POWDER ACTUATED STUD DRIVER

1. GENERAL

1.11 It is the purpose of this sec to inform Installation of the specific requirements and installation procedures on driving a threaded stud or pin into concrete walls, columns and ceilings with an R-4716 Low Velocity Powder Actuated Tool for support of lightweight objects.

1.12 The Powder Actuated Fastening System is an acceptable method of making instantaneous forced entry fastenings into various construction materials; i.e. concrete, concrete block and mortar joints.

The system consists of:

A. A Tool
B. A Fastener
C. A Power Load

Although this system is simple to use, there are precautions and safeguards that must be observed. The information and instructions provided herein will prepare the installer in becoming a qualified operator of the R-4716 Tool which is a "Hilti" DX400B Low Velocity Powder Actuated Tool.

1.13 Once the interval on the operation of supporting lightweight objects is known, it will be necessary for the supervisor on the job to contact a local Hilti Representative and have him give the installer a written examination for becoming a qualified operator. Upon completing the examination and the results are satisfactory, the Hilti Instructor will issue what is known as a Qualified Operator's Card, records of which are kept by certain Regulatory Agencies. (Refer to attached listing of representatives.)

NOTE 1: Only properly trained installers as defined in PAR. 1.13 of this sec, shall be authorized to operate the stud driver. Any authorized person with a stud driver in his possession shall neither allow unqualified persons to operate or handle the driver, nor leave the driver where it will be accessible to unauthorized persons.

NOTE 2: A qualified operator of a Powder Actuated Tool must be 21 years of age and able to read the English Language.

NOTICE - NOT FOR USE OR DISCLOSURE OUTSIDE THE BELL SYSTEM EXCEPT UNDER WRITTEN AGREEMENT

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2. INSTRUCTIONS

2.1 Installing Equipment.

2.11 Wall, Column and Ceiling Anchoring Tools.

2.12 The R-4716 Low Velocity Powder Actuated Tool shall be used for driving threaded studs or pins for installations having more than 5 fastenings.

NOTE: A sign, at least 8" x 10", using boldface type no less than 1" in height, shall be posted in plain sight on all installations where Powder Actuated Tools are used. The sign shall bear wording as follows: "Powder Actuated Tool In Use." A suitable sign is the R-4004 Item 2. It will be necessary for the installer to print the above wording.

2.13 The R-4416 Roto - Stop Hammer contained in the 66A Kit, was formerly provided only for jobs requiring anchoring to walls, columns and ceilings. Although, the R-4416 Roto - Stop Hammer is still satisfactory for all jobs, it shall only be used for installations having 5 or less fastenings for supporting lightweight objects.

2.14 The R-4716 Low Velocity Tool is identified by type and class.

A. The indirect - acting type, which we have standardized, is a tool in which the expanding gas of a power load acts on a captive piston which in turn drives the fastener into the work.

B. Low Velocity Class has been determined by ballistic tests (300 feet per second) utilizing the lightest fastener and the strongest power load which will properly chamber in the tool.

NOTE: Do not attempt to alter the stud driver in any way or to operate it with any attachments other than those specifically designed for use with the tool and furnished as a part of TS540.

2.2 Fasteners and Fastening Techniques.

2.21 The fasteners used for the R-4716 are not common nails. They are manufactured from special steel and heat treated to produce a very hard yet ductile fastener. These properties are necessary to permit the fastener to penetrate the base material without breaking.

2.22 The fastener is equipped with some type of tip, washer or other guide member. This guide aligns the fastener in the tool as it is being driven and is usually used to retain the fastener in the tool.

NOTE 1: Do not attempt to drive a fastener into a spalled area in concrete where a previous fastener has failed. Select a new location at least 6" from the spalled area.

NOTE 2: Never drive a fastener into wood, fiberboard, plaster wall, stone, marble, natural rock, glass, glazed tile, brick, slate and drywall.

2.23 There are two basic types of fasteners: Drive Pins and Threaded Studs. The System Equipment Engineer will provide the fastener within his specification, depending on the type of equipment to be supported to building surface; i.e., FS - Kondu Fittings would require a drive pin, Conduit would require a threaded stud.

