Smith Meter™ Vertical Rotary Meters

Models F4-V1, G6-V1 and G6-V3

Service

FMC Technologies

Issue/Rev. 0.3 (2/04) Bulletin MN01034

Model Number _____ **Serial Number** _____

Contents

This manual provides detailed inspection and mainte-nance information for Smith Meter™ Vertical Double Case Rotary Meters, Models F4-V1, G6-V1 and G6-V3 . Unless otherwise identified, all illustrations are of the Model G6-V1 Vertical Meter as it is typical.

Vertical double case meter construction features ease of maintenance and service. For example, the measuring unit can be removed horizontally from the outer housing without disturbing pipe connections. Also, within a given size, complete metering units and parts are interchangeable. As a result, the simple removal and disassembly steps encourage periodic preventive maintenance inspections.

It is suggested that a detailed record be maintained for each meter in the installation. Nameplate data (Figure 1), clearances, progressive totalizer readings, meter fac-tor, parts used, and other similar information provides background material for scheduling a preventive main-tenance program. An increase in meter factor drift against throughput can be used as the basis for making an inspection.

The time of the first inspection must be based on the operating conditions imposed by the installation. Flow rate, lubrication properties of the fluid, and the possibility of abrasive contaminants are points to consider. Then, at the time of inspection, the condition of the meter should indicate whether the inspection interval can be lengthened or shortened. When ordering parts or inquiring about a unit, be sure to include complete model and serial number information from the nameplate, Figure 1.

Smith Meter Vertical Double Case Rotary Meters are of the positive displacement type, Figure 2. The metering mechanism is an inner unit bolted into the outer housing.

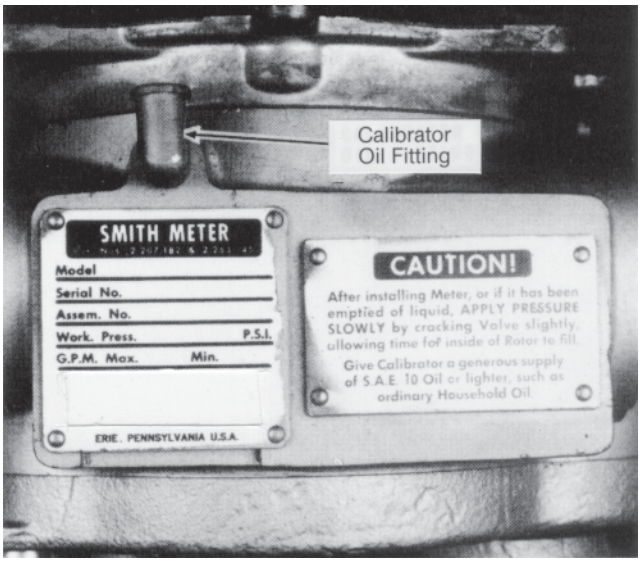

Figure 1

The double case design eliminates distortion of the measuring chamber due to pressure differential and piping strains. Pipe connections are confined to the outer housing which means the meter can be removed by taking off the cover and sliding it out. Inspection, maintenance, and service is greatly simplified through the double case design.

The measuring function is accomplished in a chamber of precise volume created by the moving blades, rotor, body, and cover. There is a smooth flow of product through the meter. The blades rotate around a fixed cam which causes them to move out to, but not touch, the body of the meter. Four chambers per revolution are formed as the rotor and blades are turned by product flow.

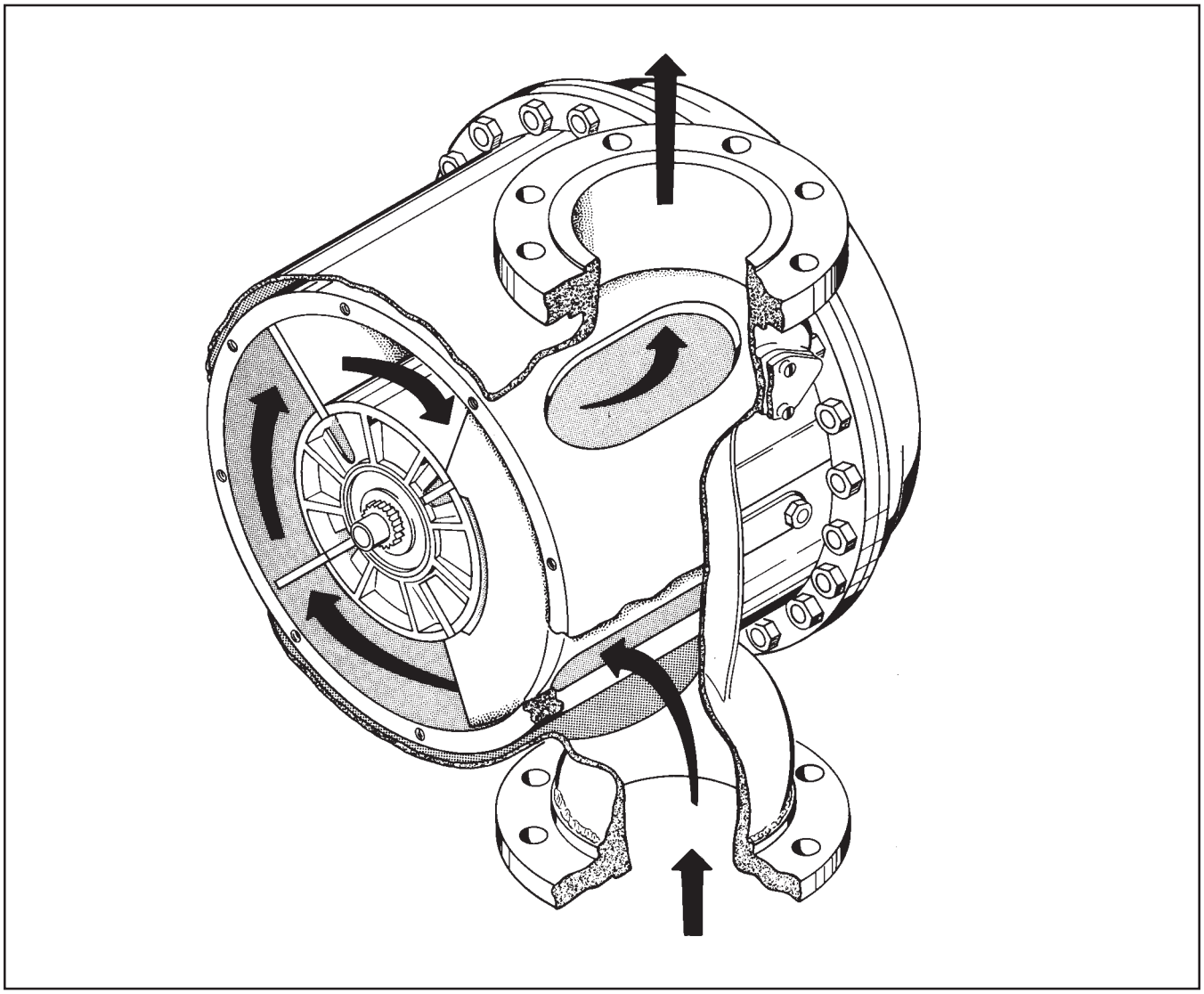

Figure 2 –Cutaway View of Vertical Double Case Meter

The following information is general in nature and is presented as a guide to the installer and serviceman.

1. It is not necessary to anchor the meter.
   - Dimensional outline drawings showing size and location of anchor holes are available for the meters if desired.
2. Install the meter so that it cannot be accidentally drained of product; however, it is advisable to drain the meter of water and sediment periodically.
   - When installing a meter, be sure drain plug is accessible.
3. Piping should not produce an undue strain on the meter.
4. Protect the meter and system against the effects of thermal expansion with a relief valve.
5. Where necessary, a deaerator or air eliminator should be installed to keep air and vapor out of the meter.
6. Remove the inner mechanism if the system is to be pressure tested with water.

