Attach This Sheet To Front Of M.I. 167

M.I. 167

Type PGR Electro-Hydraulic Governor

DISREGARD SPECIFIC RACK LENGTH AND ABSOLUTE PRESSURE SETTINGS REFERENCED IN "TESTING" - PAGES 30 THRU 35. REFER TO ENGINE MAINTENANCE MANUAL FOR APPLICABLE SETTINGS.

ELECTRO-MOTIVE DIVISION • GENERAL MOTORS CORPORATION

SERVICE DEPARTMENT

MAINTENANCE INSTRUCTION

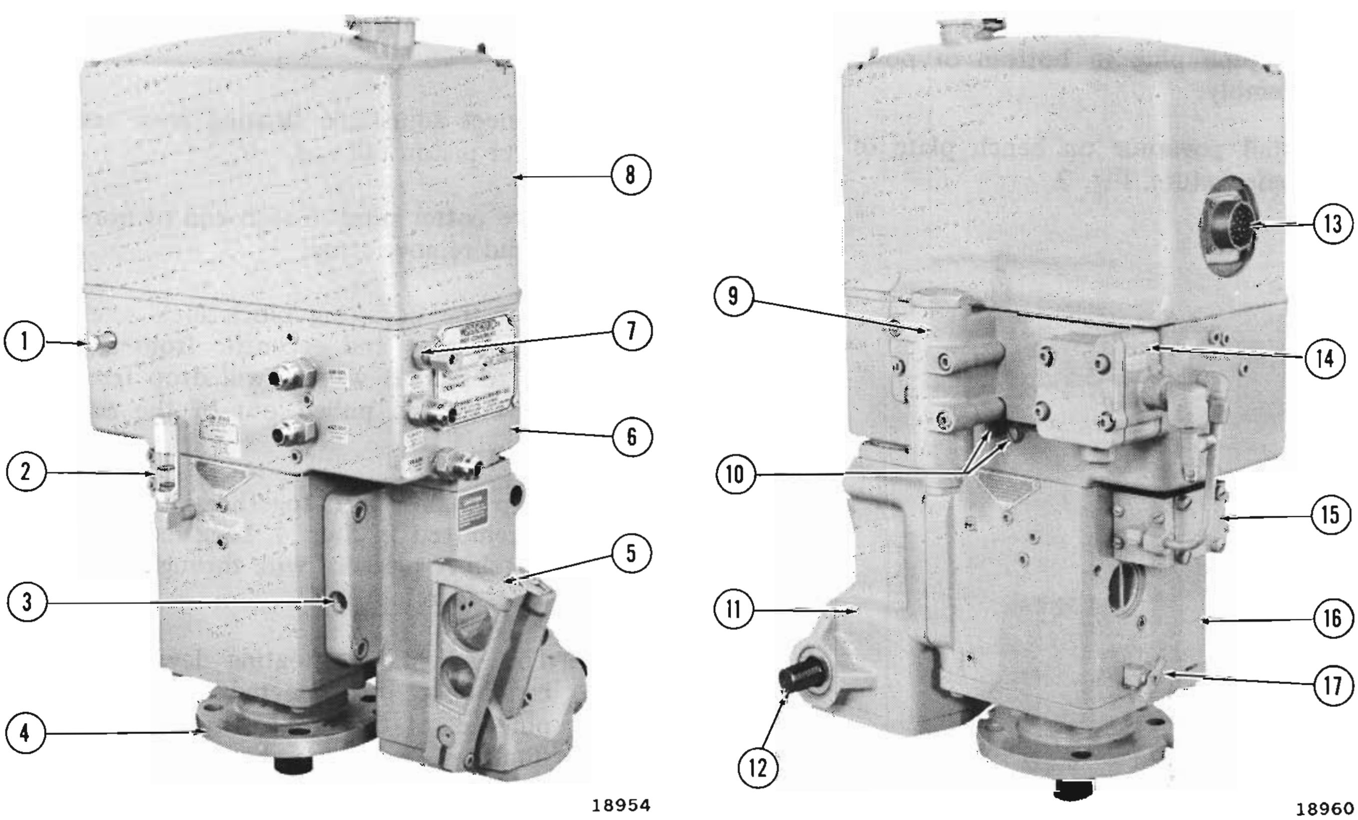
TYPE PGR ELECTRO-HYDRAULIC GOVERNOR

DESCRIPTION

It is the intention of this instruction to provide the information necessary to properly maintain the governor, Fig. 1. Proper maintenance results in efficient operation and maximum service life.

