THE QUANTZ ROTARY NUTCRACKER

OWNER'S MANUAL

MODEL RX16

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A Description Of The Quantz Rotary Nutcracker:

The Quantz Rotary Nutcracker is an intricate arrangement of precisely actuated pneumatic components. These components are mounted between five circular plates and bolted together to form a rigid structure known as the turret (Figure 1). The turret rotates and is timed to a feed chain assembly. Pressed between plates one and two are sixteen crack cylinder assemblies (the crack cylinder assemblies are discussed in detail below). Located between plates four and five are sixteen air cylinders positioned in line with and facing the crack cylinder assemblies. Plate three contains bushings (piston hubs), which act as a guide for the air cylinder sizing feed pistons. The area between plates two and three is known as the crack station. Plate one contains 4 separate air-oil ports for each of the sixteen crack stations. Five brass valves, mounted in a stationary valve plate, ride on plate one. These valves supply and exhaust the compressed air-oil mixture to the different pneumatic components when aligned with the ports in plate one. The relationship between the brass valves and air-oil ports in plate one control the feed, stress, crack, eject and reset actions of the machine.

The turret has a drive shaft stationed through the center with a drive sprocket at one end. The shaft is placed in pillow blocks and attached to the frame. The frame consists of a hopper, feed assembly and a turret mount area. It also houses the electric motor, lubrication system, pneumatic circuit, singulator system, nut discharge chute and shell discharge chute.

How Does The Quantz Rotary Nutcracker Work?

- The machine requires a source of compressed air and electricity.
- The compressed air is converted into a compressed air-oil mixture, which operates as well as lubricates all pneumatic components.
- The electricity powers the motor, which rotates the feed chain, turret and lubrication gear pump.
- Both the turret's rotation and air pressures are adjustable.
- The feed chain bucket enters the bottom of the hopper and picks up a nut.
- The feed bucket proceeds up the slanted hopper walls and encounters the singulator system.
- The singulator system positions a single nut horizontally in the feed bucket.
- The feed bucket then enters the crack station at the precise time a crack cylinder assembly and opposing piston enter the crack station.
- At that instant, the feed port aligns with the feed valve and a charge of air is sent to the feed piston.
- The piston moves forward, squeezing the nut between the piston rod assembly and the adjacent crack die.
- As the turret rotates, the stress port aligns with the stress valve actuating the piston slightly, stressing the nut to the point of fracture.
- The crack die is reset to the rear of the crack die retainer by this stressing action.

- Simultaneously the crack port aligns with the crack valve applying a charge of air to the rear of the shuttle.
- The shuttle shoots forward into contact with the crack die.
- The shuttle transfers its force, sending the crack die forward and vibrating it, shattering the nutshell.
- The crack die o-ring absorbs the remaining force of the crack die not absorbed by the nut.
- The turret continues to rotate, the eject port aligns with the eject valve retracting the piston and releasing the nut into the nut discharge chute
- The reset port then opens, sending the shuttle to its initial position at the rear of the crack cylinder.
- The shuttle o-ring absorbs the force exerted by the returning shuttle.
- This process is repeated for all six crack stations in one rotation.

A Detailed Look At The Crack Cylinder Assembly
(Figure 2, 3, 5, and 7)

Shuttle O-ring
(Figure 2)

Purpose: To absorb the force of the shuttle when it is reset to the rear of the crack cylinder.

The o-ring is positioned at the inside rear of the crack cylinder. *(Figure 3, 5)* The o-ring permits the passage of compressed air while it prevents the shuttle from contacting turret plate one.

Shuttle
(Figure 2, 7)

Purpose: To convert pneumatic force into a force capable of cracking a nut.

The free-floating shuttle is positioned within the crack cylinder. *(Figure 3,5)* The shuttle is cylindrical in shape and is considered sealed within the crack cylinder bore. *(Figure 3,5)* The shuttle and crack cylinder surfaces are lubricated with oil contained in the compressed air entering the crack cylinder.
During a crack sequence the shuttle goes through the following events:

- At the initial crack position the shuttle is located at the rear of the crack cylinder. *(Figure 3)*
- A charge of compressed air is applied to the rear of the crack cylinder firing the shuttle forward.
- The exhaust port is opened at the front of the crack cylinder allowing the air-oil mixture in front of the shuttle to be exhausted.
- The shuttle impacts the rear flat surface of the crack die transferring its force. *(Figure 5)*

- The shuttle, having less mass than the crack die, rebounds slightly allowing the reset port at the front of crack cylinder to remain open.
- Compressed air from the reset port returns the shuttle to its initial position. *(Figure 3)*

Crack Cylinder
(Figure 2, 7)

Purpose: To create a "gun barrel" for the compressed air to shoot the shuttle towards the crack die.

The crack cylinder is tubular in shape with a smaller machined outside diameter in the front to allow mounting into the crack die hub and in the rear to allow mounting into turret plate one. The crack cylinder has an inside diameter that corresponds to the diameter of the shuttle and allows the shuttle to free-float from front to rear. The clearance between the mating surfaces allows the area between the crack cylinder and shuttle to be considered sealed. The crack cylinder also has an elongated port, at the front, for the resetting of the shuttle and exhaust of the air-oil mixture during the firing of the shuttle.

Crack Cylinder Hub
(Figure 2, 7)

Purpose: To contain the crack die retainer and corresponding crack die.

A threaded crack die hub is pressed on the crack cylinder and allows the containment of the crack die with the crack die retainer *(Figure 3,5)*. It is cylindrical in shape with a smaller diameter at the front to allow for mounting into turret plate two. A large cross-section has been bored and threaded in the front to accept the crack die retainer containing the crack die and a small cross section has been bored at the rear to accept the crack cylinder and to permit the shuttle to contact with the crack die. The crack cylinder hub restricts the rear movement of the crack die. The exhaust/reset port is located in the hub and aligned with the port in the crack cylinder.

Crack Die
(Figure 2, 7)

Purpose: To transfer impact force from the shuttle into force acting directly on the nut.

The crack die, working with the air cylinder piston rod assembly, picks up a pecan from the feed assembly. The crack die is positioned within the crack die retainer. *(Figure 4,6)* The crack die is generally cylindrical with a long, small diameter head, and short, larger diameter body that conforms to the crack die retainer. It contains an inverted conical head surface and a flat rear surface. The crack die has limited front to rear movement, controlled by the crack die retainer and crack die hub. The forward movement of the crack die is dampened by the crack die o-ring.
During the crack sequence the crack die goes through the following events:

- At the initial crack position the crack die is at rest in the rear of the crack die retainer. *(Figure 3,4).*
- As the shuttle strikes the rear surface of the crack die it is propelled forward, an approximate $1/8^{th}$ inch,
- The crack die transfers its force directly to the pecan, compressing and vibrating the nut. *(Figure 5,6)*
- A rubber o-ring positioned between the crack die and crack die retainer absorbs the remaining force. *(Figure 5,6)*
- The crack die is reset to the rear of crack die retainer when a nut is picked up and stressed by an opposite piston. *(Figure 3,4)*

Crack Die O-ring
(Figure 2)

Purpose: To absorb the force from the crack die that is not transferred into the nut.

The o-ring is positioned around the conical head of the crack die and rests on the front lip of the crack die body. *(Figure 3-6)* The o-ring prevents the contact of the crack die with the crack die retainer. The o-ring absorbs the force that is not absorbed by the nut.

Crack Die Retainer
(Figure 2, 7)

Purpose: To position and contain the crack die in the crack die assembly.

A threaded crack die retainer is threaded into the crack die hub centering the crack die and allowing it limited axial movement. *(Figure 3,5)* It is cylindrical in shape, with a deep, large cross-section bore in the rear and a short, small cross-section bore in the front, corresponding with the dimensions of the crack die. The small cross-section bore allows the crack die head to be exposed to the nut. The large cross-section gives the crack die a controlled path of movement by conforming to the crack die body. The crack die retainer prevents side movement and restricts forward movement of the crack die. The crack die retainer, with inserted o-ring, allows for about $1/8^{th}$ inch front to rear movement of crack die, before the crack die begins to compress the o-ring.

MAINTENANCE & OPERATION PROCEDURES

In order for the Quantz Rotary Nutcracker to perform as designed, it is vital that the operator is familiar with both the operation and maintenance procedures. These procedures are stressed in the one-day school offered with the purchase of a machine. The following pages cover most of the key points taught in the class and is intended as a reference for those operating the machinery.

Through out this manual there will be references to specific Quantz Rotary Nutcracker parts by their technical names. Appendix I & II contains pictures of these parts labeled by their technical names. Also to help in the description of some procedures a particular side of the machine will be referenced. The front of the machine is considered the hopper side. The right side contains the controls. The left side contains the nut discharge chute. The rear contains the feed chain trap door.

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REGULATOR CONTROLS & SET POINTS

There are five different pneumatic control points on the Quantz Rotary Nutcracker. They can be adjusted by the manual regulators and monitored by the analog gauges located on the right side of the machine. These control points are described and suggested set points are listed below. Please note that the actual pressures will vary from machine and from product being cracked.

***The crack and stress pressures work together to produce the desired crack result.**

CRACK: *10-25 PSI*

Controls the force at which the shuttle impacts the crack die. The greater the pressure the harder the nut is hit. This pressure should be adjusted to the desired setting by watching the product coming out of the machine.

STRESS: *5-10 PSI*

Controls the resistance of the sizing feed piston holding the nut at the point of cracking. The greater the pressure the more resistance the sizing feed piston has from moving backwards when the nut is hit. This pressure should be adjusted to the desired setting by watching the product coming out of the machine.

