RESTRICTED

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WAR DEPARTMENT

TECHNICAL MANUAL

of

ORDNANCE MAINTENANCE

BREEZE CARTRIDGE STARTER FOR RADIAL DIESEL ENGINES

August 25, 1942

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BREEZE CARTRIDGE STARTER FOR RADIAL DIESEL ENGINES

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SECTION I

GENERAL

Paragraph
Scope 1

1. Scope.—This manual is published for the information and guidance of ordnance maintenance personnel. It contains detailed instructions for inspection, disassembly, assembly, maintenance, and repair of the breeze starter unit G–1153R, type L4A, and the breeze starter breech assembly G–1155, type A, supplementary to those in TM 9–726, which was prepared for the using arm. Additional descriptive matter and illustrations are included to aid in providing a complete working knowledge of the matériel. The breeze cartridge starter G–1154R is used on the Diesel engined light tanks M2A4, M3, M3A1, and the Diesel engined medium tanks M3, M3A1, and M3A2.

SECTION II

DESCRIPTION, OPERATION, AND ALLOCATION OF MAINTENANCE OPERATIONS

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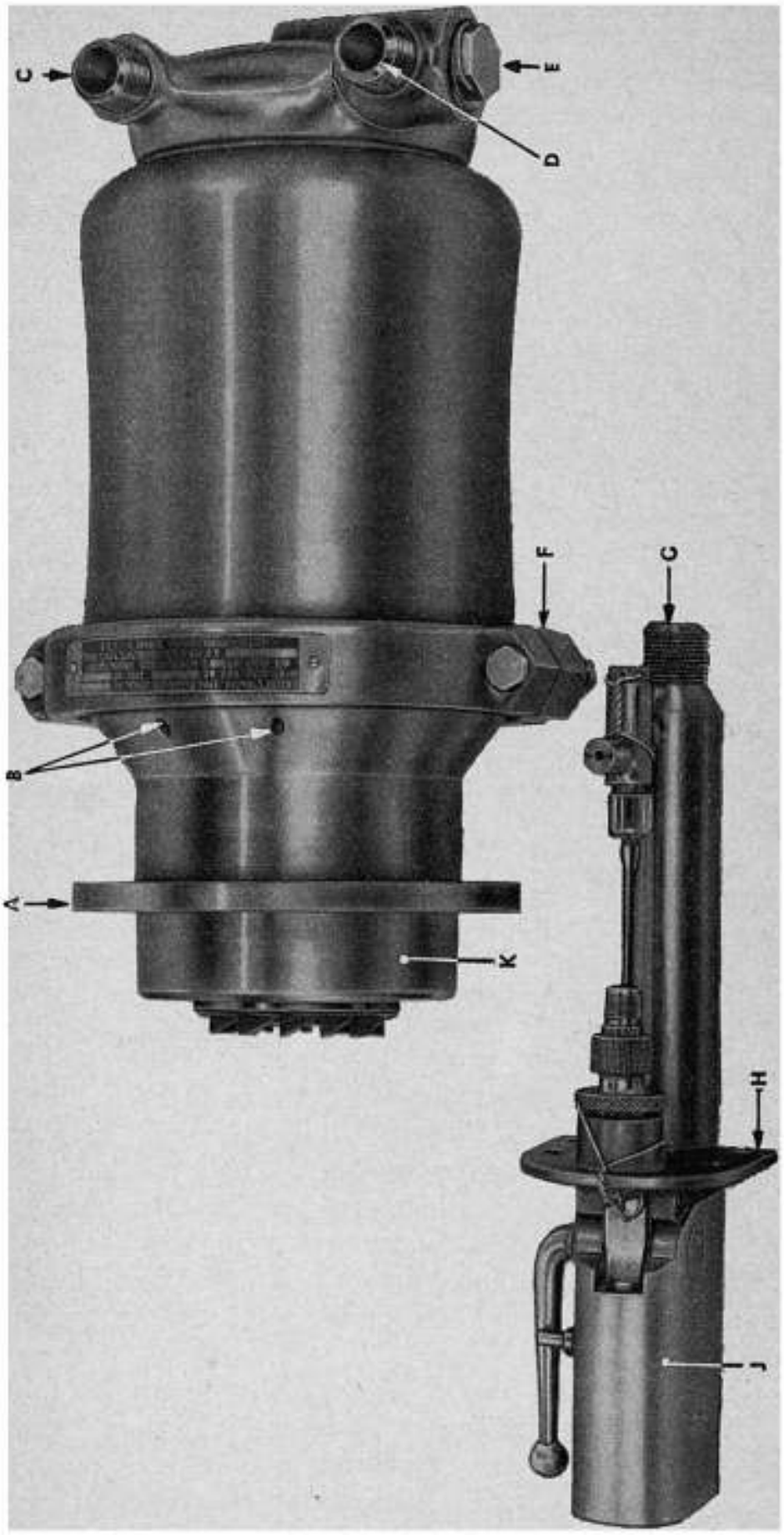
2. General.—The type A breech assembly and the type L4A starter assembly are standard equipment on the Guiberson radial Diesel engine for light and medium tanks M3.