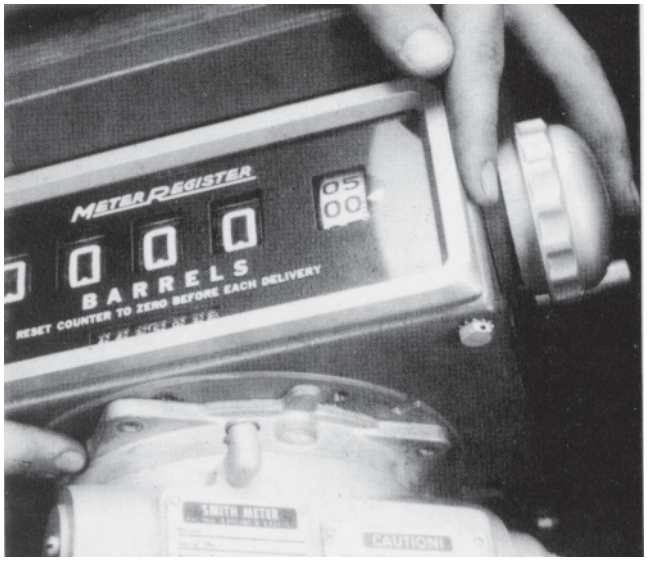

Figure 3 –Positioning Counter

7. All piping should be internally clean before meter is put into operation.
   - Rust, dirt, welding shot, and other foreign material should not be present.
   - It is best to remove the inner mechanism and flush the lines. This will prevent damaging the metering element.
   - The meter should be protected by a strainer.
8. Do not calibrate with water or allow water to stand in the meter.
   - Flush meter with a light lubricating oil if it is left idle or stored.
9. Unless otherwise specified, meters normally flow from bottom to top when viewing from the flanged side of the housing.
   - Both meters can be changed to flow top to bottom, see Section 5, Reversing.
10. A counter may be located in any one of eight positions, Figure 3.
11. The outer housing has a temperature well that is covered with a plug and flange.
    - Remove these parts to install the bulb of a temperature compensation system, Figure 4.

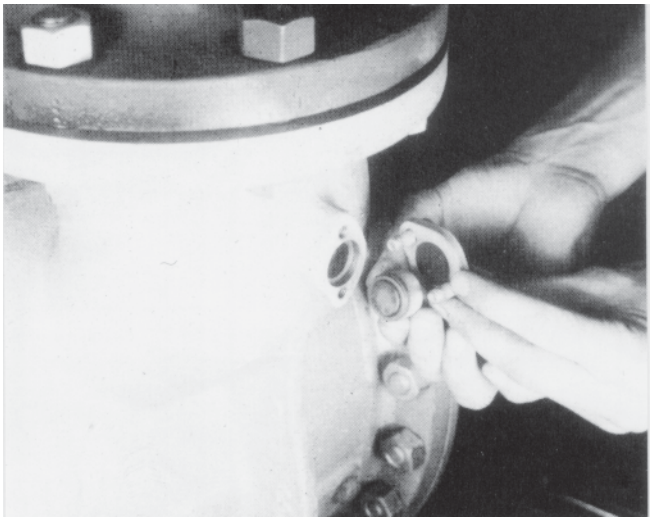

Figure 4 –Removing Temperature Well Plug

Start-Up

It is best to fill the meter by gravity. However, where hydraulic conditions require that the pump(s) be operated, extreme care should be used in opening the valves at the meter.

In all instances, the air should be evacuated slowly from the meter and system.

1. Establish product flow through meter.
   - With outlet valve closed, slowly open inlet valve.
   - Slowly open outlet valve until counter begins to turn. Leave outlet valve in throttled position until air is evacuated from meter.

   This is necessary to protect meter from excessive speeds due to air in lines of system.
2. Fully open inlet and outlet valves.
   - Open valves slowly, pausing if register operation is rough. Continue opening when operation becomes smooth.

General

Inlet and outlet valves should be operated slowly to avoid line shock. Abrupt closure can create forces in excess of normal line pressure. This could result in damage to the meter and other equipment.

Do not set a reset type counter when the meter is operating.

The ticket securing pin in a printer head must be in the down or locked position when the meter is operating.

Meter calibration is accomplished by adjusting the calibrator dial or knobs. Calibration may be changed in increments of 1/20 of 1%. The adjustment is concealed under a cover on the calibrator adapter.

General

To assure adequate inspection and maintenance, the step-by-step procedures in this manual should be care-fully followed. To gain a better understanding of vertical double case rotary meter design and construction, it is suggested that the serviceman review this manual before starting disassembly. Unless otherwise identified, all illustrations are of the Model G6-V1 as it is typical.

Suggested Tools

In addition to ordinary hand tools, the following tools and equipment will facilitate work on the meter.

- Assembly Guide , Part No. 517261 -1[1]
- 4" - 517479-1 Spring Depresser[1]
- 6" - 517480-1 Spring Depresser[1]
- Arbor Press or Spring Depresser
- Crocus Cloth
- Feeler Gauges, Leaf Type (As Illustrated During Disassembly) - See Table for Part Numbers[1]
- Micrometer, Depth Type - 1"
- Reamer, Straight - 0.189"
- Spiders[1]

Feeler Gauges			
Part No.*	**Thickness**	**Part No.***	**Thickness**
515252-1	.0015″	515252-11	.011″
515252-2	.002″	525252-12	.012″
515252-3	.003″	515252-13	.013″
515252-4	.004″	515252-14	.014″
515252-5	.005″	515252-15	.015″
515252-6	.006″	515252-16	.016″
515252-7	.007″	515252-17	.017″
515252-8	.008″	515252-18	.018″
515252-9	.009″	515252-19	.019″
515252-10	.010″	515252-20	.020″

Drain Plug

A 1/2" I.P.S. plug is provided at the bottom of the meter to permit draining the case, Figure 5. The 4" meter case holds 3 gallons of product. The 6" meter contains 5 gallons. The meter case should be vented to assure product removal.

Counter Adapter

The counter adapter may be removed with the register in place if desired.

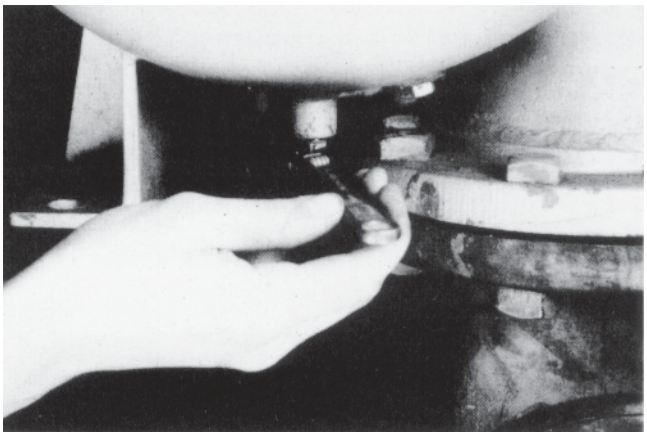

Figure 5 –Drain Plug Location

To remove adapter:

1. Break seal wire and remove the two screws which secure the adapter to the base plate.
2. Lift off adapter, Figure 6.

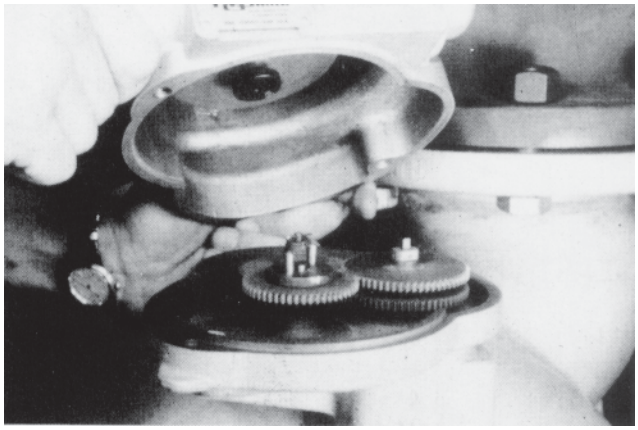

Figure 6 –Removing Counter Adapter

- The gear train can be inspected, gears reversed, and the packing gland serviced with the counter adapter removed.

Reversing

Figure 7 showns the gear train in position for normal bottom in - top out product flow.

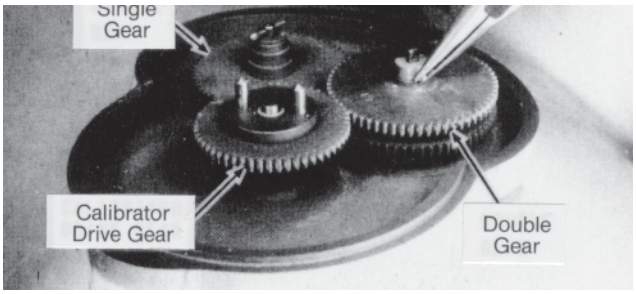

Figure 7 –Removing Cotter Pin From Pinion Gear Assem-

When it is desired to reverse the product flow, the gears are exchanged to the positions shown in Figure 8. This

1 Available through Smith Parts Operation.
2 Consists of feeler gauge soldered to 15" rod. An extension rod (22") and coupling is available as Part Number 515250.

means that the product would enter at the top and leave at the bottom of the meter. As shown, it is necessary to remove cotter pins and spacers to accomplish the exchange.