FEED: *15-20 PSI*

Controls the extending motion of the feed piston, which picks the nut out of the feed bucket. The actual pressure desired should be the least amount necessary to ensure that all of the pistons extend completely at full operating speed. The pressure should be adjusted by watching the feed pistons as they come around the rear of the machine. (The steel cracking guard may have to removed to watch the feed pistons)

EJECT: *15-25 PSI*

Controls the retracting motion of the feed piston, which drops the cracked nut into the nut discharge chute. The actual pressure desired should be the least amount necessary to ensure the all the pistons retract completely at full operating speed. The pressure should be adjusted by watching the feed pistons as they come around the front of the machine

RESET: *10 PSI*

Controls the resetting of the shuttle to the rear of the crack cylinder for the next crack sequence. ***Always set at 10 PSI.*** Too little will cause the machine to operate improperly and too much will damage the machine.

SPEED CONTROL

The Quantz Rotary Nutcracker has a varying speed control box located on the right side of the machine. The machine has a 0-50 RPM (800 nuts/minute) capability. **Do not rely on the numbers shown with the speed dial, they do not correspond with your machine's setup**. To get a true reading of the machine's RPM count the rotations manually by resting a finger on the inside lip of the drive shaft pillow block referencing the setscrew rotation. **The machine will not operate properly at very slow speeds.** The air ports must open rapidly to give an instant burst of compressed air to specific components.

PNEUMATIC CIRCUIT

Air enters the machine through the air intake assembly. This consists of a ball valve and an in-line filter. (The filter should not be the only form of air filtration for the Quantz Rotary Nutcracker. There should be other precautions taken upstream to ensure that all water and other contaminates are properly filtered from the air stream. Water and small particles are very hazardous to the machine's operation. Therefore periodically drain the in-line filter.) From the in-line filter the air enters a horizontal air leg located below the right side control panel. The horizontal air leg directs the airflow to the five pneumatic regulators, main air pressure gauge and low-pressure cut-off switch. (There is a secondary regulator in-line with the reset regulator. It ensures the reset pressure does not go beyond 10 PSI. **DO NOT TAMPER WITH THIS REGULATOR.**) From the regulators the air branches to the control gauges and to the brass valves. Before the air enters the control gauges it must pass through needle valves attached to the rear of the gauges. The needle valves prevent the gauge indicator from bouncing during operation. (Be careful with the needle valve adjustment, too much will cause the indicator to stick and too little will cause the indicator to bounce.)

***If the main air pressure is below 15 PSI then the low-pressure cut-off switch activates, turning off the motor's power.**

LUBRICATION SYSTEM

The lubrication system consists of a reservoir, filter, pump, 4-way junction, 50 lb. check valve, gauge, 7-way junction, 5 lb. check valves, metering valves, supply lines and return lines (refer to figure 8). The reservoir holds up to 12 quarts of type F transmission fluid, which is pulled through the filter by the oil pump and sent to the 4-way junction. The fluid is then distributed to the oil gauge; 50 lb. check valve and 7way-junction. The 50 lb. check valve, which is in a return line to the reservoir, allows the system to operate at a constant pressure of 50 PSI. In this system the 7-way junction has one inlet and five outlets. At each outlet a 5 lb. check valve is used to prevent the lubricant from draining out of the system when the machine is not in use. From the check valves the lubricant goes through CSA 0 metering valves which control the flow rate of the lubricant into the turret's pneumatic circuit. The type F transmission fluid not only lubricates but also flushes the system clean. The lubricant drains from the turret into the reservoir and back through the filter. Periodically check the oil level to ensure the machine has plenty of oil.

REPLACING CRACK DIES, O-RINGS & SHUTTLES

The crack die, crack die o-ring and shuttle are regular maintenance parts that need to be maintained to ensure proper machine operation. There are several factors that determine the maintenance schedule for these parts therefore it varies for every operation. The o-rings begin to disintegrate when they become worn, causing the crack die to have more movement resulting in damage to the nut and crack die. The crack die and shuttle will show very little signs of wear on the exterior but deteriorate interiorly. If any of these parts are ignored they could cause damage to the machine. As a reference point, running 24 hours a day 7 days a week the following schedule could apply:

14 days – replace crack die o-Rings
28 days – replace crack die o-rings and crack die, take shuttle out and flip it 180 degrees and reinsert
42 days – replace crack die o-rings
56 days – replace crack die o-rings, crack die and shuttle
Repeat

***This is only a reference. Check your machine periodically to determine your maintenance schedule.**

To perform maintenance on these parts refer to the following steps:

1. Turn off main air supply and unplug power supply.
2. Clean crack cylinder retainer face.
3. Remove the upper inspection plug.
4. Loosen first retainer set screw.
5. Remove crack cylinder retainer using the spanner wrench provided with the machine. (You may want to remove the steel cracking guard to allow easier access to the cracking components.)
6. Rotate open crack cylinder to the 12 o'clock position (top dead center).
7. Take note of the reset o-ring in the rear of the crack cylinder (by looking through the port exposed by the inspection cover), replace if missing.
8. Remove shuttle by inserting a soft piece of tubing into the port exposed by the inspection cover and pushing on the shuttle.
9. Clean crack cylinder and crack cylinder retainer with a clean rag.
10. Insert a new shuttle.
11. Check crack cylinder o-ring seal located at the base of the threaded crack cylinder hub, replace if damaged.
12. Lubricate new crack die o-ring and crack die and replace in crack cylinder retainer.
13. Check to make sure crack cylinder retainer lock brass is in position behind the retainer set screw.
14. Replace crack cylinder retainer, tighten retainer set screw, and proceed to the next crack cylinder.

REPLACING FEED CHAIN

1. Remove all pecans from machine.
2. Turn off all regulators except the eject and reset and run the machine to ensure all feed pistons are retracted.
3. Rotate turret until the master bucket reaches the rear of the machine and is accessible (the master bucket has a M stamped on the side).
4. Remove the singulator flap arm and slide the singulator wire out of the way.
5. Remove the master bucket by removing the setscrews and pressing the rods out of the bucket. Remove the master link of the chain.
6. Pull the feed chain from the top while maintaining tension on the low end.
7. Feed replacement chain from top, down feed track and retrieve from under the bottom sprocket.
8. Pull until the master link reaches the original position.
9. Replace master link and new master bucket.

***Always reset timing and height adjustment after replacing the chain.**

TIMING SEQUENCE

In order for the Quantz Rotary Nutcracker to perform as designed, it is vital that the piston end to end picks up the nuts. To achieve this the piston must enter the center of the feed bucket, both the vertical center and horizontal center. The following information should assist in achieving proper piston positioning in the feed bucket. When timing the Quantz Rotary Nutcracker, one must stand at the rear of the machine. The rear is the side opposite the hopper, containing the trap door.

1 Run the machine with the Feed and Stress air pressure off to retract all pistons. Stop the machine with cylinder 4,8,12 or 16 at top dead center.

2 Unscrew the timing pin from the housing located in the red valve plate. Slowly rotate the turret while looking at the #1 turret plate through the threaded hole of the timing pin housing. Align one of the four holes in the #1 plate with the threaded hole in the timing pin housing. The machine can be turned by hand to center the timing hole but remember to rotate the machine only in the direction it normally rotates. Turn the timing pin around and insert into the housing. The timing pin knob should be flush against the housing. The turret is now locked at bottom dead center.

3 Loosen the adjustable keyless bushing located at the right side of the feed chain drive shaft. This will free the movement of the feed chain from the turret. A 1_" wrench will be required.

4 Make sure the chain between the turret drive sprocket and feed chain drive sprocket contains no slack.

5 Turn the Feed pressure up until a piston is actuated. Be sure the piston is fully extended and located in a feed bucket. If the piston is hung up on the side of a feed bucket rotate the feed chain until it extends through the feed bucket. Turn off the Feed pressure.

6 Position the feed chain so that there is equal distance between the back of the feed bucket and piston and front of the feed bucket and piston. In other words, center the piston in the feed bucket. Use a flashlight or whatever necessary to ensure that the piston is centered.

7 Observe the depth of the piston in the feed bucket. If the desired depth exists continue to step eight. If the depth needs to be altered refer to "Depth Adjusting Sequence" located on the following page. Once the desired depth is achieved, **repeat step six** before performing step eight.

8 If the machine is locked at bottom dead center, the chain between the turret drive sprocket and feed chain drive sprocket is tight, and the piston is in the center of the feed bucket, tighten the adjustable keyless bushing. Be sure that all three sprockets located at the top right of the machine are in line so that the chain rides smoothly.

9 Remove the timing pin and screw it backing into the housing.

10 The machine will be consistent at picking up the nuts end to end. If you are getting side feeds then the piston is not positioned correctly. Try again.

DEPTH ADJUSTING SEQUENCE

Use this sequence when the depth of the piston in the bucket needs to be changed due to the changing in diameter of nuts being cracked. For smaller diameter nuts, the piston should be lower in the bucket. For larger diameter nuts, the piston should be higher in the bucket. Generally the piston should be about 1/8" above bottom of bucket. Again it depends on the size of the nut being cracked.

1 Loosen setscrews located on the inside corners of the red top frame.
2 Standing at rear of machine, move frame toward you to lower piston in the bucket, away from you to raise it out of the bucket. Use the setscrews to obtain the desired movement. Be sure the setscrews are tightened equally to ensure the turret remains straight on the frame.
3 When finished, tighten setscrews and lock nuts to prevent the red frame from moving.

IMPORTANT: Always reset the timing after a piston depth adjustment.

REPLACING BRASS VALVE

There are five brass valves that transfer the stationary air circuit on the frame to the rotating air circuit in the turret. There are four with a 3/8" diameter hole and one with a 1/8" diameter hole. The Reset position requires the 1/8" brass valve.

***If the 1/8" brass valve is put in the wrong position then the machine will not operate properly.**

1. Close main air supply valve.
2. Remove valve retainer screws.
3. Gently pull valve retainer out.
4. Slide brass valve out of valve retainer
5. Replace brass valve, leaving new brass valve protruding from valve retainer about one inch.
6. Push valve retainer back into valve plate just enough to get screws started.
7. Use screws to pull valve retainer into position.