3. Description.—*a.* Cartridge engine starters derive their power for operation from the gas pressure developed when a cartridge is fired. A fresh cartridge is required for each start. The complete starter and breech assemblies consist of—

(1) *Starter unit* (fig. 1).—The starter unit is attached to the engine accessory case and utilizes the gas pressure developed by the firing of the cartridge to revolve the crankshaft of the engine.

(2) *Breech assembly* (fig. 1).—This assembly is in the fighting compartment and is the mechanism in which the cartridge is fired.

(3) *Intake tube assembly.*—This assembly transmits the gas pressure from the breech assembly to the starter unit.



RA PD 5878

A. Starter unit mounting flange.
B. Vent holes.
C. Intake connection.
D. Exhaust connection.
E. Safety disk holder assembly.
F. Cylinder clamp split ring set.
G. Intake connection.
H. Breech assembly mounting flange.
J. Type A breech assembly.
K. Type L4A starter unit.

FIGURE 1.—Breeze type A breech assembly and type L4A starter unit.

(4) *Exhaust tube.*—The exhaust tube releases the gas pressure from the starter unit to the atmosphere.

(5) *Safety disk and holder* (fig. 2).—This screw plug assembly screws into the combustion chamber of the starter. When the pressure in the starter unit exceeds 3,000 pounds per square inch, the safety disk ruptures and the pressure is transmitted to the atmosphere.

b. At present the Ordnance Department issues the "102" cartridges for summer use, and the "104" cartridges for winter use. Figure 15 illustrates the 102 starter cartridge.