2.231 The Drive Pin, which is a special nail-like fastener, is designed to permanently attach one material to another, such as wood to concrete. Head diameters are generally 1/4", 5/16 of 3/8". However, for additional head bearing in conjunction with soft materials, washers of various diameters are either fastened through or made a part of the drive pin assembly.

2.232 The Threaded Stud, which is a fastener, is comprised of a shank portion which is driven into the base material and a threaded portion to which an object can be attached with a nut. The threaded stud size is a 1/4"-20.

2.24 The material into which the fastener shank is driven and from which holding power is obtained is known as the base material. The base materials that we will be fastening to, at this time, will be concrete, concrete block and mortar joints. However, it is very important that the Qualified Operator be able to determine the suitability of any base material into which he tends to drive a fastener.

2.241 The following procedure shall be performed on questionable material to be driven through and attached to the base material. Soft materials to be attached need not be tested. Center punch material with fastener.

a. If the material shows a clear fastener point impression and the fastener point is not blunted, proceed with the fastening.

b. If fastener point is blunted, material is too hard.

c. If material cracks or shatters, material is too brittle.

d. If fastener sinks into material with an average hammer blow, the material is too soft.

2.242 If in doubt on the center punch test for determining satisfactory base material, consult the local Tool Manufacturer's Representative in your area before attempting to fasten.

2.25 It is important to understand what happens when a fastener is driven into any masonry material and why the fastener holds. The holding power of the fastener results primarily from a compression bond of the masonry to the fastener shank. The fastener, on penetration, displaces the masonry which tries to return to its original form and exerts a squeezing effect. When the depth of penetration produces a bond on the fastener shank equal to the strength of the masonry, the maximum holding power results.

2.251 For soft masonry (approximately 2,000 to 2,500 psi) penetration should be equal to approximately 9 to 10 times the shank diameter.

2.252 For average masonry (approximately 3,500 to 4,000 psi) penetration should be equal to approximately 7 to 8 times the shank diameter.

2.253 For hard masonry (approximately 5,000 to 6,000 psi) penetration should be equal to approximately 5 to 6 times the shank diameter.

NOTE 1: Do not attempt to drive a fastener through an existing hole or too close to the edge of any work surface.

NOTE 2: Drive at least 3" from the unsupported edge of concrete.

NOTE 3: Recommended minimum fastener spacing based on shank diameter is 6".

NOTE 4: It is important that the masonry be at least three times as thick as the fastener penetration.

NOTE 5: Fastening into mortar joints should only be attempted in the horizontal joint.

2.26 If it should become necessary for the Installer to select a proper drive pin, allow for the thickness of material through which the drive pin is to be driven, (X) plus the depth of penetration required (Y), utilizing the preceding shank diameter - penetration rules will determine the proper pin length. (FIG. A)

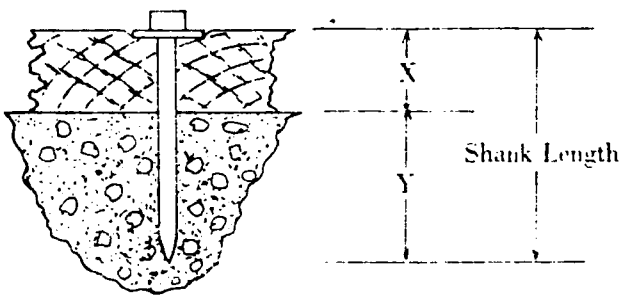


FIG. A

2.27 The proper threaded stud shank length is determined by using the preceding shank diameter - penetration rules, select a thread length to allow for the thickness of the material to be attached and a nut and washer. (FIG. B)