CHECKING FOR A BRASS VALVE LEAK

Periodically test the brass valves to ensure they are sealing properly.

***If a brass valve is leaking then the machine will not operate properly.**

1. Rotate Turret to close all air ports (make sure you hear no rushing air when machine is stopped).
2. Turn off all air regulators.
3. Open one regulator.
4. Turn off main air supply and watch for a drop in the main air pressure gauge. There should be no movement or very slow movement of that gauge.
5. Turn off that regulator, turn the main air supply back on and repeat for the other four regulators.
6. If a leak is found rotate the turret and recheck to make sure the machine is not stopped on a port.
7. If a leak is confirmed, replace brass valve.

SINGULATOR SYSTEM ADJUSTMENT

For the Quantz Rotary Nutcracker to successfully crack a nut it must first single out the nuts and position them end-to-end. This is done by the singulator system. The singulator system consists of a flapper arm, singulator wire and a side wedge (refer to Appendix II).

Flapper arm – ensures that the nuts are lying in the bucket end to end.
Singulator wire - ensures that only one nut is position in a bucket.
Side wedge – ensures that the one nut is locked in the bucket.

The singulator wire can be moved by loosening the bolts in the singulator block and sliding it into the bucket or out of the bucket. This movement allows the user to set the machine for the specific nut being run.

***It is very important to ensure that the machine is singulating the nuts correctly. If there is not only one nut laying end to end in the buckets then the machine will not be able to crack them properly.**

Figure 1
Turret Assembly

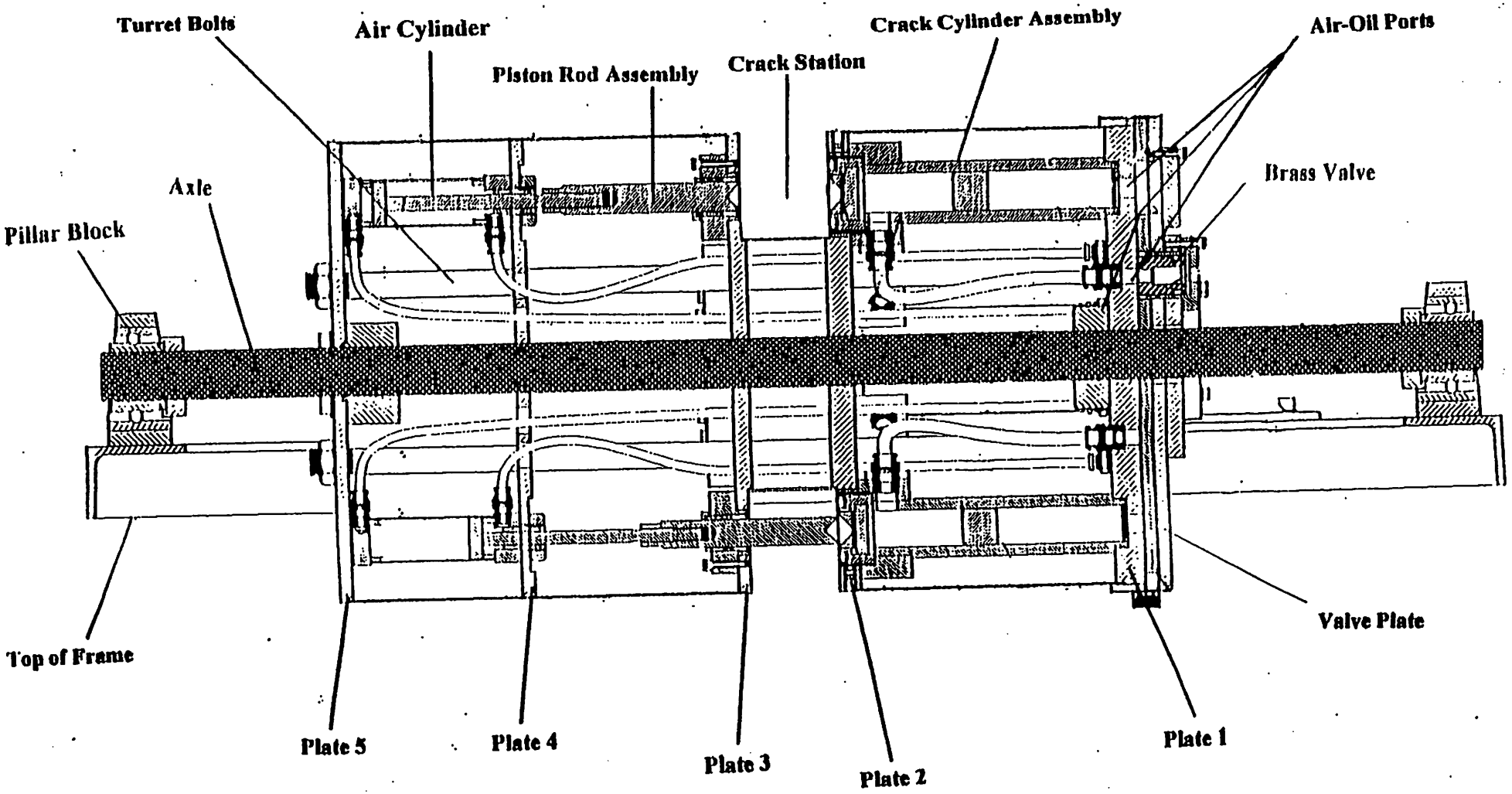

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Figure 2
Crack Cylinder Assembly

