  - (2) Loosen both lock nuts, and remove the rod ends and lock nuts from the firing rod.
- e. Remove the firing selector lever and the trigger.
  - (1) Remove the taper pin, the firing selector lever and the cam.
  - (2) The knurled head, the plunger and the spring may be removed from the lever by grinding off the riveted end of the plunger.
  - (3) Remove the taper pin, the bearing pin, and the trigger.

**12. Assembly and Installation of the Trigger Mechanism**

- a. Install the firing selector lever and the trigger.
  - (1) Assemble the plunger (298701-2), the spring (298701-4), and the knurled head (298701-3) with the lever (298720-9).
  - (2) Install the cam (298708-3) through the side of the slide, and attach the firing selector lever with the taper pin (No. 00 x 1").
  - (3) Install the bearing pin (298699-5), the trigger (298727-2) and drive in the taper pin (No. 000 x 3/4").
- b. Assemble the crank assembly.
  - (1) Assemble the rod ends (298720-2) on the rod (298720-1), locking them with the lock nuts (1/4"—28).
  - (2) Attach the crank (298710-1) to the firing rod by means of the clevis pin (298720-6), and fasten with the cotter pin (1/16" x 1/2").

- c. Install the crank assembly and firing plunger in the trunnion.
  - (1) Insert the firing plunger (298697-1) from the inside of the slide.
  - (2) Install the crank assembly and the pivot pin (298710-2).
- d. Assemble and install the firing lever.
  - (1) Assemble the spring (298719-2), the plunger (298704-2), the pawl (298717-4), the bearing pin (298719-1), and the cotter pin (1/16" x 1") in the firing lever (298718-1).
  - (2) Place the assembly in the slide, and install the bearing pin (298704-3) in the bracket (298708-2). Install the lock screw (1/4"—20 x 1/2").
- e. Attach the trigger mechanism springs and the firing rod.
  - (1) Install the firing lever spring (298720-5) and attach the firing rod with connecting screws (298693-5).
  - (2) Install the firing lever spring stud (298720-3) and the trigger spring stud (298699-6) and attach the trigger spring (298727-3) and the firing lever spring.

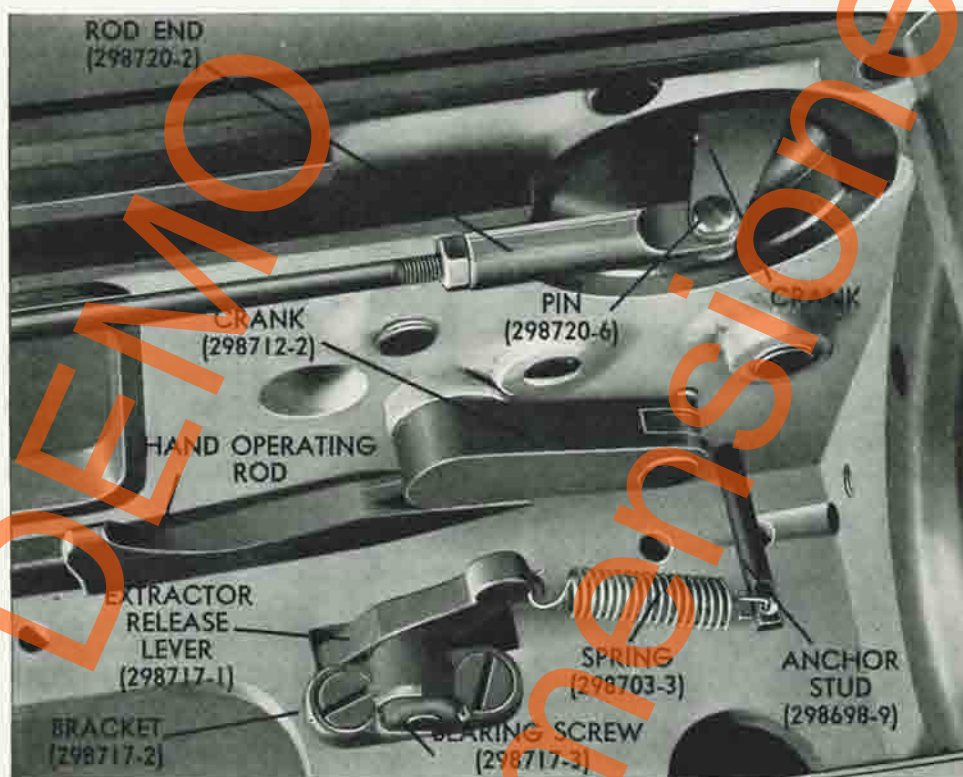


Figure 86

Detail of the interior of the slide.