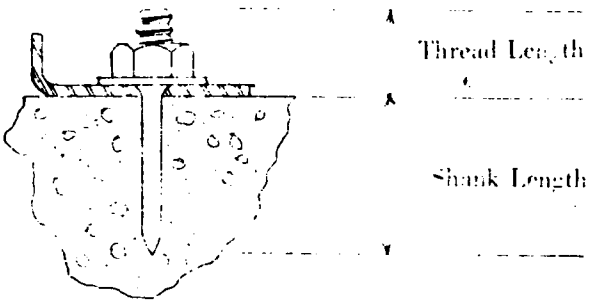


FIG. B

3. POWER LOADS

3.1 Type of Power Load.

3.11 The power load is a unique, portable, self-contained energy source used in powder actuated tools. The power loads (R-4719, R-4720 and R-4721) which we have standardized are cased power loads contained in a metallic case which is a Rim-fire cartridge. The primer is situated in the rim of the base. To affect ignition it is necessary for the rim to be struck, thereby, compressing the primer and causing it to ignite. The cartridges are .27 caliber, brass cases and crimped. The three basic color codes which we have standardized are green, yellow and red. Each cased power load is clearly identified on one end by its power level color. Refer to Table A.

POWER LEVEL	LOAD TYPE	CASE COLOR	LOAD COLOR
3	LIGHT	BRASS	GREEN
4	MEDIUM	BRASS	YELLOW
5	HEAVY	BRASS	RED

TABLE A

NOTE 1: Any person involved in the shipping and packaging of the R-4719, R-4720 and R-4721 Boosters must be familiar with the following prescribed methods and procedure for shipping and packaging Hazardous Material.

HAZARDOUS MATERIAL PACKAGING AND SHIPPING METHODS

1. CARTRIDGE PACKAGING

1.1 Cartridges (R-4719, R-4720, and R-4721) must be kept dry and not removed from their original containers until time of being used.

1.2 Cartridges shall not be packaged loose, i.e., less than 100. (Manufacturer's standard count per container is 100.)

1.3 Cartridge containers must be packaged in pasteboard or other inside boxes, or in partitions designed to fit snugly in the outside packaging.

1.4 The inside boxes and partitions must be packaged in secured closed strong outside wooden or fiberboard boxes. The present standardized R-4448 Fiberboard Cartons are satisfactory for cartridge packaging.

1.5 Maximum quantity of R-4719, R-4720, and R-4721 Cartridges in one package for all Truck Line Carriers is 50 pounds.

1.51 Passenger carrying aircraft or railcar is 50 pounds.

1.52 Cargo, only aircraft, is 150 pounds.

1.6 Stapling devices or any other method that will puncture the fiberboard is prohibited in sealing cartons.

2. MARKING HAZARDOUS MATERIAL

2.1 Each package must be plainly marked "SMALL ARMS AMMUNITION".

2.2 The marking must be durable in English and printed on or affixed to the surface of a package or on a label, tag, or sign.

2.3 The marking or label must be displayed on a background of sharply contrasting color.

2.4 The marking or label must be unobscured by labels or attachments.

2.5 The marking or label must be located away from any other marking that could substantially reduce its effectiveness.

3. HAZARDOUS MATERIAL LABEL

3.1 In compliance with Hazardous Material Regulations, 49CFR172.101, labels are not required for use on packages of .27 Caliber Cartridges which have been defined as SMALL ARMS AMMUNITION. Although the rules state no labels are required, Common Installation Engineeing, along with the consent of our Safety Organization, feel that the label will immediately identify the contents of the package and will give proper attention as to care and storage. Therefore, NO person may offer for transportation a package containing a hazardous material unless that package is conspicuously labeled.

HAZARDOUS MATERIAL LABEL (Cont'd)

3.2 The type of label for the R-4719, R-4720, and R-4721 Cartridges is a self-adhesive 4" diamond (square-on-point) decal, orange background with black inscription "EXPLOSIVE C". An Installation "R" number, 4755, has been assigned for such a label.

4. SHIPPING PAPERS (BILL OF LADING)

4.1 Types of Packages: i.e., Box.

4.2 The proper shipping name of the hazardous material must be indicated for description: i.e., SMALL ARMS AMMUNITION.

4.3 Hazard Class: i.e., Class "C" Explosive.

4.4 Total Weight: i.e., 10 LBS.

5. SHIPPER'S CERTIFICATION

5.1 A shipper's certification is required when a person offers a hazardous material for transportation. The person shall certify in writing that the material has been presented for transportation in accordance to the rules and regualtions of the Department of Transportation.