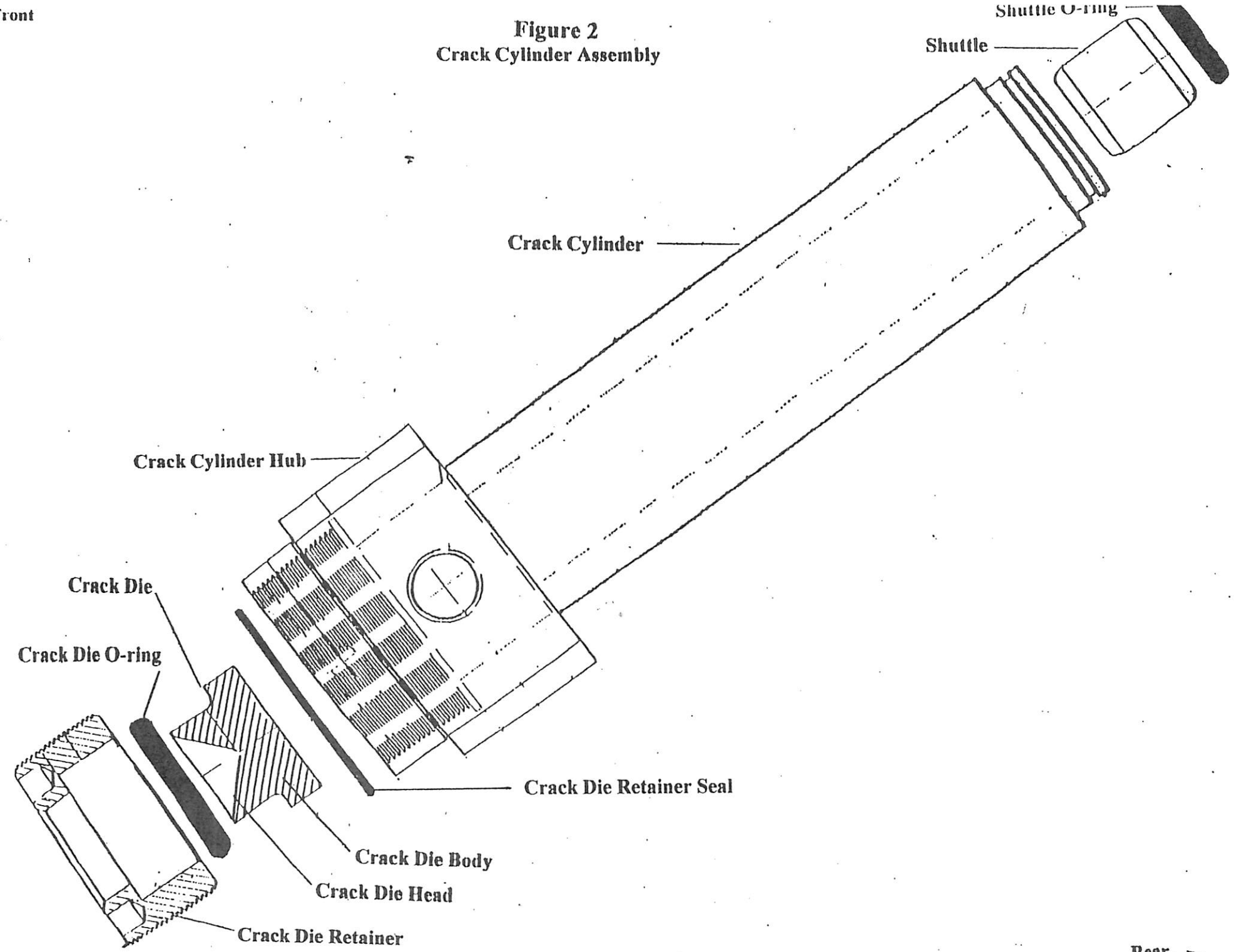


Figure 3
Crack Cylinder Assembly
Initial Position

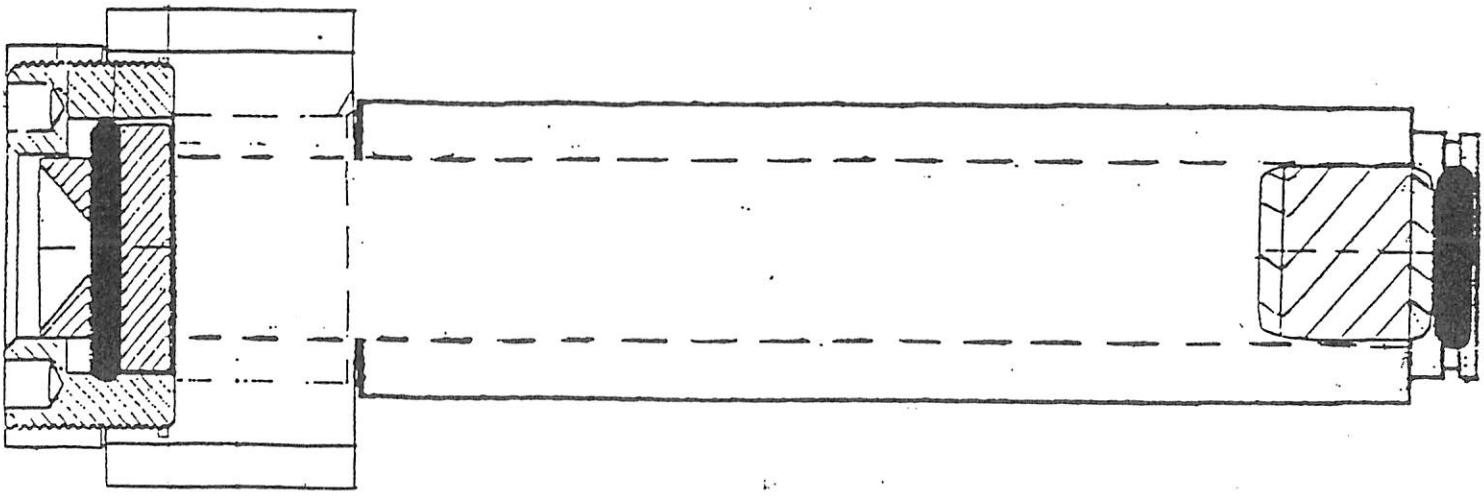


Figure 4
Crack Die and Retainer
Initial Position

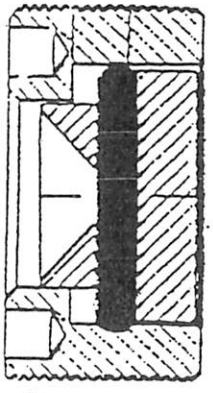


Figure 5
Crack Cylinder Assembly
Crack Position

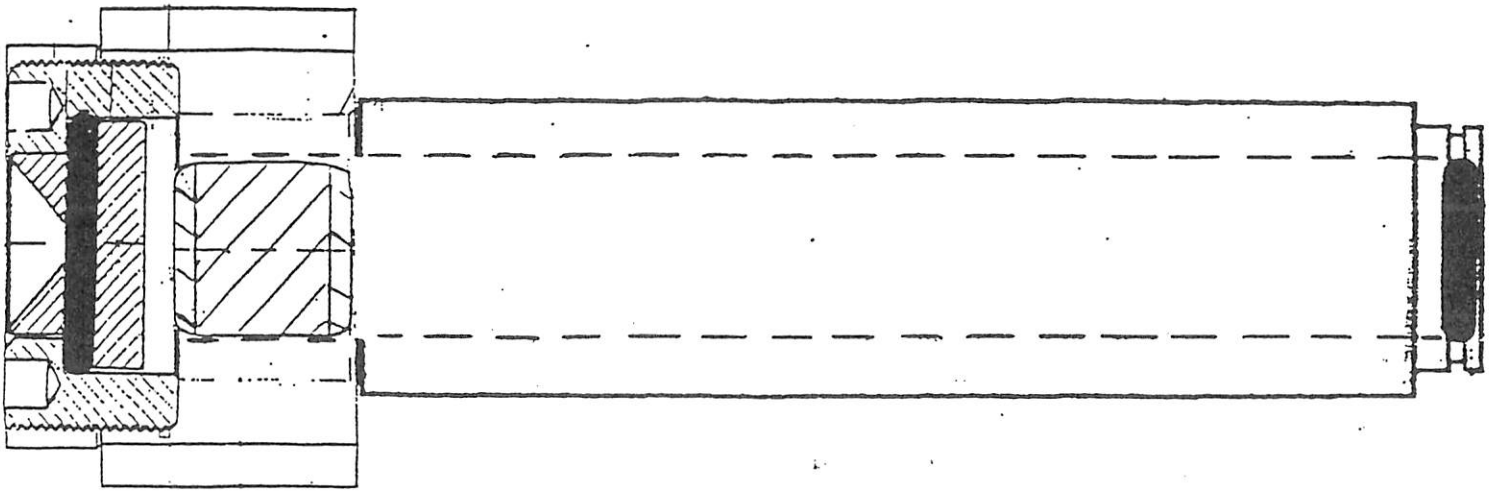


Figure 6
Crack Die and Retainer
Crack Position

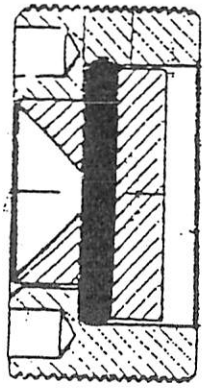