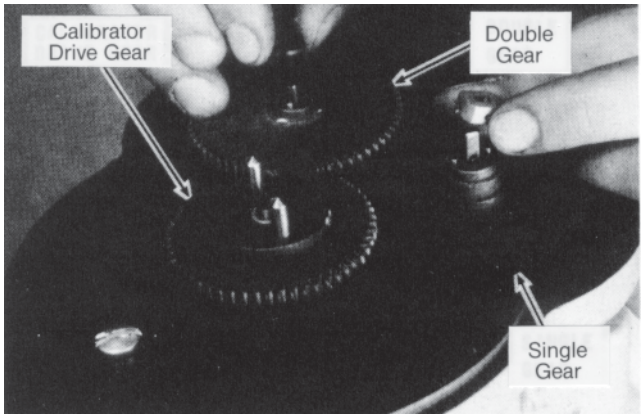

Figure 8 –Gear Positioning for Reverse Flow

Packing Gland

Product seepage into the base plate area is an indica-tion of packing gland leakage.

To remove the type HP-9 or PG-15 packing gland:

1. Remove the cotter pin and jackshaft washer.

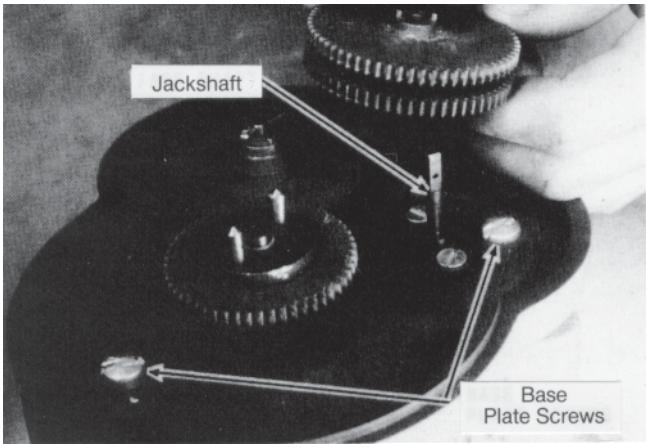

Figure 9 –Removing Pinion Gears

Figure 10 –Removing Packing Gland

2. Lift the gear assembly off the jackshaft, Figure 9.
3. Remove screws and lift off flange, Figure 10.
4. Lift off packing gland.
   - The packing gland is replaced as an assembly in the event it is removed for leakage.
5. Reassemble in the reverse of the disassembly steps.

Jackshaft, Link Shaft, and Coupling

To remove the jackshaft, link shaft, and coupling parts:

1. Drain about 1 gallon of product from the meter, Figure 5, if it has not been drained.
2. Remove the gear(s) from the jackshaft and take out the base plate screws, Figure 9.
3. Take out the access cover screws and remove the plate, Figure 11.

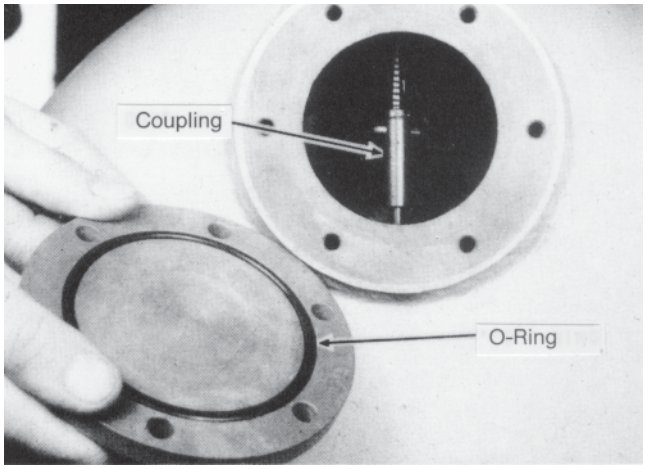

Figure 11 –Remove the Access Plate

   - A new O-Ring should be used if the access plate is removed. The new O-Ring is installed dry.
4. Push up to disengage the coupling, Figure 11, and turn end so drive pin is parallel to meter case, Figure 12.

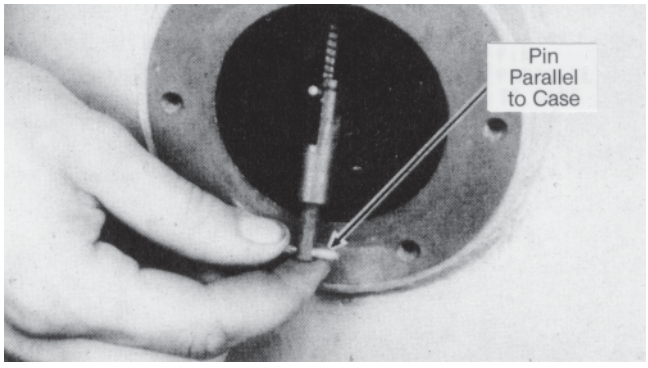

Figure 12 –Positioning Pin for Removal of Assembly

5. Lift up on base plate to withdraw drive shafts and coupling, Figure 13.
6. Generally, the packing gland and gear train need not be removed if there is no evidence of leakage in the base plate area.
   - Refer to Figure 9 if it is necessary to remove the packing gland.

7. The shafts and coupling should be disassembled for examination and replacement of parts as necessary.

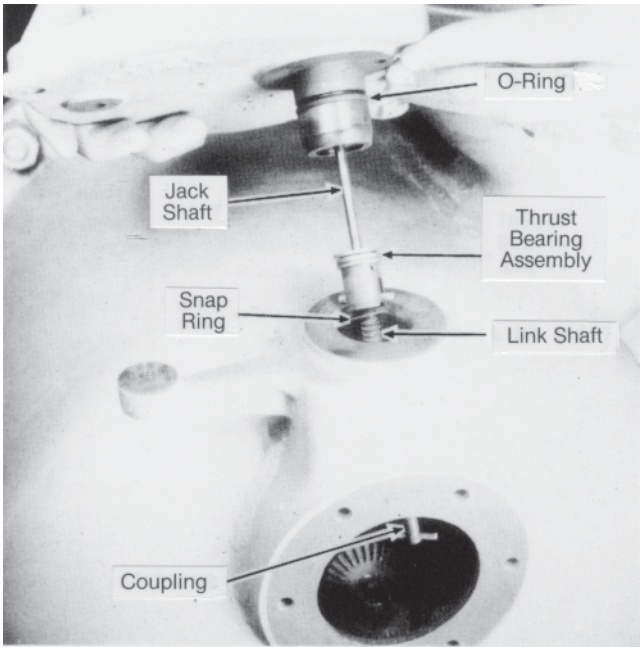

Figure 13 –Remove Drive Shafts and Coupling

- The jackshaft may be cleaned and polished with fine crocus cloth if it is not worn or corroded. Use a rotary motion to prevent longitudinal grooving or scratching. Lightly coat with grease when reinstalling.
- Inspect thrust bearing assembly, Figure 13. Replace plates if worn, do not reverse. Check ball retainer for roughness. Reuse if it runs smooth.

8. The O-Ring, Figure 13, should be replaced if fluid leaks from where the base plate joins the meter case.

The jackshaft, link shaft, coupling, and base plate parts can be replaced in reverse of the disassembly order if the meter is not to be completely taken apart.

Inner Mechanism Removal

Inner mechanism removal is facilitated by the use of Smith Part Number 517261-1 assembly guides. Figure 16 shows guides in use.

If not already drained, any product left in the case can be removed at the drain plug, Figure 15.

1. Remove the nuts and bolts that secure the outer housing cover to the outer housing and lift off, Figure 14.
   - Be prepared for any product that may drain from case.
2. Disconnect the coupling, Figures 11 and 12.
3. Take out the bolts that fasten the body to the housing, Figure 15.
   - 4" meters have 2 bolts and 6" meters have 4 bolts.
   - Upon reassembly, coat underside of the bolt head with Permatex No. 1 hardening type sealer.
4. Install 2-5/8" x 11 N.C. eyebolts in inner mechanism. Figure 14 identifies eye bolt locations.