The major functions of the governor are to maintain preset engine speeds by continuous regulation of fuel flow and main generator excitation and to provide automatic shutdown of the engine in event of engine lubrication oil pressure failure or operation of the low water and crankcase pressure detector. In addition, the rebalancing type governor used on turbocharged engines, through an absolute pressure sensor assembly, may limit fuel and engine load in proportion to the air supply available to the cylinders for combustion.

Because of the importance of the governor in engine operation, it is essential that the detailed



1. Shutdown Plunger Assembly
2. Oil Level Gauge Assembly
3. Compensating Needle Valve
4. Base Assembly
5. Terminal Shaft Scale
6. Column Assembly
7. Bulkhead Fitting
8. Cover Assembly
9. Filter Assembly
10. Ballhead Hold Down Screws
11. Power Cylinder Assembly
12. Terminal Shaft
13. Electrical Receptacle
14. Lube Oil Diaphragm Plate
15. Time Delay Accumulator Assembly
16. Power Case Assembly
17. Drain Cock

Fig. 1 – Electro-Hydraulic Governor

service procedures be closely followed and that the work space and tools be kept clean.

MAINTENANCE

To facilitate maintenance, the text has been arranged so that major component disassembly and assembly procedures are designated by an appropriate heading.

DISASSEMBLY

Due to the similarity in appearance of many of the parts, it is recommended that components of each sub-assembly be kept together in a suitable container through all operations prior to assembly. Also, because of the numerous sub-sub-assemblies contained in the governor it is advisable that many of them should not be disassembled until the time of major component assembly, as explained in the text.

PREPARATION

1. Drain governor by removing drain cock and the pipe plug in bottom of power cylinder assembly.
2. Install governor on bench plate of governor repair fixture, Fig. 2.

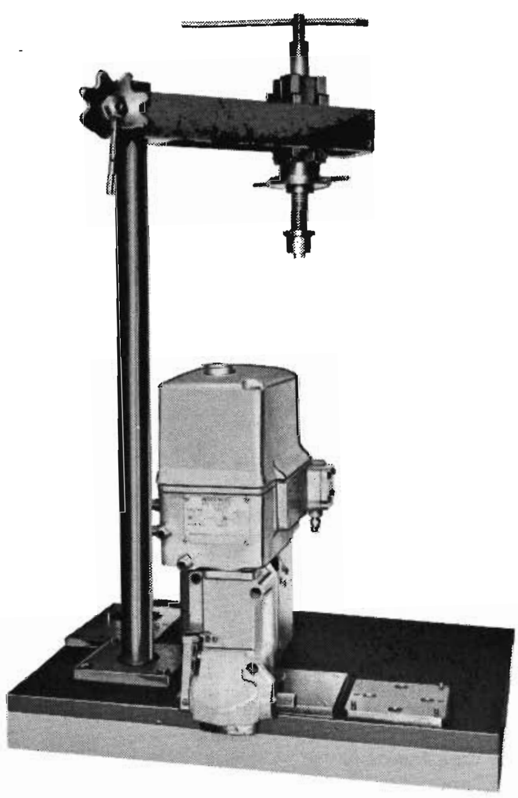


Fig. 2 – Repair Fixture

3. Remove cover assembly and oil level gauge assembly.
4. During disassembly, all oil seals, gaskets, seal rings, and diaphragms should be scrapped.

LOAD CONTROL PILOT VALVE LINKAGE, Fig. 3

1. Remove reblancing rocker arm support bracket from top of overriding solenoid and remove electrical equipment assembly from governor. Remove small coil spring from "D" solenoid plunger rod. Do not disassemble the electrical equipment assembly at this time.
2. Remove shutdown plunger.
3. Remove tube assembly connecting limiter servo to bulkhead fitting in column.
4. Disconnect rebalancing rocker arm and support bracket from vertical link.
5. Disconnect connecting beam at both ends and remove.
6. Disconnect adjustable floating lever assembly at power piston tail rod.
7. Remove cotter pins at each end of horizontal strap and remove strap.
8. Remove the adjusting block lock screw and remove washer and eccentric from adjusting block. A second washer will drop free when the eccentric is pulled out of the adjusting block.
9. To keep linkage parts together, slip horizontal strap, removed in Step 4, back onto pins and bend a short piece of wire through the cotter pin holes to retain it.

NOTE: The adjustable floating lever assembly cannot be disconnected from the pivot pin link at this time. Lay the adjustable floating lever assembly and connected linkage back over the speed setting cylinder to provide room to continue disassembly of load control pilot valve.