5.2 Shipments by truck lines, with the exception of UPS, shall be typed on the shipping paper containing the required shipping description statement as follows:

> This is to certify that the above-named materials are properly classified, described, packaged, marked, and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

5.3 Shipments by airlines require the preceding statement along with the following:

> This shipment is within the limitations prescribed for passenger aircraft/cargo only aircraft.

5.31 If shipment is less than 50 pounds, cross off "cargo only aircraft".

NOTE 2: For the storage of the R-4716 Powder Actuated Tools and associated R-4719, R-4720 and R-4721 Boosters within Operating Telephone Company building, refer to the following rules and regulations:

5.311 The person shipping hazardous material shall sign his or hers full signature on Shipper's Certification Statement.

I. R-4716 POWDER ACTUATED TOOLS AND BOOSTERS

1. General

1.1 Not more than one (1) shipping crate of 2,400 boosters shall be stored in any single Telephone Company building.

1.11 The crate of 2,400 boosters shall be stored in a cabinet similar to the design of a UL approved Flammable Storage Cabinet (R-4237).

1.12 The R-4237 Cabinet and 2,400 boosters shall be placed in an enclosed storeroom, free of flammable or combustible materials, and the storeroom door(s) shall be kept locked except during the time needed to gain access.

1.2 Not more than 1,200 boosters (100 boosters per individual container) can be stored on an open shelf within an enclosed storeroom, free of flammable and combustible materials, and the storeroom door(s) shall be kept locked except during the time needed to gain access.

1.3 Not more than three (3) containers of booster loads totaling three hundred (300) shall be allowed on each floor of a Telephone Company building.

1.31 Boosters shall be kept in original packages completely separated from other boosters of varied force.

1.32 Boosters may be stored in the carrying case or enclosure used for storage of powder actuated tools.

1.4 The explosive actuated tool and all unused boosters shall be returned to the appropriate storeroom at the end of each work day or during extended periods of time when the tool is not in use.

1.41 Loaded tools shall not be placed in the storage box.

3.2 Selection of Power Loads

3.21 In selecting the proper power load to use for any application, it is important to start with the lightest power level recommended for the R-4716. (Refer to PAR. 3.11, Table A.) Using the lightest load, if the first test fastener does not penetrate to the desired depth, the next higher power load should be tried. If necessary, continue increasing power levels by single steps until proper penetration is obtained.

NOTE 1: If a misfire should occur, continue to hold the driver against the work surface for at least 30 seconds. Then make a second attempt to fire. If this attempt should fail, wait an additional 30 seconds, open the tool and remove the cartridge before moving the tool away from the work surface. Defective cartridges or misfires shall not be discarded into trash or refuse containers. They shall be rendered inactive by being soaked for a minimum of one hour in a light oil (SAE #10 or lighter) and then discard cartridges and oil in closed container into refuse containers.

NOTE 2: Cartridges must be kept dry in their original boxes. Carrying loose cartridges in pockets are forbidden.

NOTE 3: Do not attempt to use any other type of cartridge other than Hilti .27 caliber cartridges. Use the cartridge for its intended purpose only.

NOTE 4: Never attempt to force a power load into a tool chamber.

NOTE 5: Always check the color of each power load before inserting it into the tool chamber.

NOTE 6: Do not load the stud driver until ready to use it. If work is interrupted after loading, unload the stud driver immediately. The stud driver shall never be moved from job to job or carried from one location to another while it is loaded.

NOTE 7: Do not leave tool unattended for any length of time. If so, place in carrying case and lock with R-2558 Padlock. If it is an extended length of time (several hours) return to locked storage area.

4. OPERATION

4.1 Operating, Cleaning and Maintenance of the R-4716.

A. With the empty tool closed and locked, insert the head of the fastener into the piston recess. Push back until the fastener is held by the magnet in the baseplate. (See Fig. C)

NOTE 1: Always be sure to use the correct fastener - piston combination.

NOTE 2: If the piston is too far back in the baseplate, press the latter back as far as possible, which will bring the piston forward.