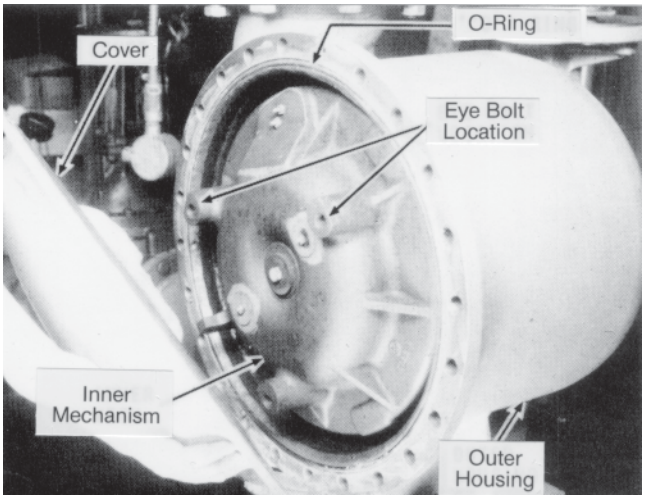

Figure 14 –Removing Outer Housing Cover

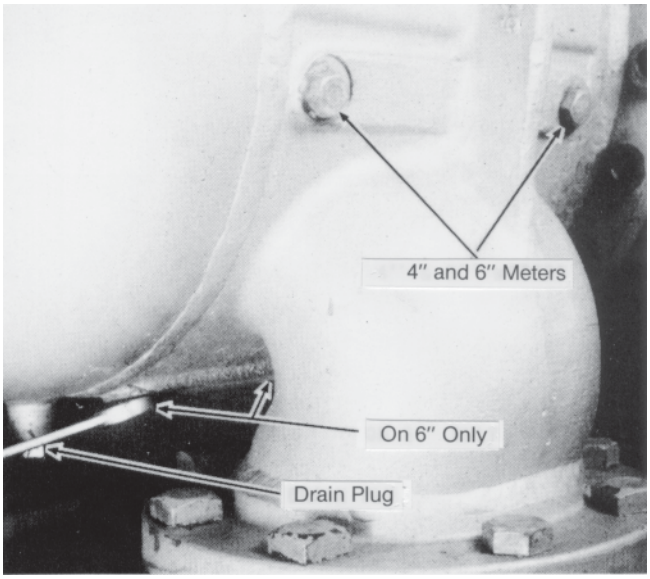

Figure 15 –Bolt Location

5. Attach two (2) Part No. 517261-1 assembly guides to meter case, Figure 16.

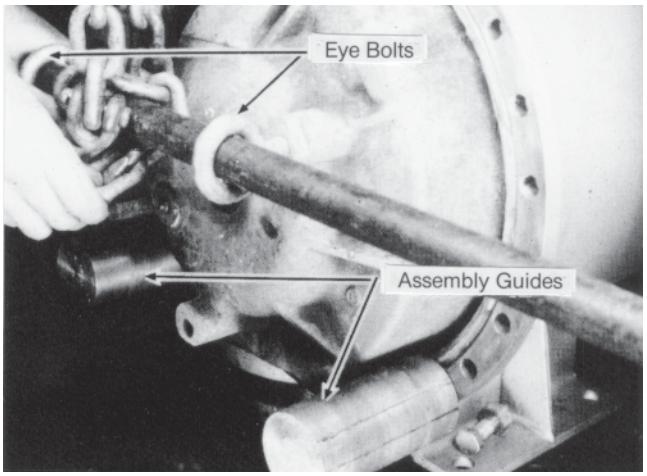

Figure 16 –Preparing to Remove Inner Mechanism

6. Run a bar through the bolts and attach chain from hoist as shown in Figure 16.
   - Be certain the hoist, chain, and bar are sufficient to support the weight of the inner mechanism.
7. Remove the inner mechanism.
   - Work bar back and forth while slowly pulling (and lifting) mechanism out of case. Due to sealer, it may be necessary to "break apart" the housing and mechanism if they cling together.
   - Be careful not to permit mechanism to fall or swing off ends of assembly guides.
   - Figure 17 shows the inner mechanism suspended from the hoist. Be careful not to damage the gear and bearing block assembly attached to the inner cover.

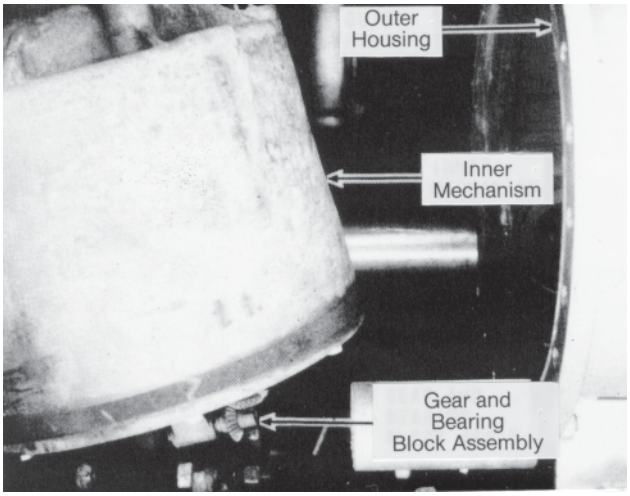

Figure 17 –Inner Mechanism Removed

   - Figure 18 shows the interior of the outer housing after the inner mechanism has been withdrawn.

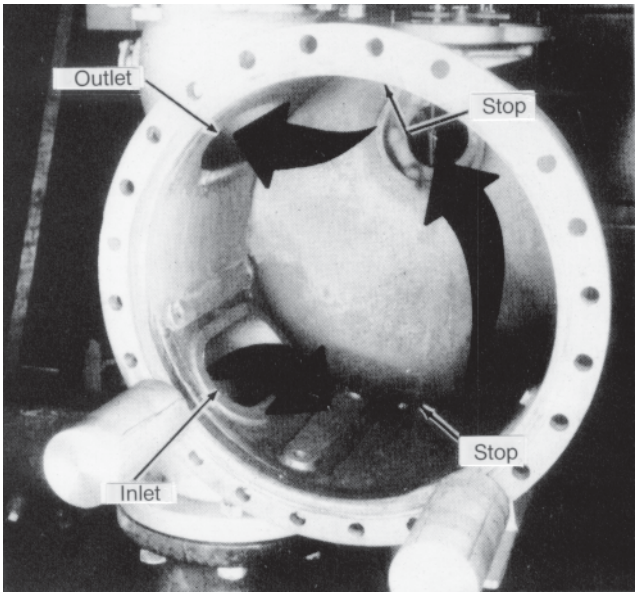

Figure 18 –Interior of Outer Housing

Inner Mechanism Disassembly

1. The gear and bearing block assembly, Figure 19, is removed from the outer housing by taking out the screws holding the bearing block in place.

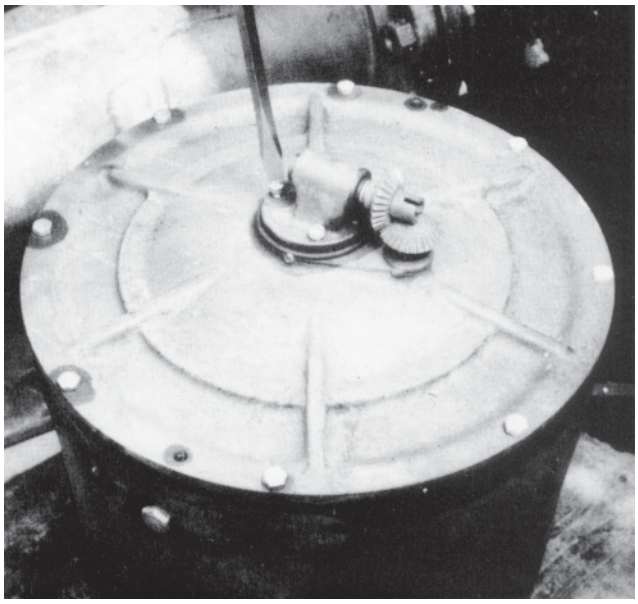

Figure 19 –Removing Gear and Bearing Block

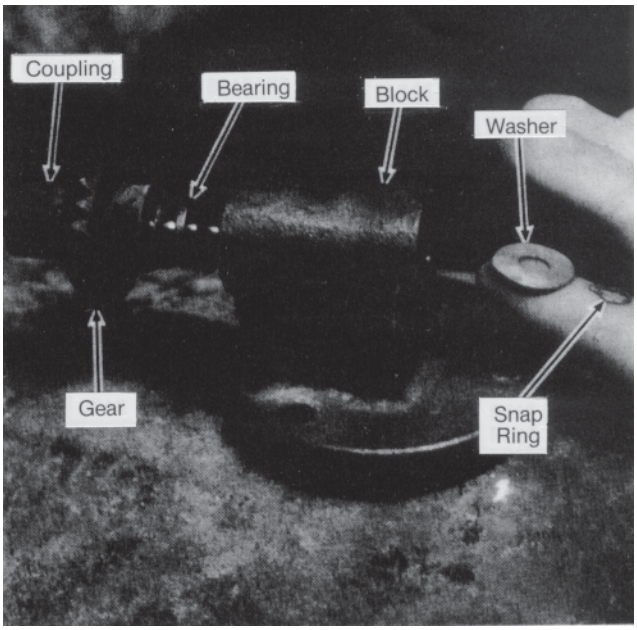

Figure 20 –Disassembly of Bearing Block

   - Removing the snap ring and washer, Figure 20, allows the thrust bearing, gear, and drive coupling to be withdrawn from the block.
   - If the bearing block assembly is removed as a part of total inner mechanism teardown, it should be left off until rotor end clearance adjustment is made, Figure 36.