LOAD CONTROL PILOT VALVE, Fig. 4

1. Lift up on the adjusting block (2) until a wrench can be inserted under the pilot valve indicator washer (3) to engage the locknut (4).

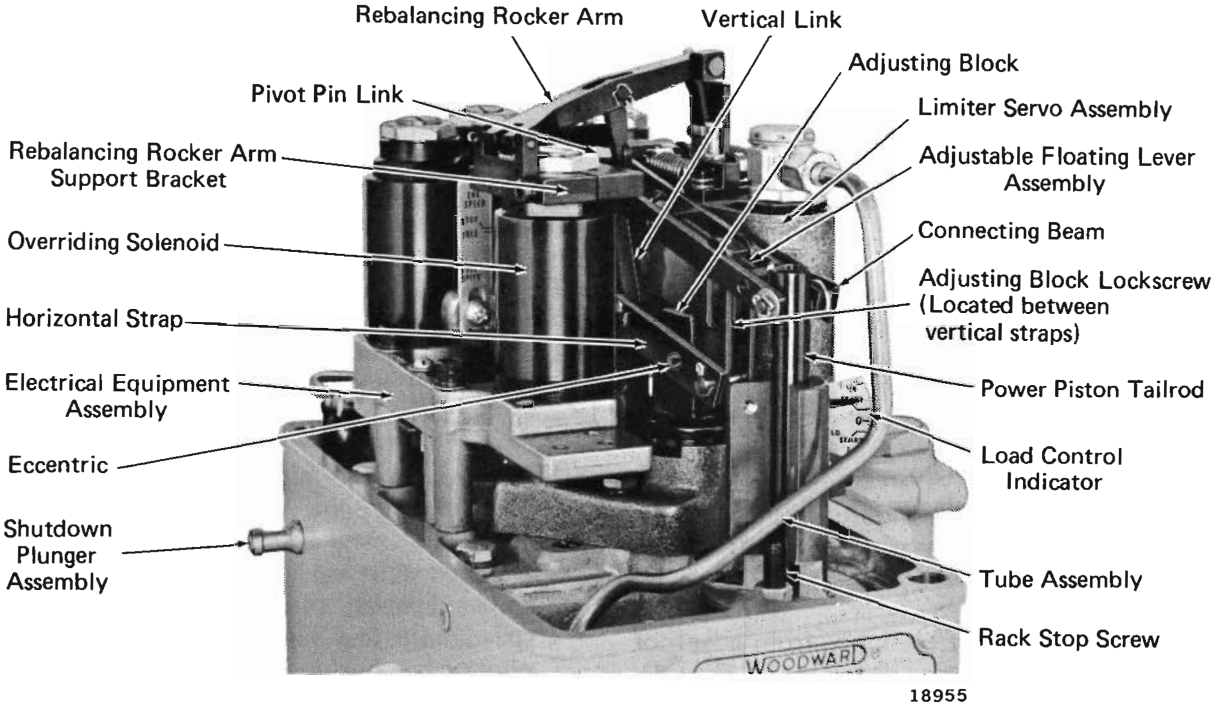
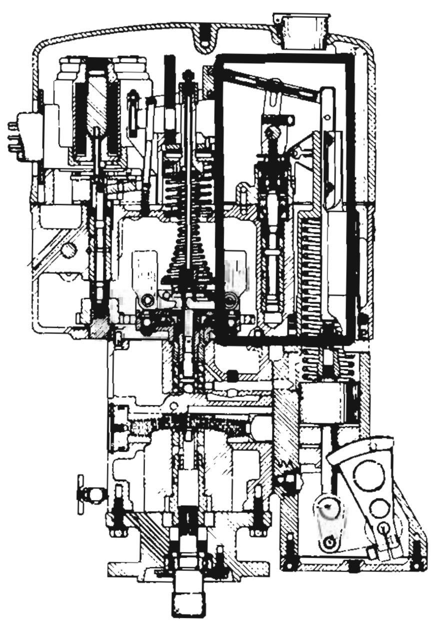


Fig. 3 – Load Control Pilot Valve Linkage



1. Eccentric Lock Screw
2. Adjusting Block
3. Indicator Washer
4. Locknut
5. Snap Ring
6. Spring Retainer
7. Outer Spring
8. Inner Spring
9. Locknut
10. Spring Collar
11. Overriding Piston
12. Overriding Valve Plunger
13. Capscrew
14. Overriding Plunger Spring
15. Overriding Cylinder
16. "O" Ring
17. Oil Seal
18. Oil Seal Gasket
19. Pilot Valve
20. Pilot Valve Bushing Spring
21. Pilot Valve Bushing
22. Retaining Ring
23. Pivot Link Pin
24. Cotter Pin
25. Floating Lever Assembly