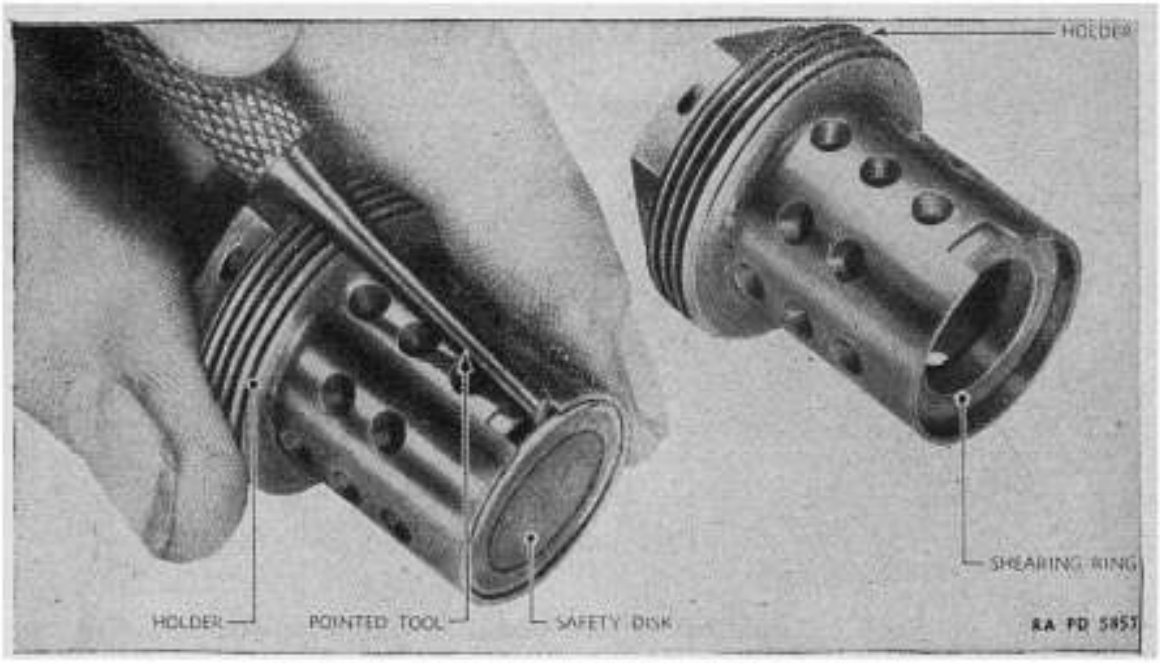


FIGURE 2.—Cartridge starter safety disk holder.

4. Starter unit construction (fig. 1).—The starter unit consists of the following assemblies and parts:

a. Safety disk holder assembly (fig. 2).—This stainless steel assembly, composed of a holder and shearing ring, screws into the combustion chamber near the exhaust tube. Its function is to provide a holder for the easily removable safety disk. The shearing ring is a light press fit in the holder. Replace the shearing ring if it is nicked or scratched. This is necessary because a pressure of 3,000 pounds per square inch is required to shear the copper safety disk which seats on the shearing ring. Scratches or nicks on the shearing ring will cause the safety disk to shear at a lower pressure, and full torque will not be obtained from the starter unit.

b. Safety disk assembly (fig. 2).—This assembly is composed of light sheet copper on one side and asbestos on the other side. Install a new safety disk when the starter unit is overhauled. Install with the asbestos side out (toward the flame in the combustion chamber). The

A. Exhaust tube connection.
B. Safety disk holder assembly.
C. Exhaust valve seat.
D. Fuel combustion chamber.
E. Exhaust valve ball.
F. Exhaust valve spring.
G. Exhaust valve housing.
H. Spacer.
J. Clip.
K. Cylinder clamp ring bolt.
L. Plain washer.
M. Nut.
N. Exhaust valve control bolt.
P. Exhaust valve control bolt nut.
Q. Cylinder clamp ring.
R. Housing assembly.
S. Hub assembly.
T. Shoulder.
U. Cylinder.
V. Perforated disk.
W. Combustion chamber gasket.
X. Intake tube connection.
Y. Exhaust valve.