FIG. C

B. Rotate the front end of the tool to unlock, pull forward and lower to open the tool. (See Fig. D.)

FIG. D

C. Insert the booster flush in the chamber. (See Fig. E.)

FIG. E

D. Raise rear end to align with grip, pull back to mate parts and rotate to locked position. (See Fig. F.)

FIG. F

E. Line up scribe marks on baseplate with layout lines (when necessary). Press tool firmly against work surface and squeeze trigger. (See Fig. G.)

NOTE 1: Keep face and hands away front the sides of the shield when firing the tool.

NOTE 2: Be sure the tool is perpendicular to the work surface when it is fired.

NOTE 3: If the stud driver develops any defect during use, the installer shall immediately cease to use it and shall contact local Hilti Representative. (See attached listings.)

NOTE 4: Any person either operating the stud driver or in the proximity of the tool while it is being operated shall wear R-4501 Goggles.

FIG. G

F. To extract the booster case, unlock and open the tool. Swing the front end down and the used booster will be extracted automatically. (See Fig. H.)

FIG. H

G. If booster fails to ignite, refer to PAR. 3.21, Note 1.

NOTE 1: Never place any part of your body, in front of the tool and never point the tool at any person. (See Fig. I.)

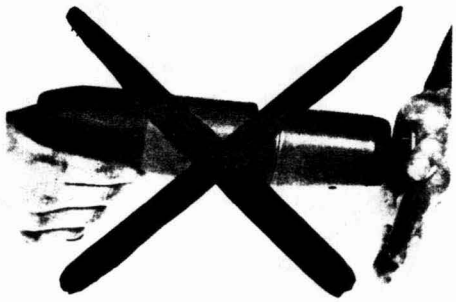


FIG. I

4.11 The tool shall be cleaned daily or after each 1,000 fastenings. If during the cleaning operation, it is found that repair work is required on the tool, a Hilti Representative within your area shall be contacted. (See attached listings.)

NOTE: You will note that several stop rings (R-4716 Det. 8) are provided in TS540. The reason for this is, frequent over-driving due to use of too strong a booster, too short a fastener, or too little resistance may result in piston breakage or deformation of the stop ring, jamming it on the piston. If a stop ring is deformed, it must be replaced.

A. Place the piston with the jammed stop ring and the stop ring holder front end down on a hard surface. Fit the stop ring extractor over the piston head and force deformed stop ring down and off the piston. (See Fig. J.)

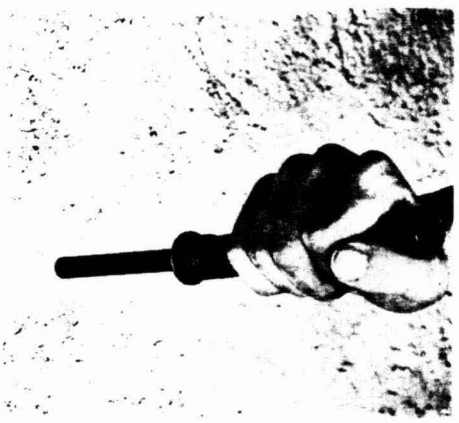


FIG. J

B. Remove the stop ring from the stop ring holder and replace it. (See Fig. K.) A step-by-step procedure for cleaning and maintenance is as follows:

FIG. K

1. Disassemble the front end of tool. Use care in removing the front cap since it is under spring tension. Push back the retaining latch and turn the front cap a quarter turn. (See Fig. L.)