2. Remove the inner mechanism cover.
   - Take out all of the cover screws. Place two (2) cover screws into the tapped holes as shown. Using the screws as jacks, remove the cover, Figure 21.
   - When reassembling, align locating pin and cover hole, Figure 22. Tighten cover screws evenly.

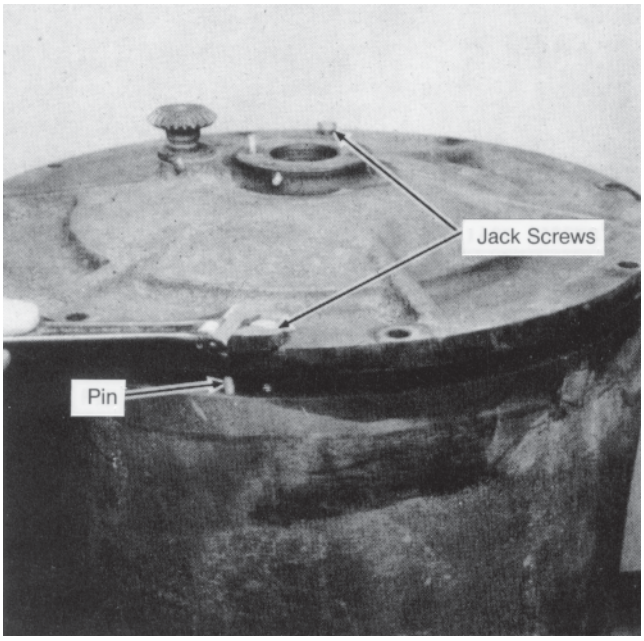

Figure 21 –Removing Mechanism Cover

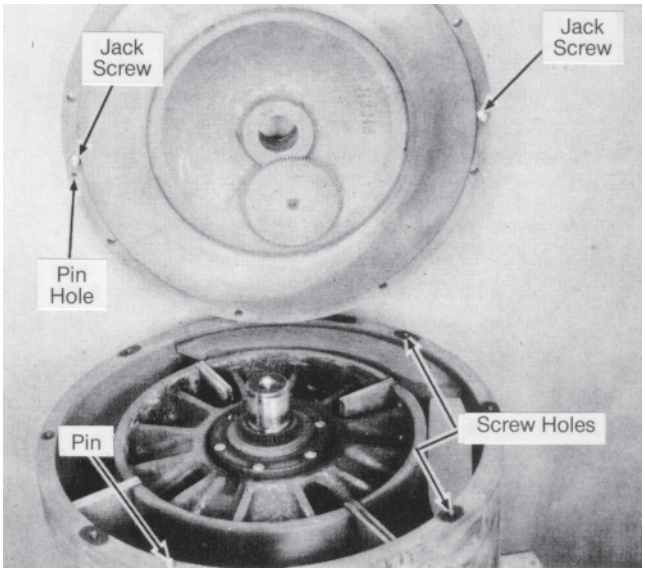

Figure 22 –Cover Removed

Clearance Checks

Clearances should be checked with a leaf type feeler gauge and compared with the Clearance Guide. Any average of clearances that are outside of the tolerance listed should be noted. Certain parts may be at or over the maximum shown but consideration should be given to the condition of the part and the accuracy obtained during meter calibration. Certain major parts such as the rotor, cam, and blades need not be replaced if the meter proving records show no appreciable change in accuracy between provings.

Clearance Guide

This clearance guide lists the recommended minimum and maximum fitting clearance for repaired meters. Meters often exhibit acceptable accuracy even if the clearances exceed the ranges shown.

(All units of measurement are inches.)

Meter Model No.	Rotor to Block	Rotor Adj. Total End Clearance Divided Equally Each End	Blade Slot Total Clear.[3]	Blade Ends Top End Clearance Below Rotor[4]	Blade Roller Over Radius Portion of Cam[5]	Blade Tip Toward Housing[6]
Reference Illustration	Figure 24	Figure 36	Figure 27	Figure 28	Figure 30	Figures 23 and 35
F4-V1	.004-.006	.004-.007	.0015-.0045	.000-.002	.001-.005	.0045-.006
G6-V1, G6-V3	.004-.006	.005-.008	.002-.0055	.000-.002	.001-.005	.006-.008

The above clearances apply to meters operating at standard operating temperatures of -20°F to 150°F (-29°C to 65°C) and viscosity less than 2,000 SSU (400 mPa•s). For higher temperatures and viscosities, consult factory.

1. Check the blade top toward the housing clearance, Figure 23, and compare with Clearance Guide.
   - Spiders (concentricity fixtures) are used to maintain rotor concentricity with inner housing when the cover is removed. Consult Smith Parts Operation for availability.
2. Check rotor to block clearance, Figure 24, and compare with Clearance Guide.

3 Blades should move freely in rotor slots and the average clearance in each slot should not exceed the listed clearances, nor should any single point be more than 100% above the maximum listed.
4 Lower edge of blade should not project below bottom surface of rotor.
5 With the blade in the measuring chamber, this total clearance should be maintained between the radius of the cam and one roller only.
6 With the blade held toward the housing, these clearances should be maintained between the measuring chamber and the full length of the edge of the blade.

3. Remove the rotor assembly from the housing, Figure 25.
   - Carefully lift out the rotor assembly to prevent dam aging the blades.
   - Be certain to engage locating arm and pin upon reassembly.

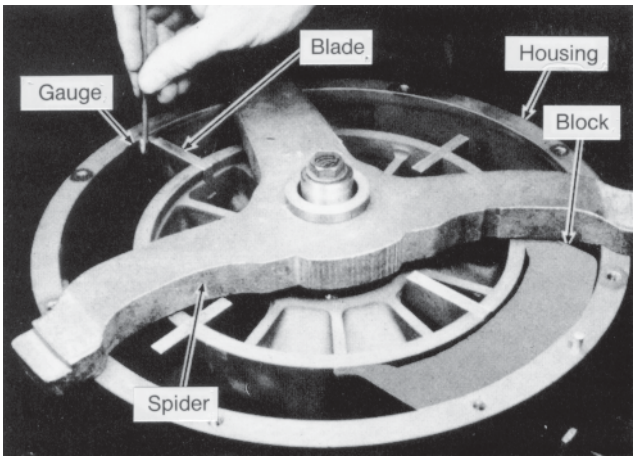

Figure 23 –Checking Blade Tip Toward Housing Clearance

4. To disassemble the rotor, place the assembly on wooden blocks or other suitable surface, Figure 26.
   - Loosen the socket head cap screw and lift off the locating arm.
   - Upon reassembly, be sure arm is keyed to shaft. Place key on arm before installing arm on shaft. Upset end of key should be toward top and outside of locating arm.
   - Before placing the rotor and blade assembly into the housing, place the assembly (vertically) onto a suitable support. Hold the shaft stationary and turn the rotor. There should be no binding between cam and blade bearing(s), blades and blade bearing(s), or blade and blade slots through a complete revolution.