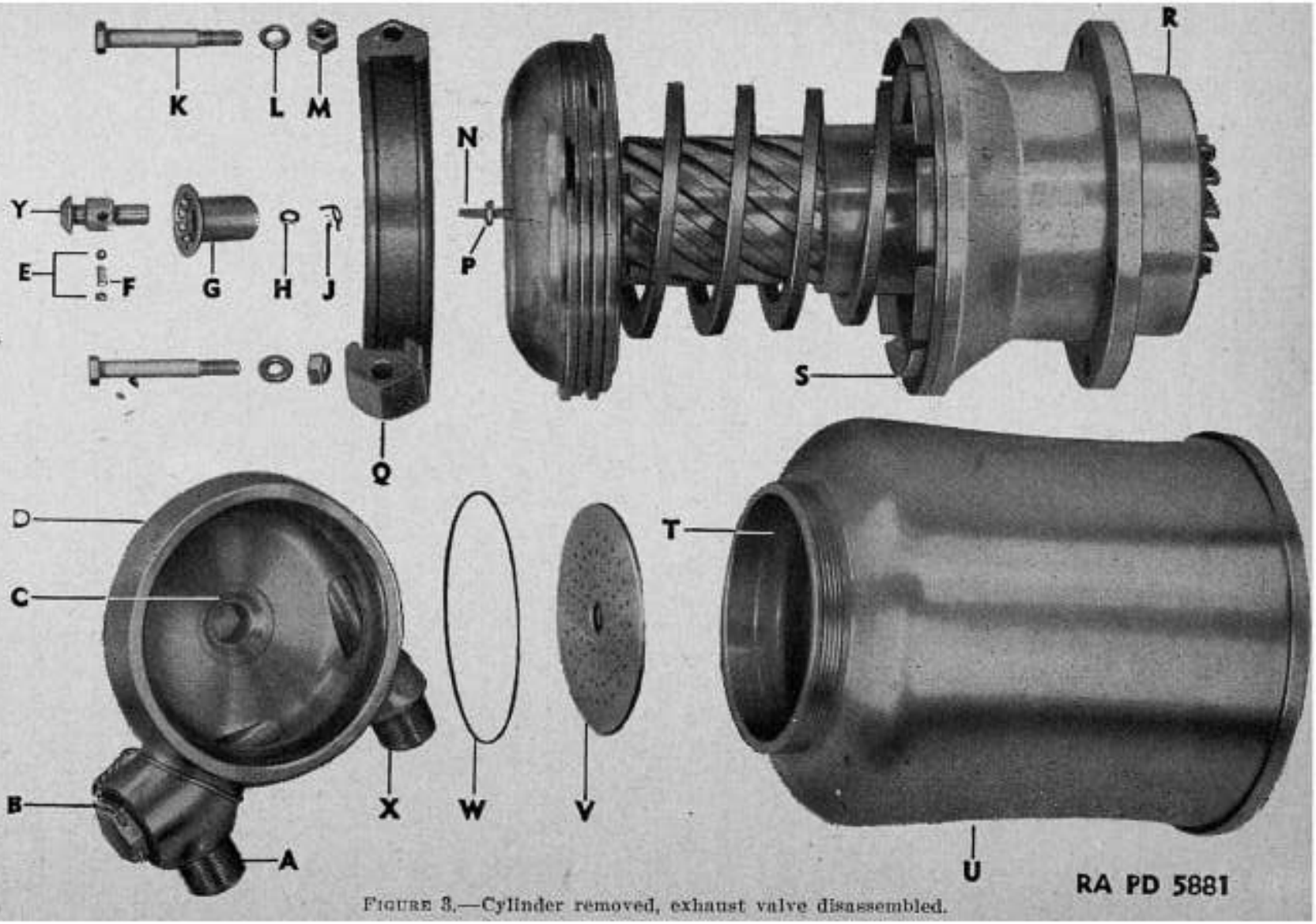


FIGURE 3.—Cylinder removed, exhaust valve disassembled.

copper side must make good contact with the shearing ring in order that the copper may shear at the correct pressure.

c. Fuel combustion chamber (fig. 3).—This stainless steel forging is attached to the cylinder by a milled thread. A soft copper gasket between the cylinder and combustion chamber forms a seal for the pressure developed when a cartridge is fired. The exhaust valve seat, exhaust and intake tubes, and safety disk holder assembly are attached to the combustion chamber.

d. Cylinder (fig. 3).—This part is machined from a stainless steel forging. A male milled thread is on the smaller end for attaching the fuel combustion chamber. A perforated disk is held in place against a shoulder by the exhaust valve housing. This disk prevents unburned pellets of powder from the cartridge from becoming wedged between the piston head and cylinder. The larger end of the cylinder has a flange which permits the cylinder to be attached to the starter unit by a clamp ring set.