Figure 7
Crack Cylinder Assembly

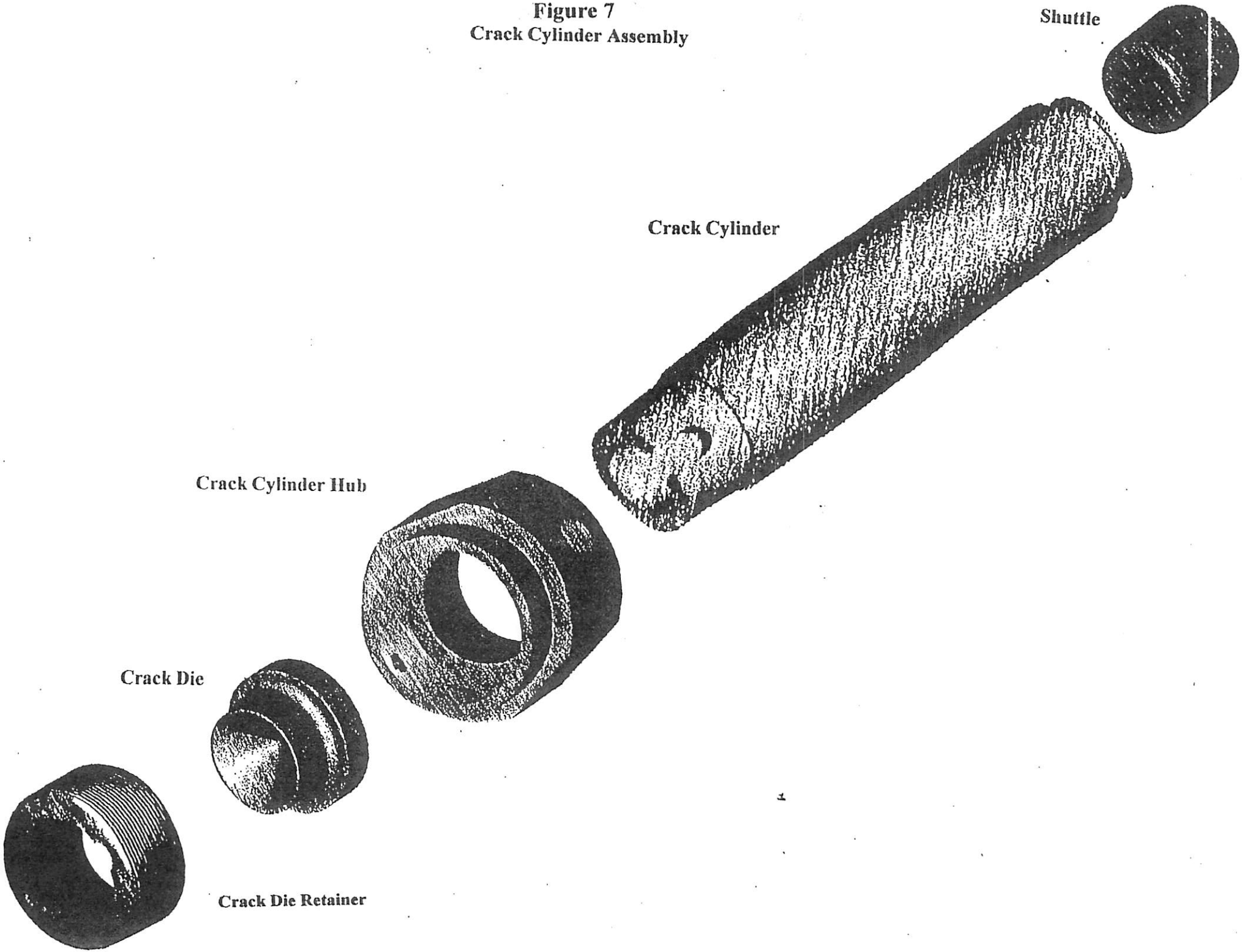
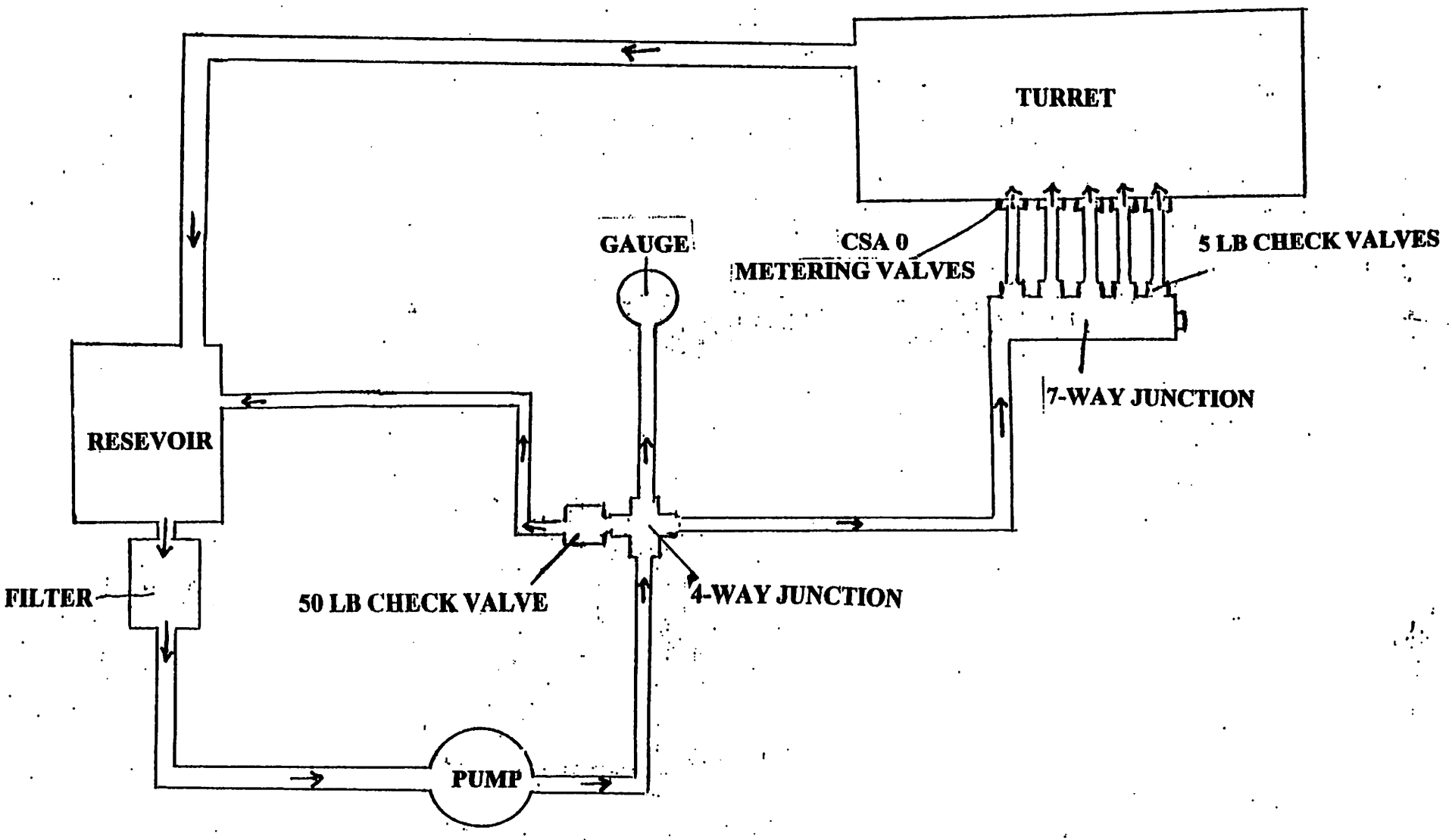
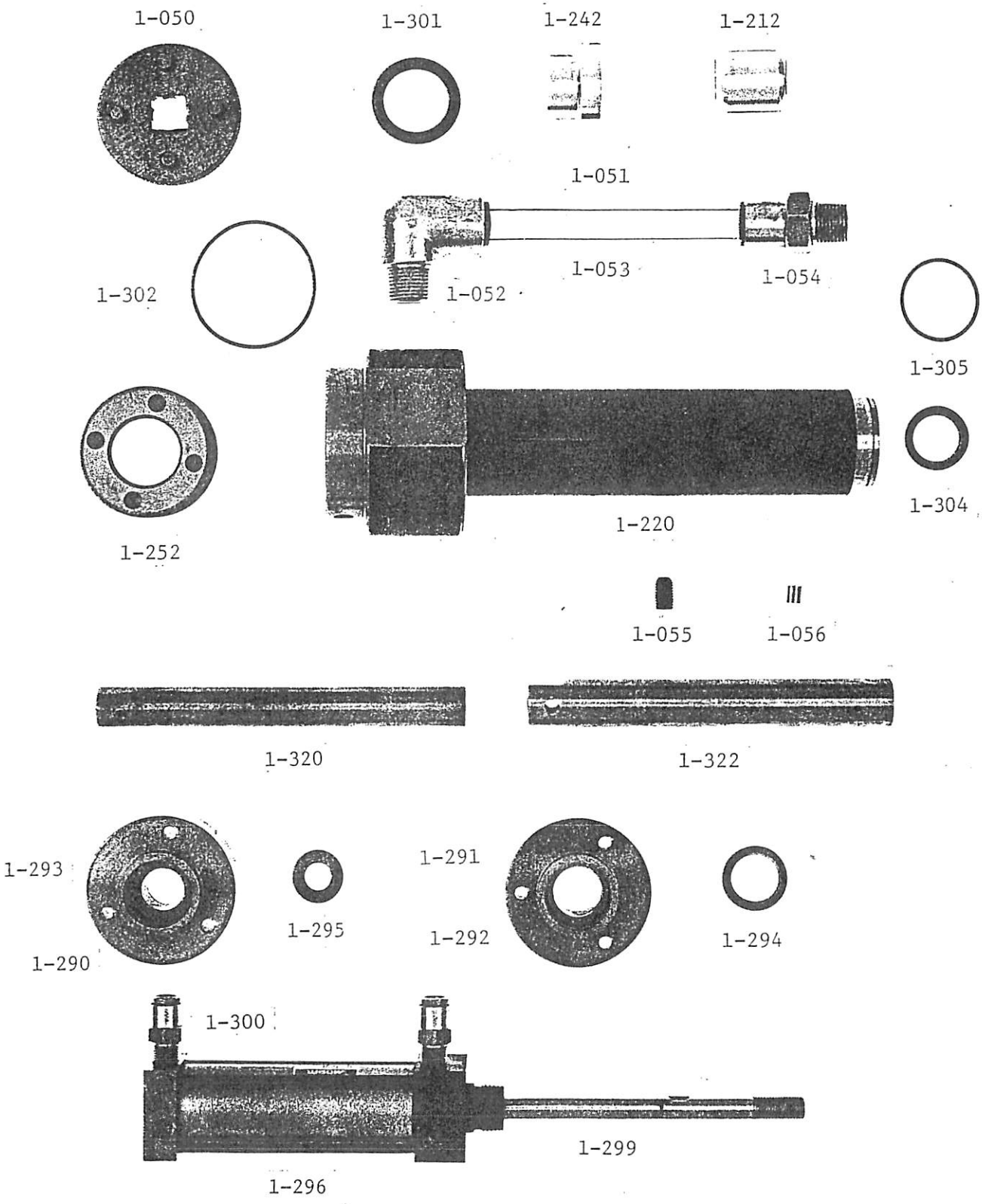


FIGURE 8

LUBBRICATION SYSTEM

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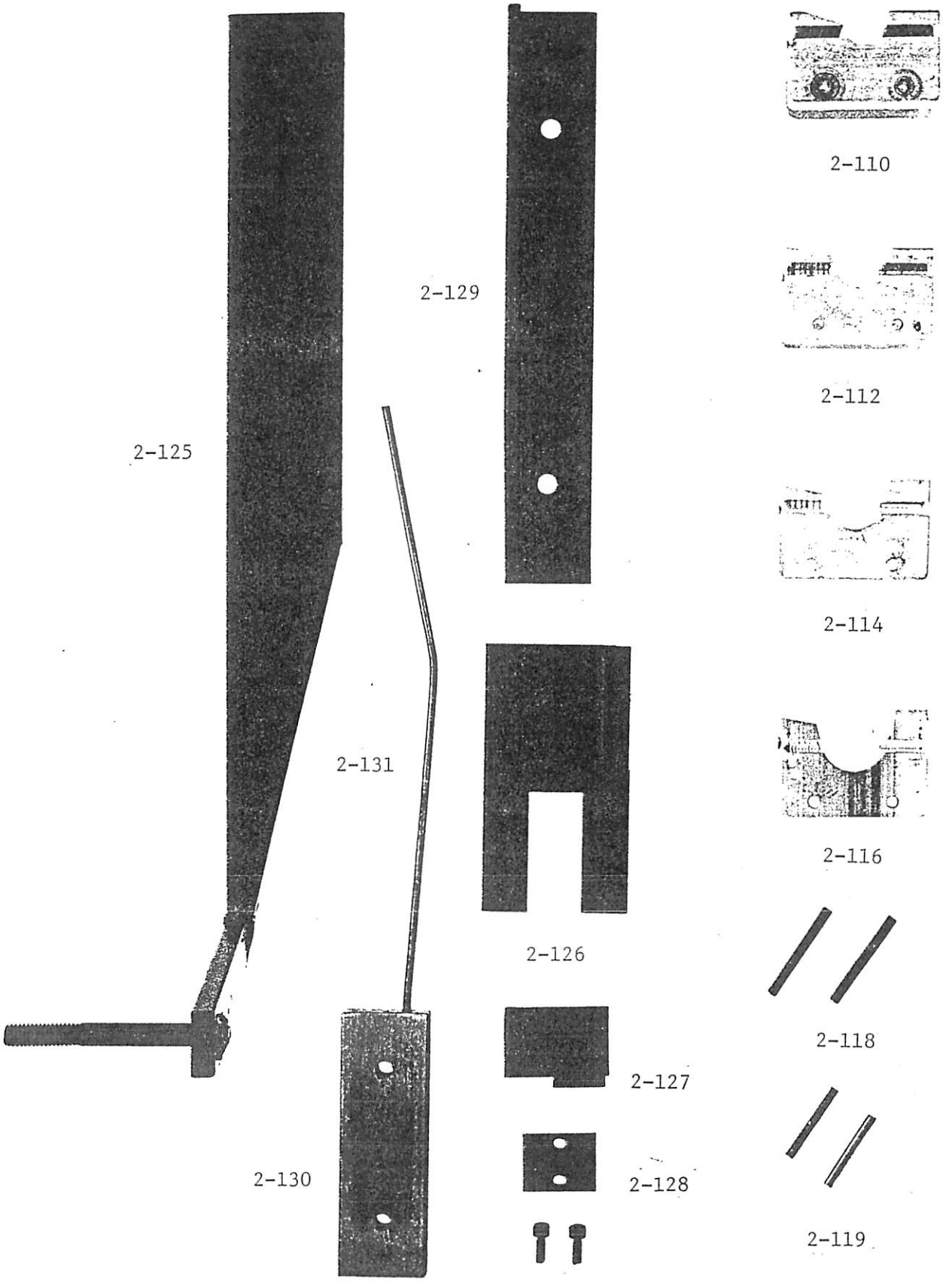
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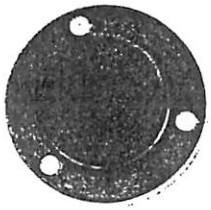