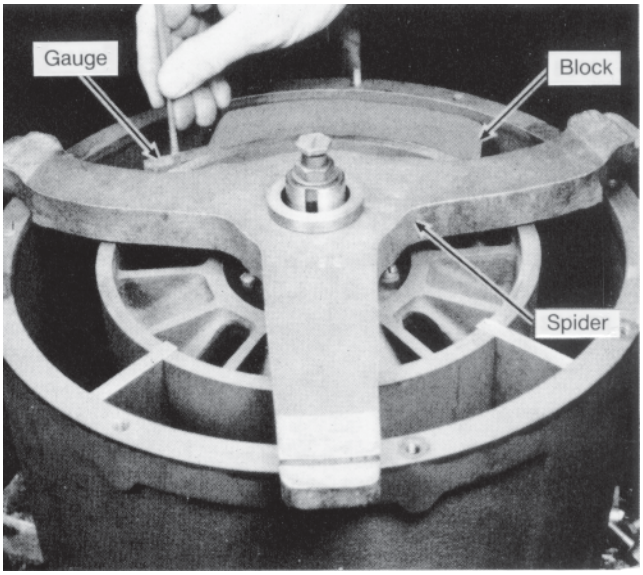

Figure 24 –Checking Rotor to Block Clearance, Series F4

5. To check blade slot total clearance:
   - Turn the rotor right side up and check clearance through length of slot, Figure 27. Compare with Clearance Guide.
   - Repeat for all blades.
6. To take blade ends (top end) clearance below rotor:
   - Place a depth micrometer on the rotor over the blade end, Figure 28. If a depth micrometer is not available, a feeler gauge may be used.