e. Cylinder clamp split ring set (fig. 1).—These half circle rings are made of stainless steel forgings and are furnished in pairs. If one part of the set becomes defective, replace with a new set. This is necessary because each half is mated to the other. A wide groove machined in the inside surface of the ring set permits the housing cylinder (fig. 3) and the hub assembly to be attached together. The ring set is held in place by two bolts and safety nuts. The deeper shoulder formed by the groove in the ring set is *always* placed toward the housing. The force against the flanges of the housing and cylinder is approximately 30 tons when a cartridge is fired. This same force is exerted against the shoulders of the split ring set. Improper installation of the split ring set may result in destruction of the starter unit.

f. Exhaust valve mechanism (fig. 3).—The exhaust valve, housing, and bolt are made of stainless steel. The bolt screws into the valve and is locked in place by a spacer, clip, and jam nut. The exhaust valve closing and opening springs control the amount of force exerted upon the bolt and seat of the valve. A hole drilled through the stem of the exhaust valve provides a guide for two steel balls and an exhaust valve control compression spring. The housing of the exhaust valve provides a guide for the exhaust valve stem, and a grove in which the balls are forced by the spring provides a means of keeping the exhaust open until the piston returns to its original position. The exhaust valve housing is held in place between the perforated disk and combustion chamber. The housing is held in alinement with the exhaust valve seat by the small end of the housing

passing through the hole in the center of the perforated disk; the larger end of the housing fits into a counterbored recess in the combustion chamber which is concentric with the exhaust valve seat.

g. Piston, piston rings, starter jaw bolt, and spiral coil spring (fig. 4).—The piston is a bronze forging, carrying four conventional piston rings and is attached to the bronze internal and external helical splined shaft by a lock ring. Thus the splined shaft which is attached to the piston is free to turn on the piston head.

(1) The following procedure is used in assembling the starter jaw bolt to the piston (fig. 5):

(*a*) The bolt is screwed into the under side of the piston head until the threaded end of the bolt seats firmly against the head of the piston.

(*b*) Working from the combustion chamber side of the piston head, drill a hole, parallel with the axis of the bolt, through the piston head and into the bolt in such a way that half the drill diameter is in the bolt and half in the boss of the piston.

(*c*) The hole is then counterbored to a sufficient depth to permit the head of the set screw to be flush with the head of the piston.