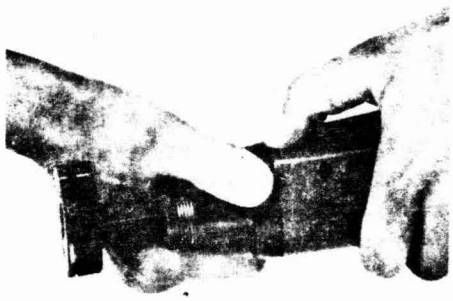


FIG. L

2. Remove operating assembly. (See Fig. M.)

FIG. M

3. Remove pressure spring. (See Fig. N.)

FIG. N

4. Remove the piston and stop ring holder from the quide sleeve. (See Fig. G.)

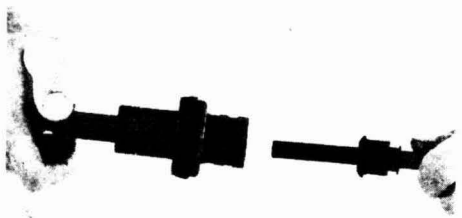


FIG. O

5. Remove the stop ring holder and stop ring from the piston. (See Note). (See Fig. P.)

FIG. P

6. Turn the baseplate a quarter turn and pull it out of the guide sleeve. (See Fig. Q.)

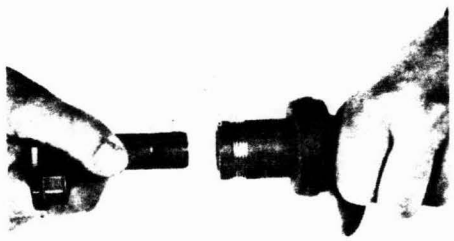


FIG. Q

7. Place the front end cap on the guide sleeve and stand sleeve rear end down on a hard surface. Insert baseplate into the guide sleeve and seat it with a light blow making sure the flats on the baseplate are aligned with the two flat bosses in the guide sleeve. (See Fig. R.)

FIG. R

4.111 To clean the tool, the front end is disassembled as illustrated in Fig's L to R.

8. Push the front end of the tool back through the lock ring as far as it will go to free the chamber bushing. Remove the chamber bushing. (See Fig. S.)

FIG. S

9. Remove the front cap from the guide sleeve. (See Fig. T.)

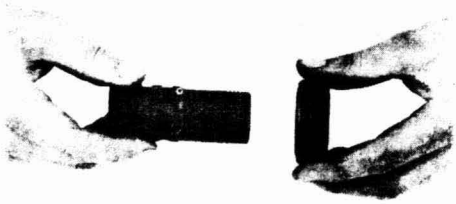


FIG. T

10. Clean the inside rear of the tool body with the round wire brush. (See Fig. U.)

FIG. U

11. Clean the inside front of the tool body with the flat wire brush. (See Fig. V.)

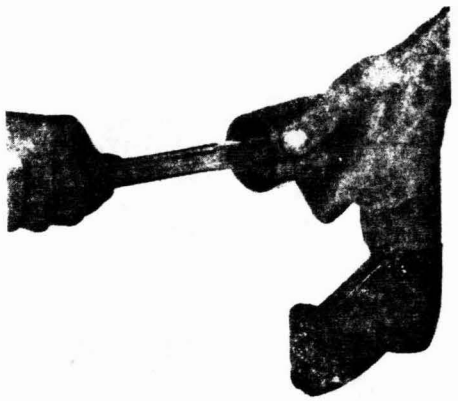


FIG. V

12. Clean the inside of the chamber bushing with the round wire brush, the outside with the flat wire brush, the booster chamber with the .27 caliber bore brush. (See Fig. W.)