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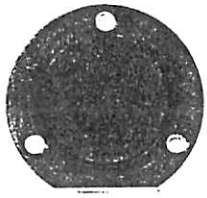

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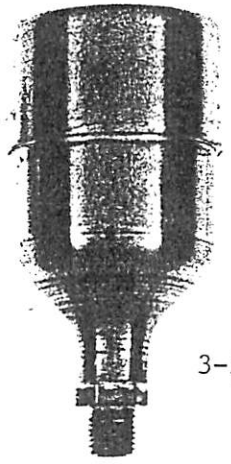

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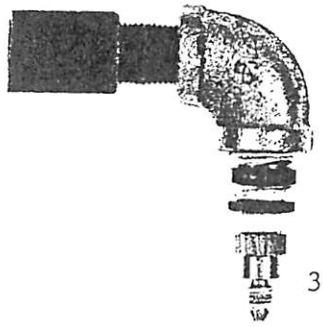

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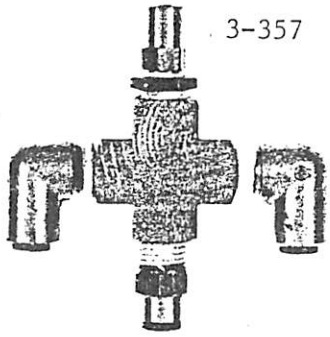

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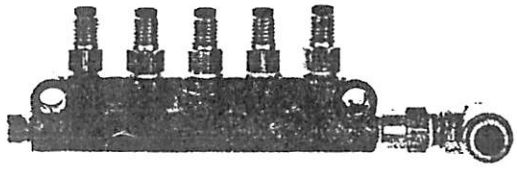

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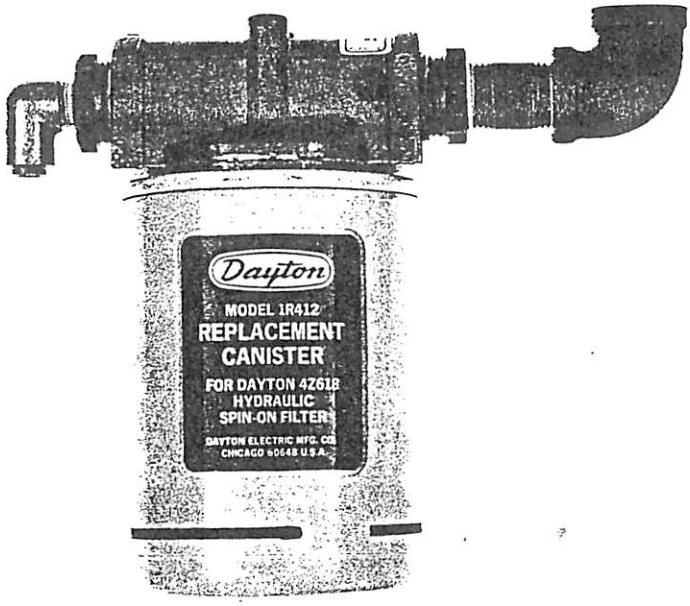

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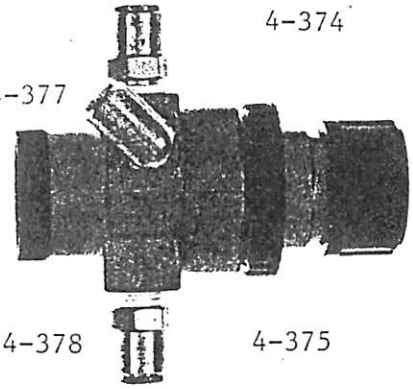

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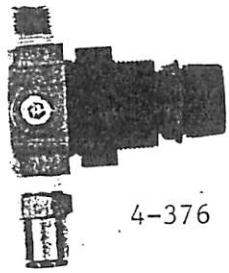

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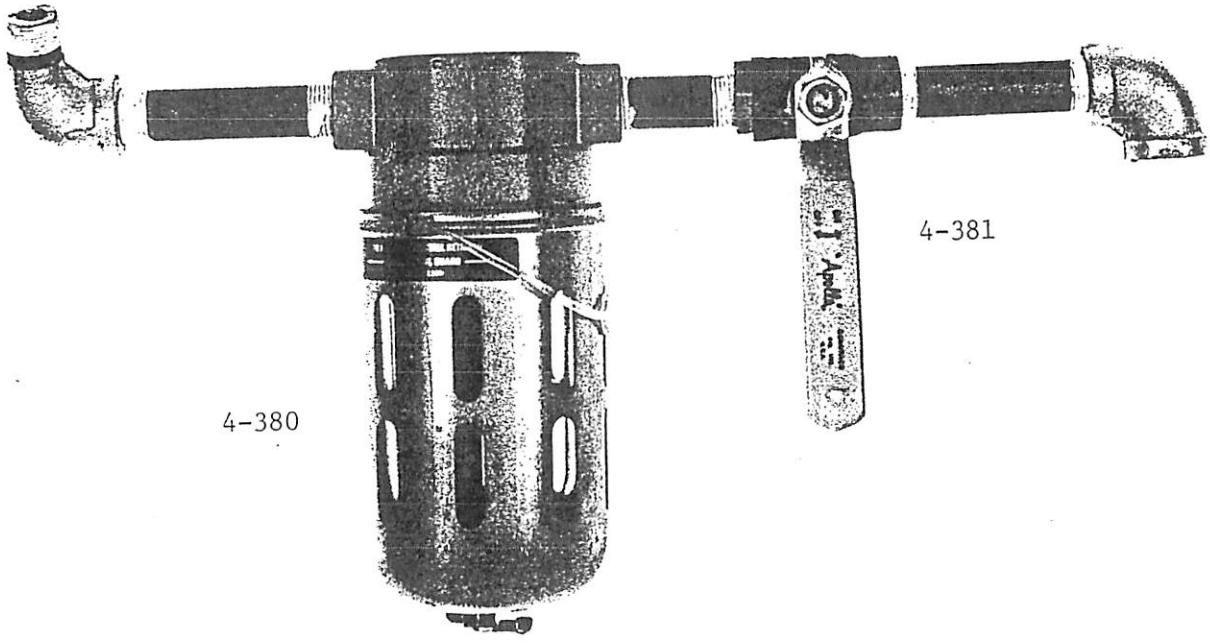

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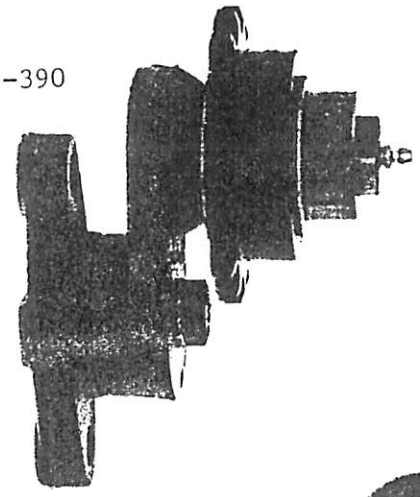

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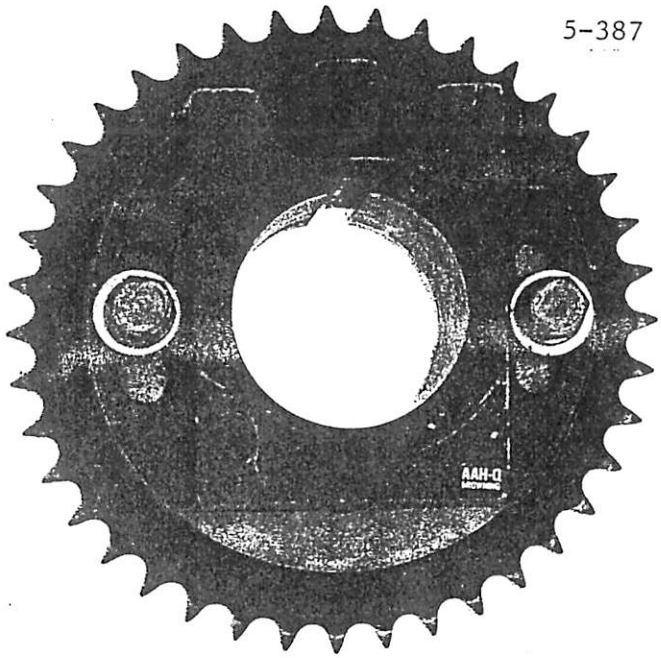

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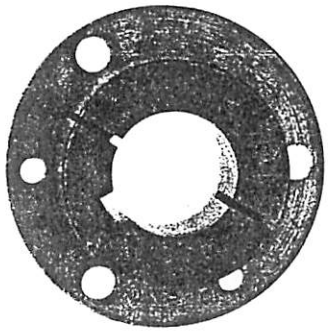