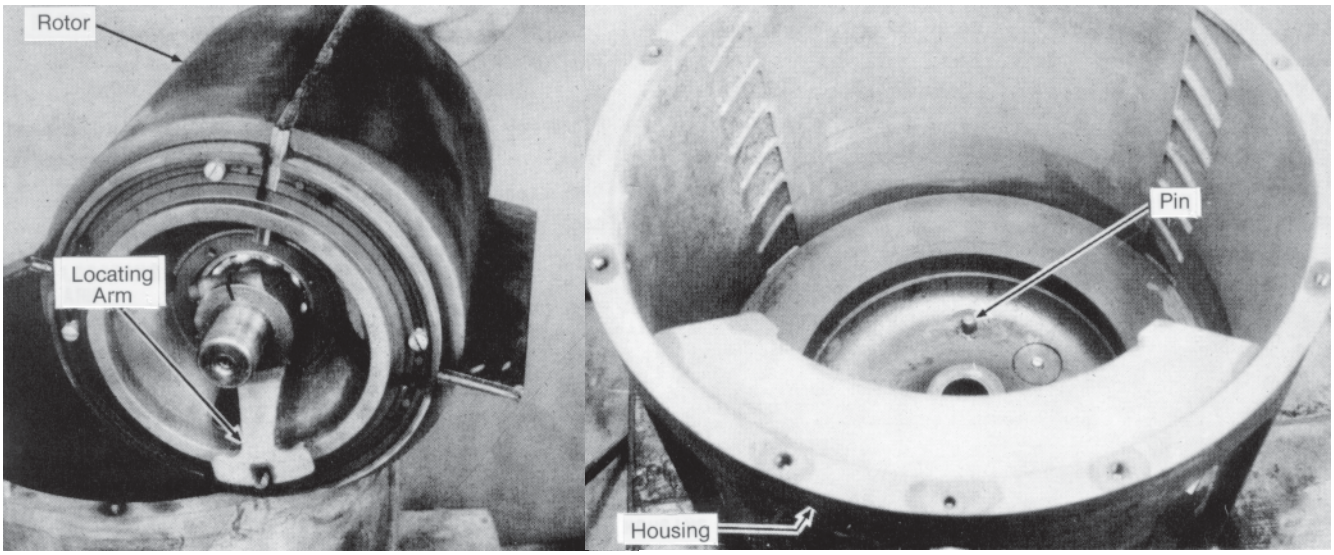

Figure 25 –Rotor Removed

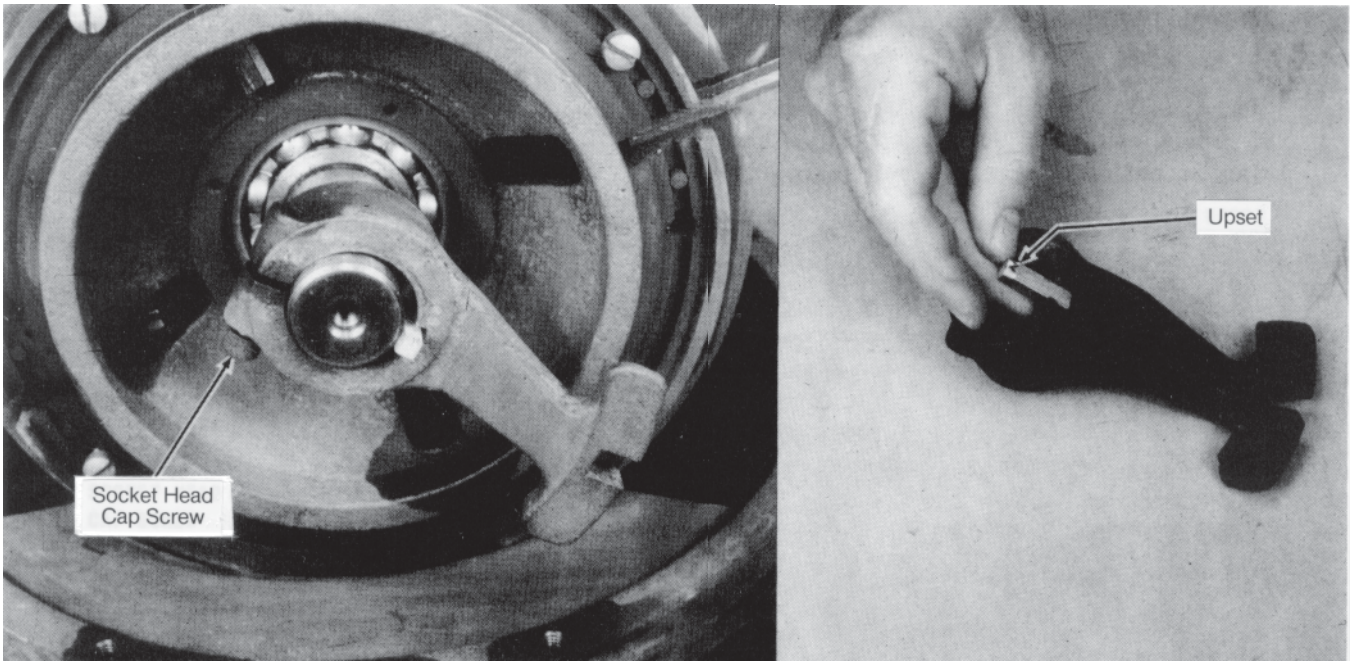

Figure 26 –Removing Arm from Rotor

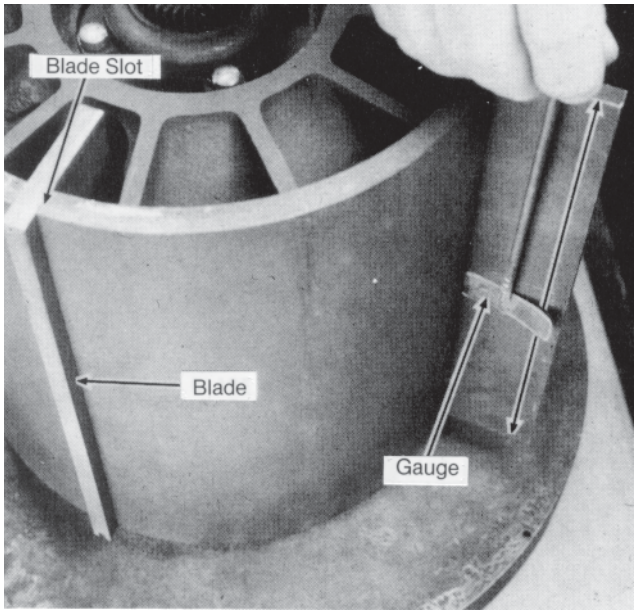

Figure 27 –Checking Blade Slot Clearance

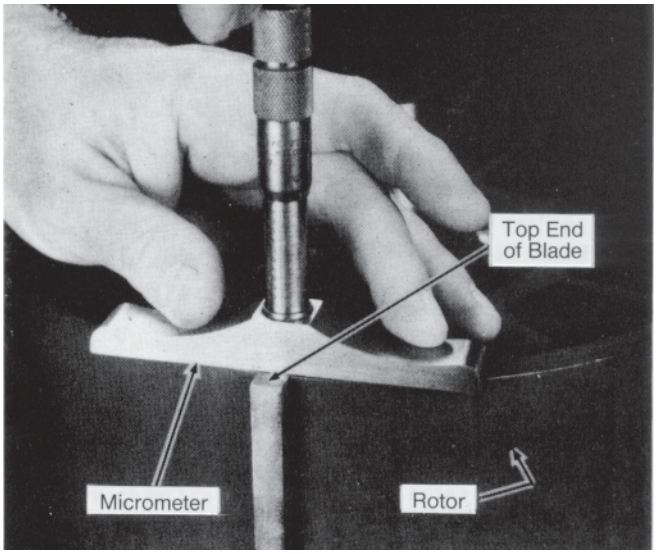

Figure 28 –Taking Top End Clearance

7. The rotor cover and rotor are mated parts. If taken apart, they should not be exchanged with another meter or replaced individually.
   - To separate the cover and rotor, pry up (to prevent damaging edge of rotor) at the openings provided, Figure 29.
   - Lift off the cover. Note position of locating pin and hole to assure proper positioning during reassembly.
8. To measure blade roller clearance over radius portion of cam, insert feeler gauge (Figure 30A) and check through radius. Compare measurement with Clearance Guide.
   - Check only one blade roller on each blade as shown in Figure 30A.
   - Upon reassembly, the outer bearing clip must engage in the cover keyway, Figure 30B.

     Note: *Inner and outer bearing clips are secured with an adhesive and must not be removed or disturbed.*
9. Mark the position of the blades in relation to the rotor slots before proceeding with disassembly, Figure 30B.

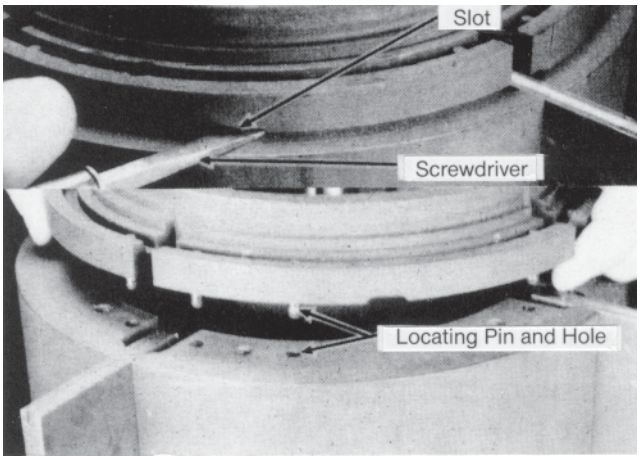

Figure 29 –Removing Cover From Rotor

- Remove the lower rotor bearing if it is still in place.
- Lift out the lower blade.

10. Turn the rotor over and remove the rotor gear plate, Figure 32.
    - Take out the screws that hold the plate to the rotor and lift off. Remove wavy spring, adjusting screws and ball, Figure 37.
11. An arbor press or spring depresser should be used to remove remaining parts from rotor, Figure 33.
    - Place rotor assembly in arbor press and slip a pipe or tube over shaft, or if available use spring depresser.
    - Apply sufficient force to relieve pressure on thrust collar and remove pin. Make certain that slot in rotor top is aligned to receive pin. Cam and shaft, spacer, rotor spring, and upper blade may now be removed from rotor.