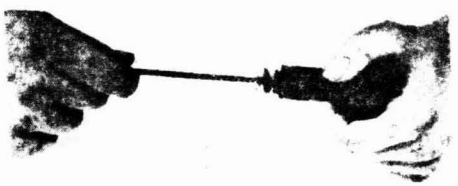


FIG. W

13. Clean the inside of the baseplate using the round brush, the outside using the flat wire brush. (See Fig. X.)

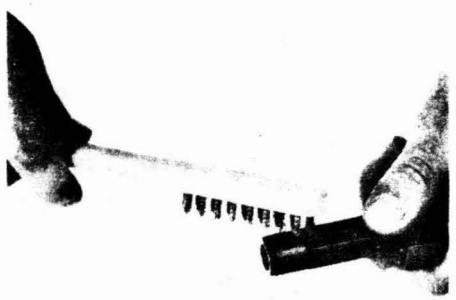


FIG. X

14. Clean the inside and outside of the front cap with the flat wire brush. (See Fig. Y.)

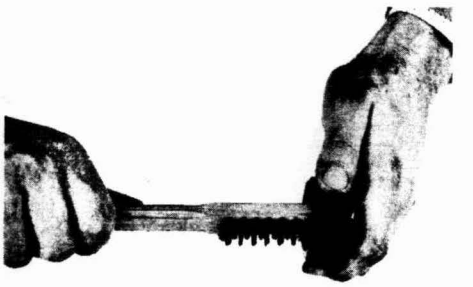


FIG. Y

15. Clean the inside of the quide sleeve with the round wire brush, the outside with the flat wire brush. (See Fig. Z.)

FIG. Z

16. Clean the outside of the stop ring holder with the flat brush, the inside with the round brush. (See Fig. AA.)

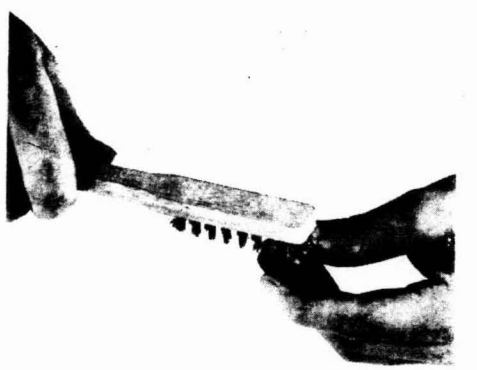


FIG. AA

17. Clean the piston with the flat wire brush. (See Fig. BB.)

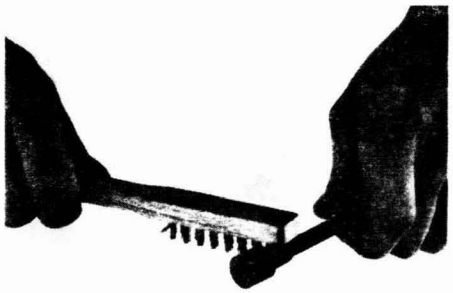
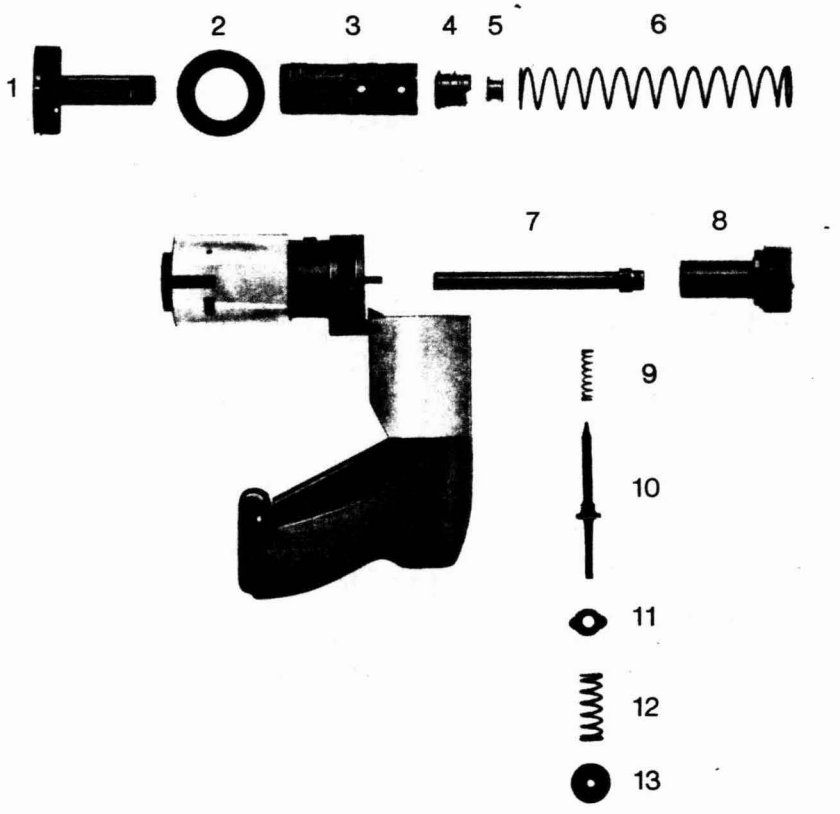


FIG. BB

18. The re-assembly is accomplished in reverse order of disassembly. During the re-assembly, place a light coating of oil on the outer surface of the chamber bushing and pressure spring.