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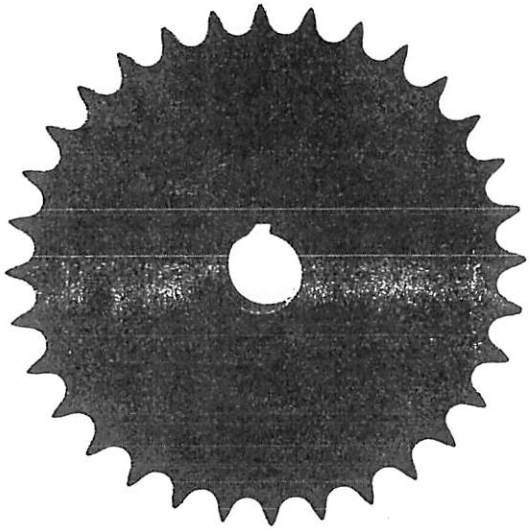

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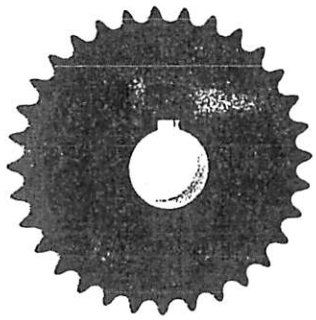

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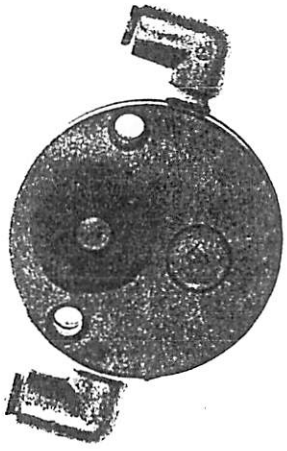

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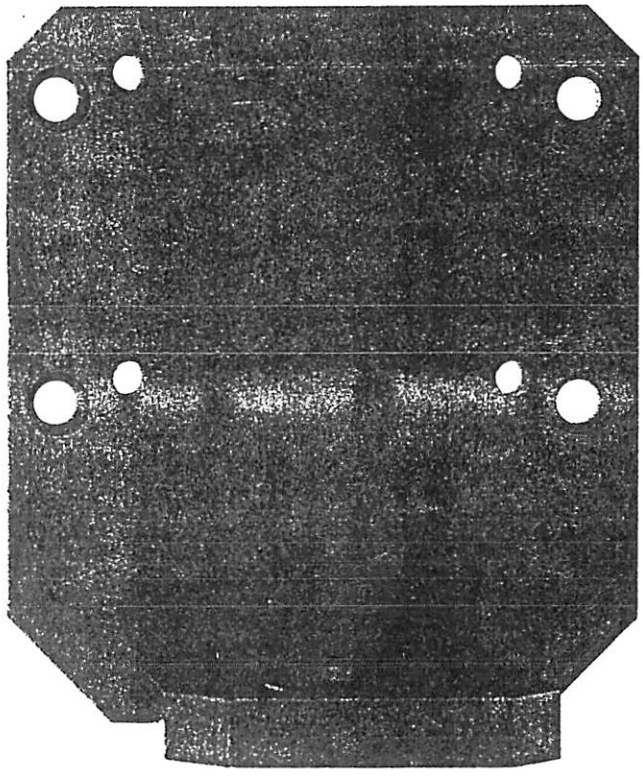

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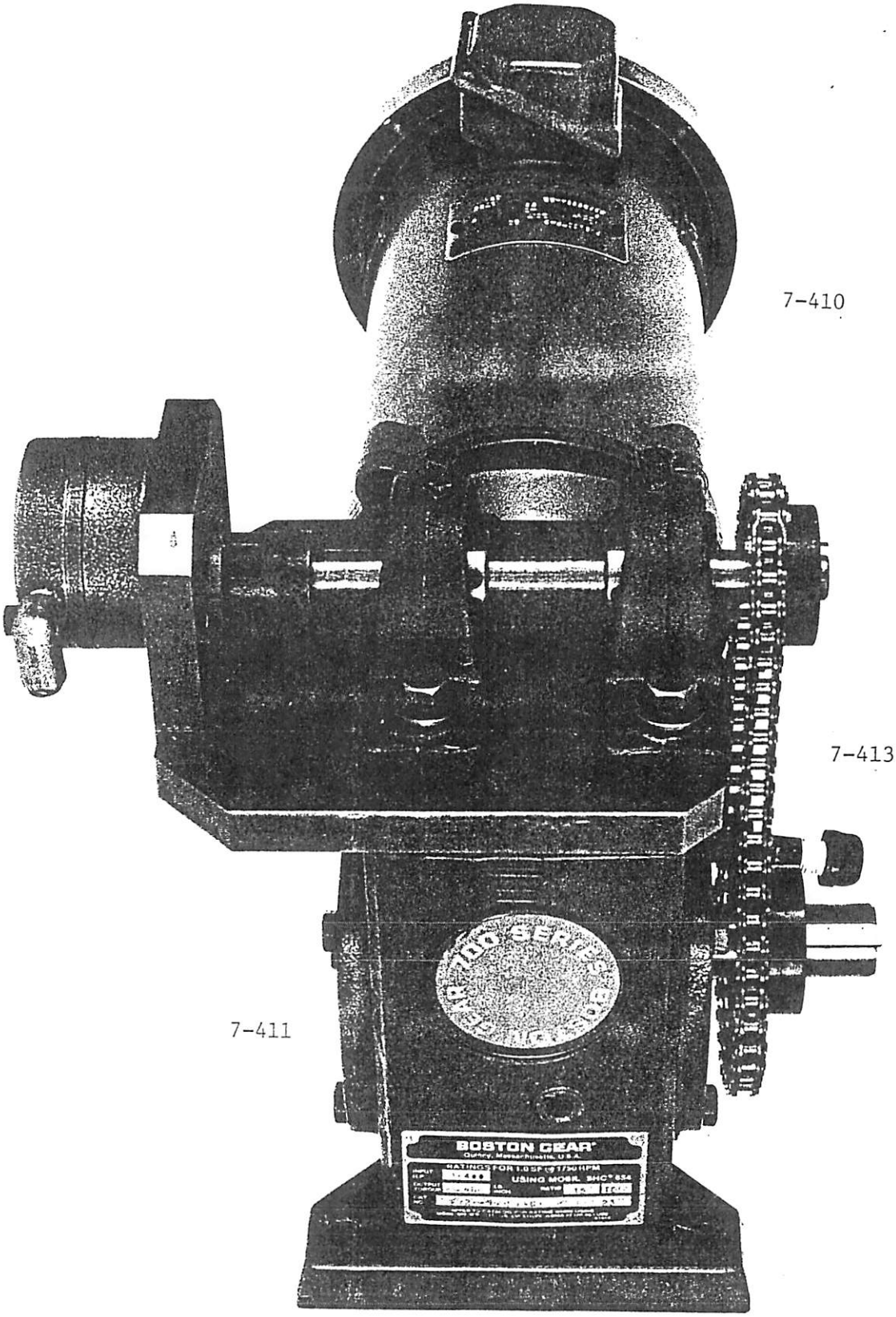

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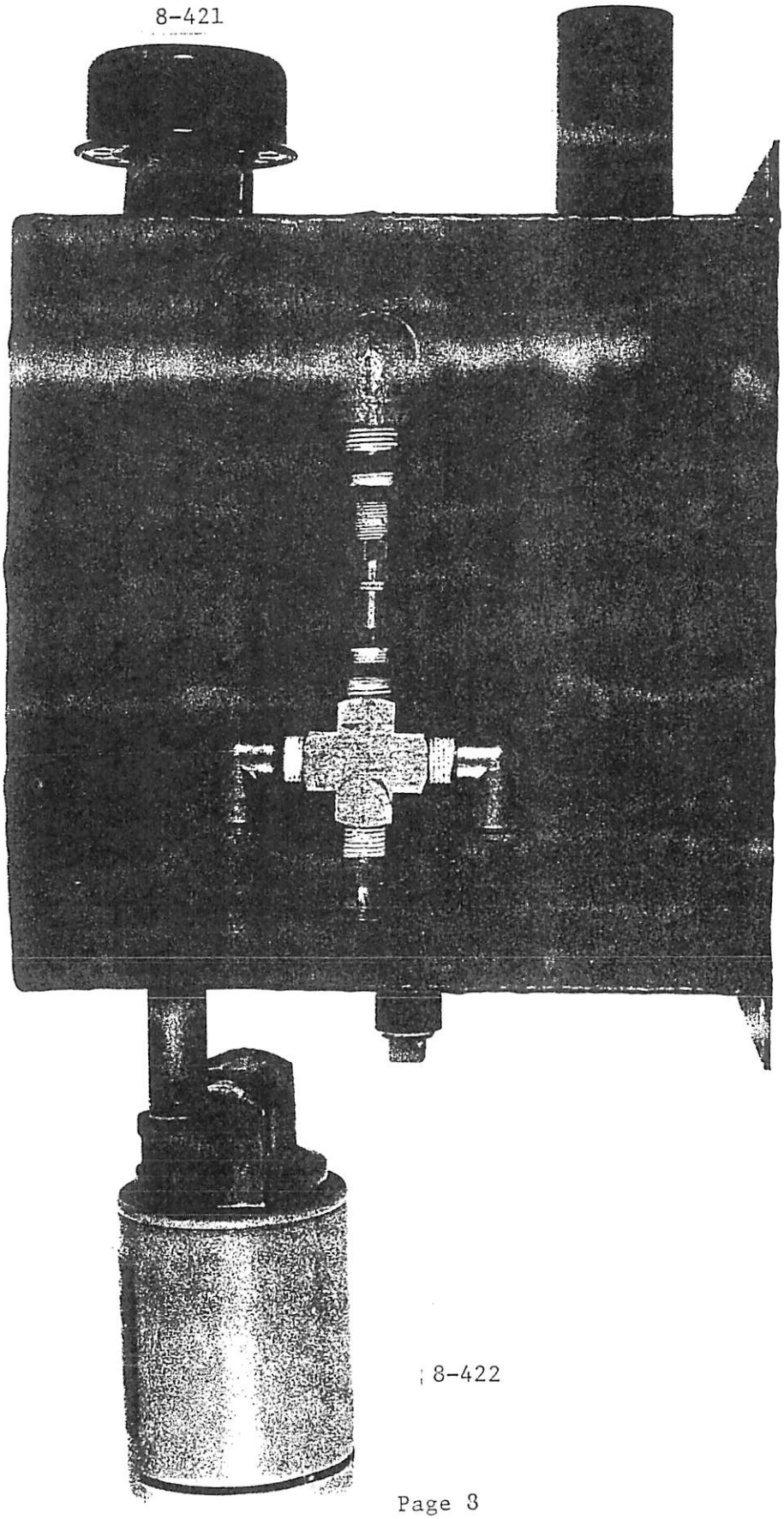