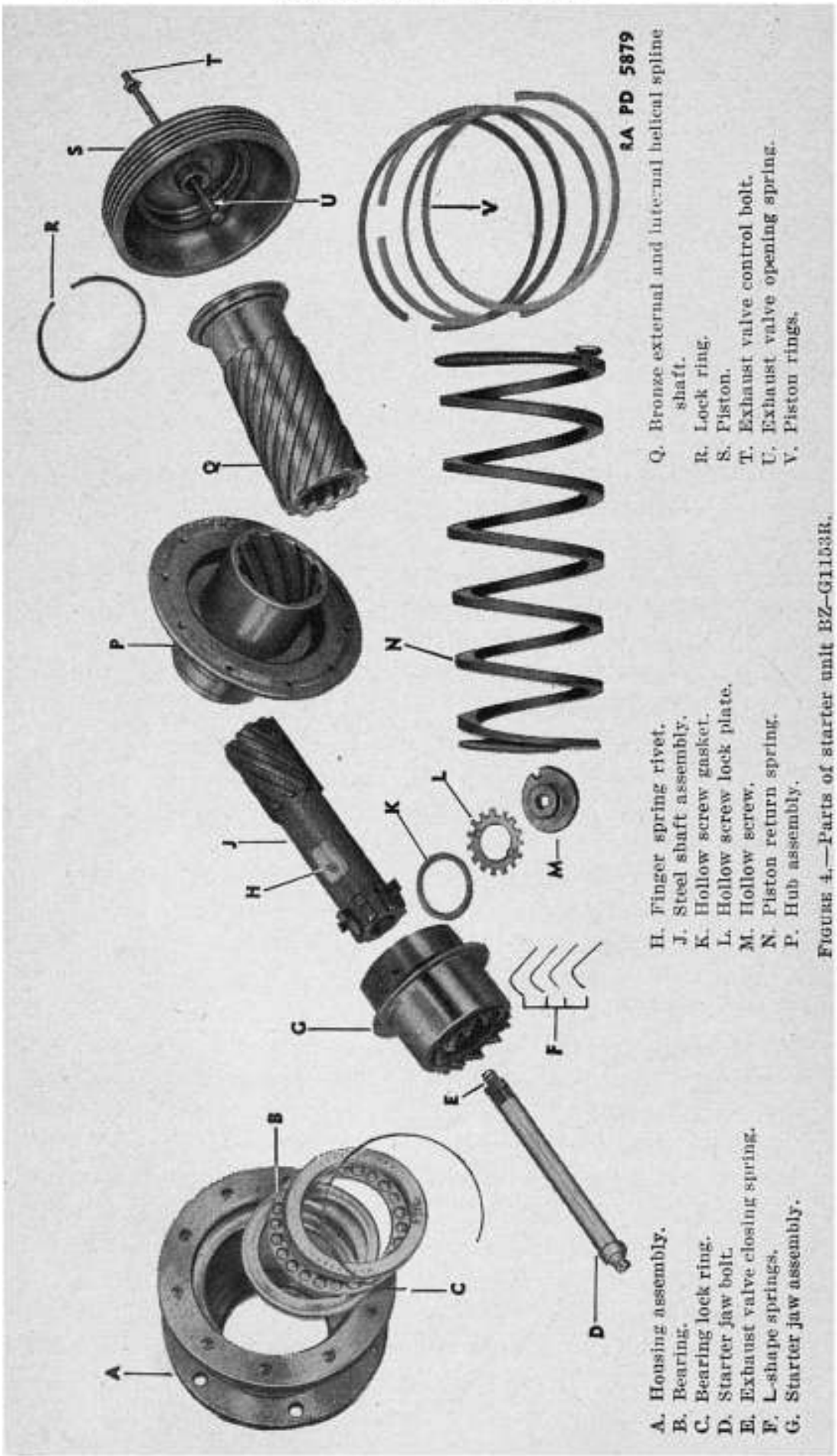
(*d*) The started jaw bolt is removed and the hole in the piston is tapped with a 8–32NC–2 tap.

(*e*) This procedure makes the starter jaw bolt mated with the piston. The head of the starter jaw bolt prevents the piston from striking the cylinder head and has a screw driver slot to permit assembly to the piston head.

(2) The large taper spiral coil spring (fig. 4), which returns the piston to its original position when the exhaust valve opens, requires a pressure of approximately 675 pounds to collapse its coils. This spring exerts 290 pounds against the piston head with the piston in the normal position. The larger end of the spring rests against the piston head and the smaller end against the housing. Cold drawn annealed steel is used to make this spring. The free length varies between 9¾ and 10½ inches.

h. Bronze internal and external helical splined shaft (fig. 4).—This shaft, made of case manganese bronze, is loosely attached to the piston head by means of a lock ring. The exterior helical splines mesh with the interior helical splines of the hub assembly. The interior helical splines of the shaft mesh with the exterior splines of the steel shaft assembly.

i. Hub assembly (fig. 4).—This assembly consists of a steel forging and a pressed-on bronze bearing. The exterior surface of the bronze bearing is machined concentric with the internal helical



A. Housing assembly.
B. Bearing.
C. Bearing lock ring.
D. Starter jaw bolt.
E. Exhaust valve closing spring.
F. L-shape springs.
G. Starter jaw assembly.
H. Finger spring rivet.
J. Steel shaft assembly.
K. Hollow screw gasket.
L. Hollow screw lock plate.
M. Hollow screw.
N. Piston return spring.
P. Hub assembly.
Q. Bronze external and internal helical spline shaft.
R. Lock ring.
S. Piston.
T. Exhaust valve control bolt.
U. Exhaust valve opening spring.
V. Piston rings.

FIGURE 4.—Parts of starter unit EZ–G1153R.