4.12 If at any time the installer and/or the Operating Company is in doubt on building surfaces, fasteners or tool, they may contact the local Hilti Representative in the area or the Regional Offices. Refer to attached listings.

4.121 A pictorial layout of the tool disassembled and each part is named in Fig. CC.



1. Baseplate
2. Front Cap
3. Guide Sleeve
4. Stop Ring Holder
5. Stop Ring
6. Pressure Spring
7. Piston
8. Chamber Bushing
9. Firing Pin Return Spring
10. Firing Pin
11. Firing Pin Guide
12. Firing Pin Spring
13. End Cap

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AM - W. REILLY
FCS- J. DOLAN
617-254-3600

188 Bloomfield Avnue
Caldwell, New Jersey 07006
AM - E. FOLGO
FCS- R. CAMPBELL
201-226-8180

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AM - D. SCORDO
FCS- J. LISTERMAN
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Dallas, Texas 75247
AM - D. FISCHER
FCS- J. PALOMA
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Denver, Colorado 80219
AM - D. DINKEL
FCS- R. McCUTCHAN
303-936-4825

520 Hilton Road
Ferndale, Mich. 48220
AM - V. SBORDON
FCS- D. HUGHES
313-545-3222

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AM- G. KOLBECK
FCS-S. HOFFMEIER
913-722-4550/1008

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702-382-6534

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Long Island City,N.Y.11103
SM - T. CAPUTO
FCS- J. GISONNA
212-278-4850

2930-B S. W. 30th Ave.
Hallandale, Florida 33009
AM - J. RZEPIEJEWSKI
FCS- J. WOODS
304-920-2900

2410 E. Hennepenn Ave.
Minneapolis, Minn. 55413
AM - D. WERNER
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612-331-9155

8001 Chef Menteur-Suite 106
New Orleans, Louisiana 70127
AM - C. WAGER
FCS- M. FALGOUST
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4205 N.W. 10th Street
Okla. City, Okla. 73107
AM - J. TADICH
FCS- W. COULTER
405-943-1311

10184 "L" Street
Omaha, Nebraska 68127
AM - To be assigned
FCS- G. SPENCER
402-592-3212

151 N. 12th St.
Phila. Pa. 19107
AM - D. GILLISPIE
FCS- F. MOFFATT
215-568-7780

1456 N. 27th Ave.
Phoenix, Ariz. 85009
AM - N. RAY
FCS- C. ETHINGTON
602-272-8001

1700 Beaver Ave.Chateau Plza
Pittsburgh, Pa. 15233
AM - W. MARPLE
FCS- M. RYAN
412-231-4000

112 E. Whitlock Street
Salt Lake City, Utah 84115
AM - W. HUGHES
FCS- R. SCOTT
801-487-5986

7864 Raytheon Road
San Diego, Calif. 92111
AM - P. DRALLE
FCS- R. SIMECKA/J. UHLMN
714-278-2626

212 So. Grand Ave.
Santa Ana, Calif. 92701
AM - P. GORMAN
FCS- R. TRAVER
714-278-2626

6122 6th Ave. South
Seattle, Wash. 98101
AM - R. BAKER
FCS- J. PETERSON
206-762-2766

12158 St. Charles Rock Rd.
St. Louis (Bridgeton) Mo. 63044
AM - R. BREITENFELD
FCS- J. CAVENAGH
314-291-2820

4025 W. Kennedy Blvd.
Tampa, Florida 33609
AM - J. COUGHENOUR
FCS- T. CASSIDY
813-870-3904

A-1419 Air Rail Avenue
Virginia Beach, Va. 23455
AM - E. PATTON
FCS- W. COX
804-460-2421

1505 University Blvd.
Langley Park, Md. 20783
AM - R. LOFTIS
FCS- O. THOMAS
301-431-2800

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