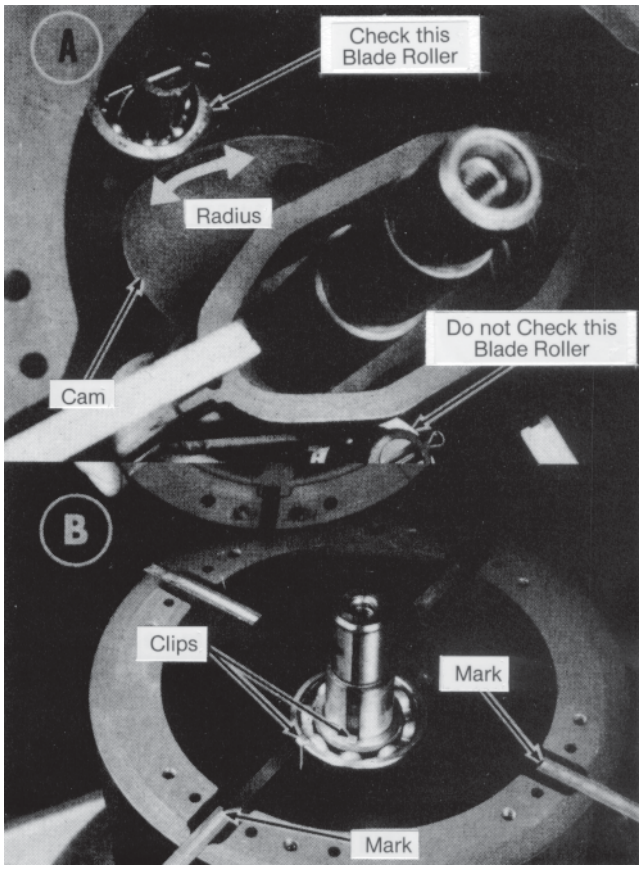

Figure 30 –Checking Clearance

12. Thoroughly wash all parts in solvent or kerosene.
    - Inspect all parts for wear, replacing as necessary.

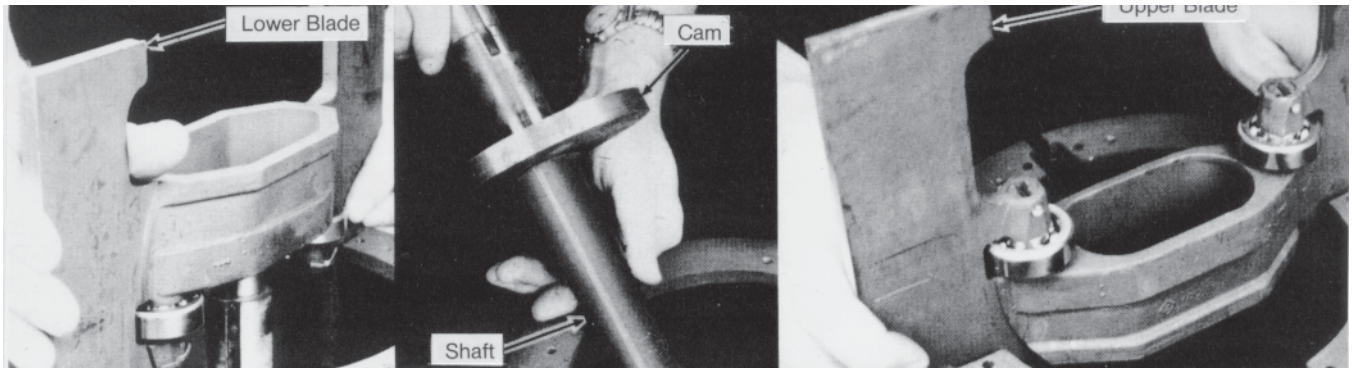

Figure 31 –Removing Blades and Shaft

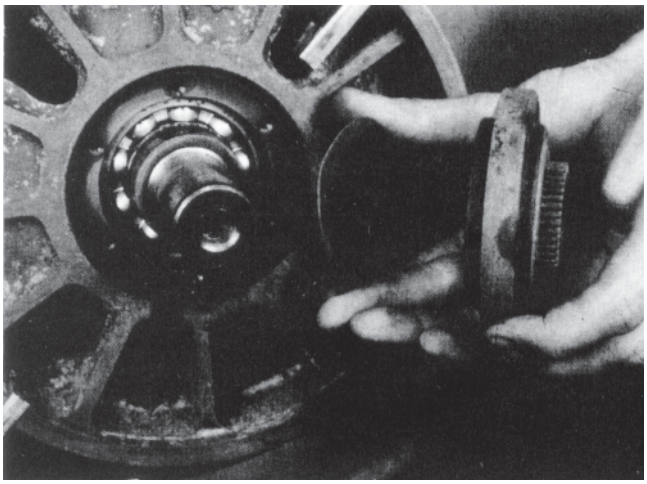

Figure 32 –Removing Rotor Gear Plate

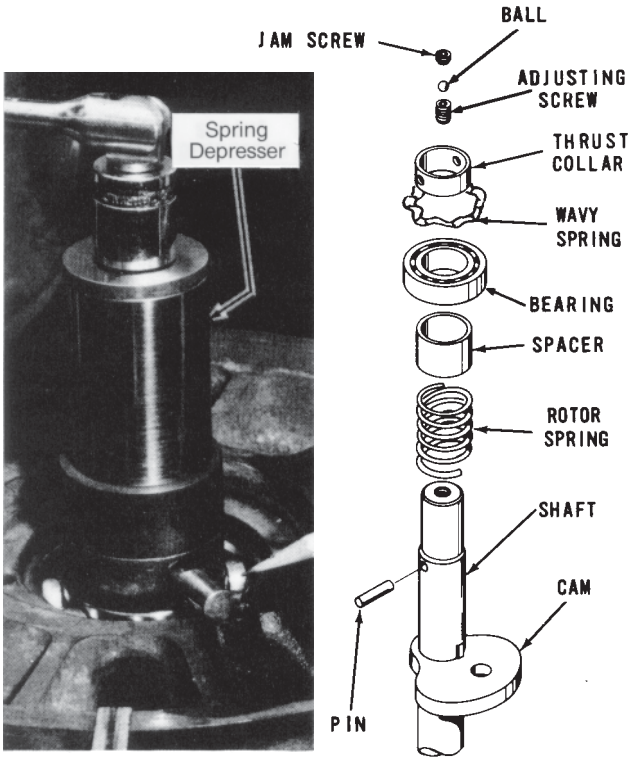

Figure 33 –Removing Collar

13. The cam may be removed from the shaft by press-ing it off. A Woodruff key is used to prevent the cam from turning on the shaft.
14. If blade bearings need replacement, removal is accomplished as follows, Figure 34.
    - Remove cotter pin and press out blade roller pin with a drill rod.
    - Reassemble with new bearing in press. Use care to align slot in pin with cotter pin hole.
    - Bend ends of cotter pin as shown.

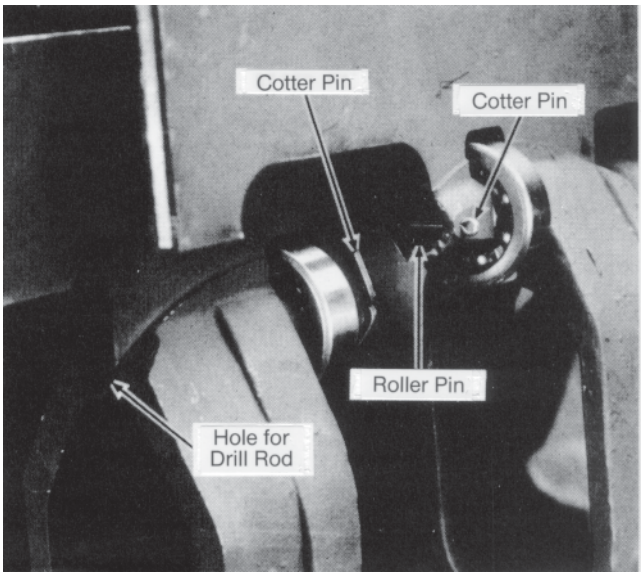

Figure 34 –Bearing Fastener Detail

Reassembly and Clearance Checks

1. Reassembly is essentially the reverse of the disassembly steps.
    - Be sure to observe the reassembly precautions noted during teardown, Step 4, Page 11.
    - Upon reassembly, apply varnish type Gasoila sealer to the body of the inner mechanism (inlet side opening only)
2. If new blades are installed, they may need to be fitted to the meter housing.

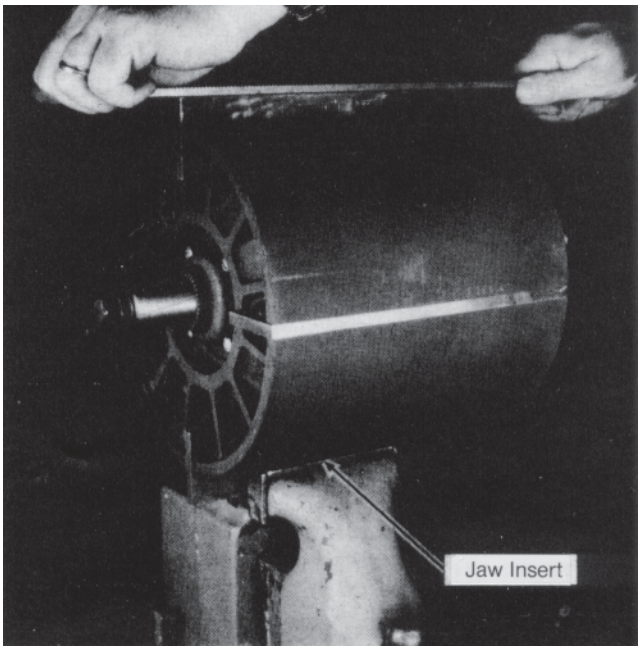

Figure 35 –Filing Edge of Blades

- After reassembling the rotor, install it in the meter housing and check clearances with feeler gauge, see Clearance Guide.
- Dress blade edges with a file as necessary, Figure 35. Protect blades from vise with jaw inserts.
- Use a Vixen (babbit metal) file for aluminum blades. A mill coarse file is suggested for cast i ron blades.
- The blades should have sharp, clean cut edges.
- Check and adjust to all clearances listed in the Clearance Guide.
- Adjust end clearances according to the following.

3. Total end clearance (see Clearance Guide) is divided, end to end, by setting the rotor adjusting set screw, Figure 36.

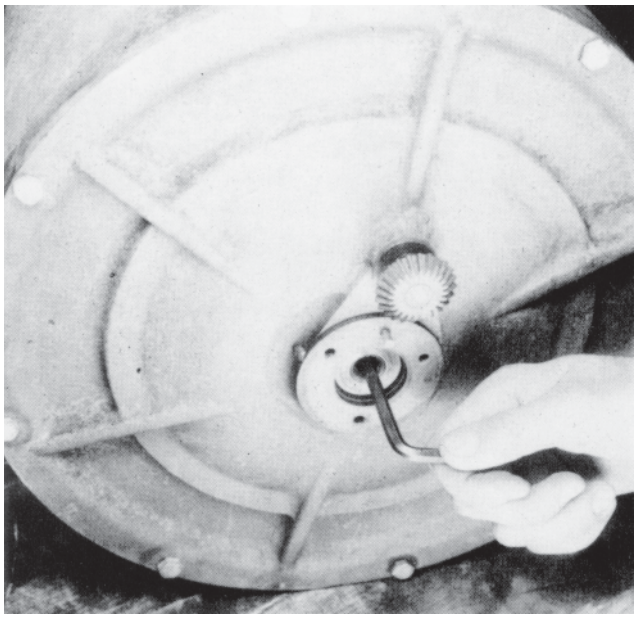

Figure 36 –Adjusting Rotor

- Figure 19 shows how access to the end clearance adjustment screw is obtained. The screw is under the gear and bearing block assembly.
- Turn the adjusting set screw to adjust rotor approximately half way within the end clearance. Use a 1/4" set screw wrench.

If the rotor cannot be adjusted properly, it is an indication of faulty assembly. The mechanism will have to be disassembled and the necessary corrective steps taken.

A properly cleaned and adjusted meter can be turned by hand with a slow, even torque applied to the jackshaft coupling. Do not use pliers to turn coupling.

Figure 37 shows the rotor end clearance adjustment parts removed for examination.

4. Figure 19 shows how the gear and bearing block assembly is attached to the inner mechanism.
   - This assembly should be replaced after the end clearance adjustment has been accomplished.

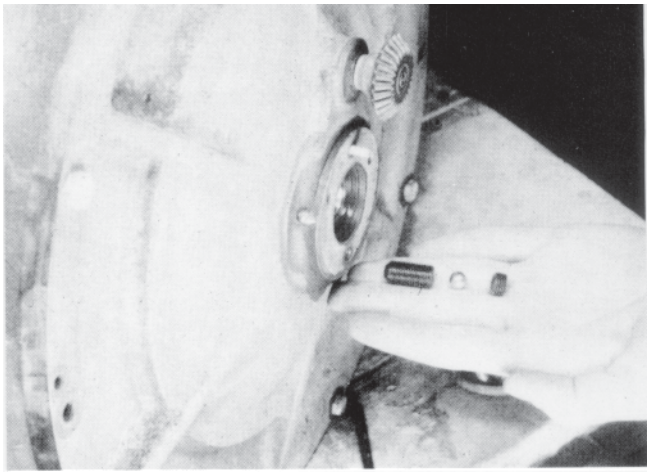

Figure 37 –Rotor Adjustment Components

Revisions included in MN01034 Issue/Rev. 0.3 (2/04):
Added Model G6-V3

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