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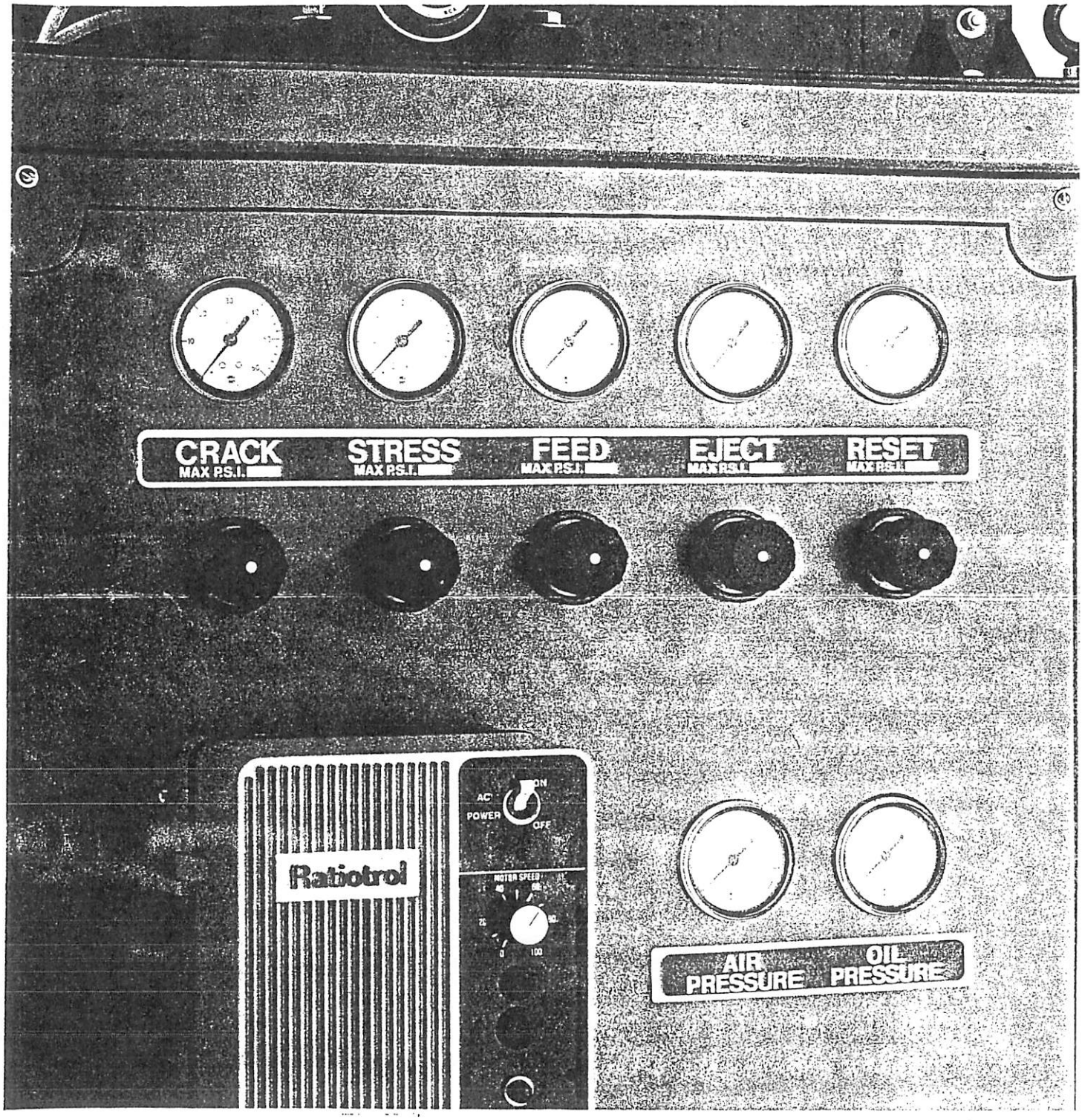
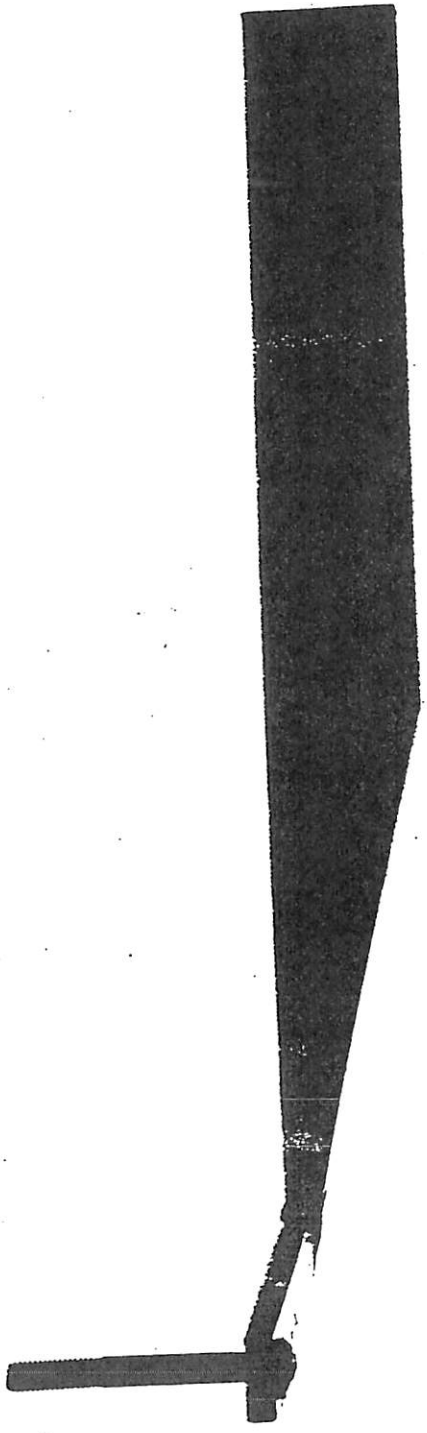
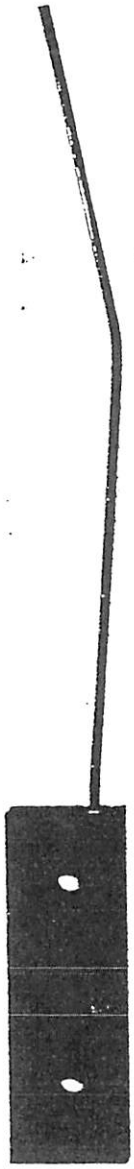

CRACK
MAX P.S.I.
STRESS
MAX P.S.I.
FEED
MAX P.S.I.
EJECT
MAX P.S.I.
RESET
MAX P.S.I.
Ratiotrol
AC POWER
ON
OFF
MOTOR SPEED
AIR PRESSURE
OIL PRESSURE

9-425

FLAPPER ARM



SINGULATOR WIRE



SIDE WEDGE

SINGULATOR WIRE BLOCK

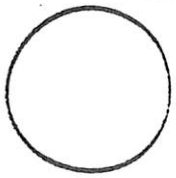
SPANNER WRENCH

CRACK DIE O-RING

CRACK DIE

SHUTTLE

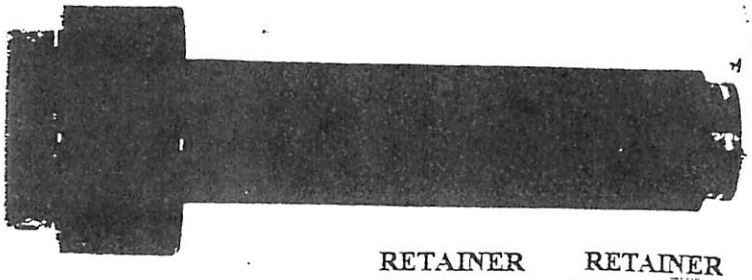
CRACK DIE O-RING SEAL



BRASS VALVE

CRACK CYLINDER

CRACK DIE RETAINER

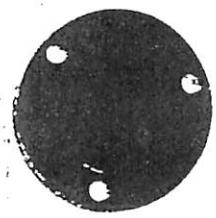


SHUTTL
RETUR
O-RING

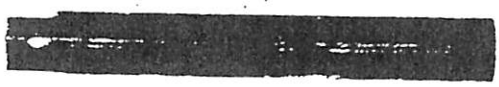
RETAINER SET SCREW

RETAINER LOCK BRASS

INSPECTION COVER

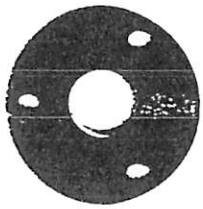


SIZING FEED PISTON



VALVE HOUSING

PISTON HUB



PISTON HUB SEAL

AIR CYLINDER