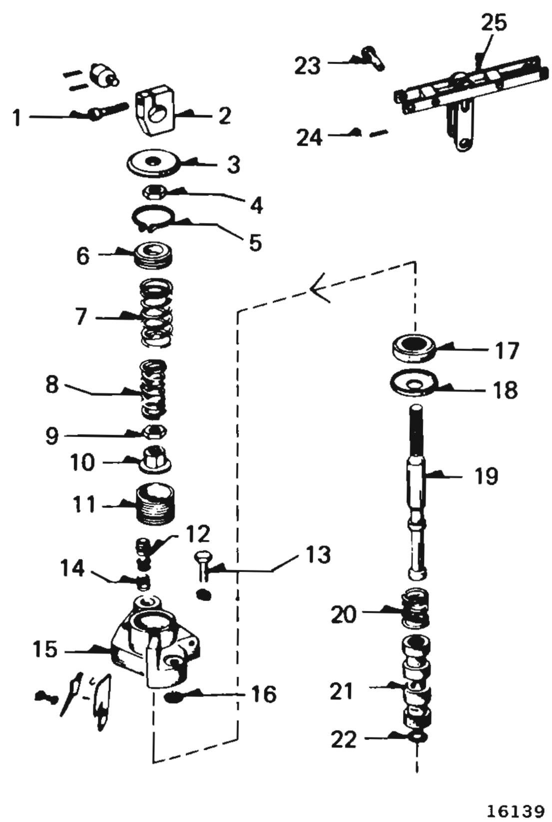


Fig. 4 -- Load Control Pilot Valve

2. Break the adjusting block loose with a wrench and unscrew the adjusting block, indicator washer, and locknut from the pilot valve plunger (19).

3. Disengage retainer snap ring (5) and remove retainer (6) and springs (7 & 8) from overriding cylinder (15).

4. Lift pilot valve plunger until a wrench can be engaged with flats on spring collar (10) and, using a second wrench, loosen the locknut (9) above the spring collar. Unscrew locknut and spring collar from pilot valve plunger.

5. Remove overriding valve plunger (12) and plunger spring (14) from bore in limiter servo assembly body and remove load control indicator, Fig. 3, from servo body.

6. Remove limiter servo assembly from governor and remove overriding piston (11, Fig. 4), from cylinder bore. Do not further disassemble the limiter servo assembly at this time.

7. Remove pilot valve plunger, oil seal (17), oil seal gasket (18), spring (20), and bushing (21) from column.

NOTE: If bushing does not slide easily out of bore in column, use load control pilot valve bushing removing tool, Fig. 5.

8. The adjustable floating lever assembly (25) and connected linkage may be disconnected from the pivot pin link at this time, if desired. It is not necessary to remove this linkage unless heavy wear is noted in other areas of the governor, and an inspection of the hardened linkage pins is considered necessary.

SPEED CONTROL PILOT VALVE, Fig. 6

1. Remove special regulator bushing retainer screw (6) and retainer bolt (2), washer (5), spring (3), and collar (4).

2. Remove retainer (8), "D" solenoid cup assembly (1), and pilot valve pin (11).

3. Remove pilot valve plunger (14), spring (15), thrust bearing (10), regulating bushing (9), speed adjusting pilot valve bushing (16), and pilot valve bushing spring (17) from column.

4. Disconnect lower floating lever (12) from floating lever link.

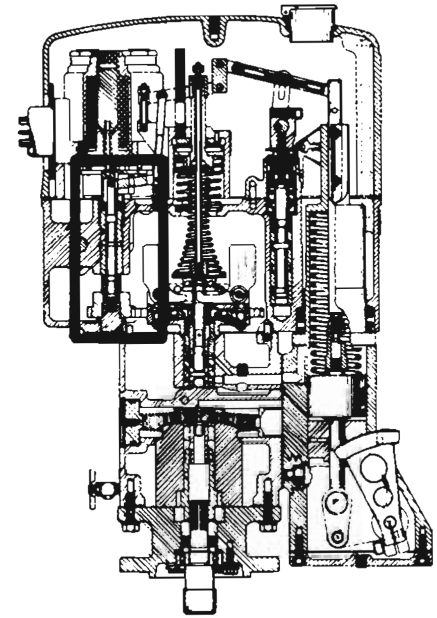
5. Remove solenoid counterbalance spring (18) and bypass valve assembly from column. Do not disassemble at this time.

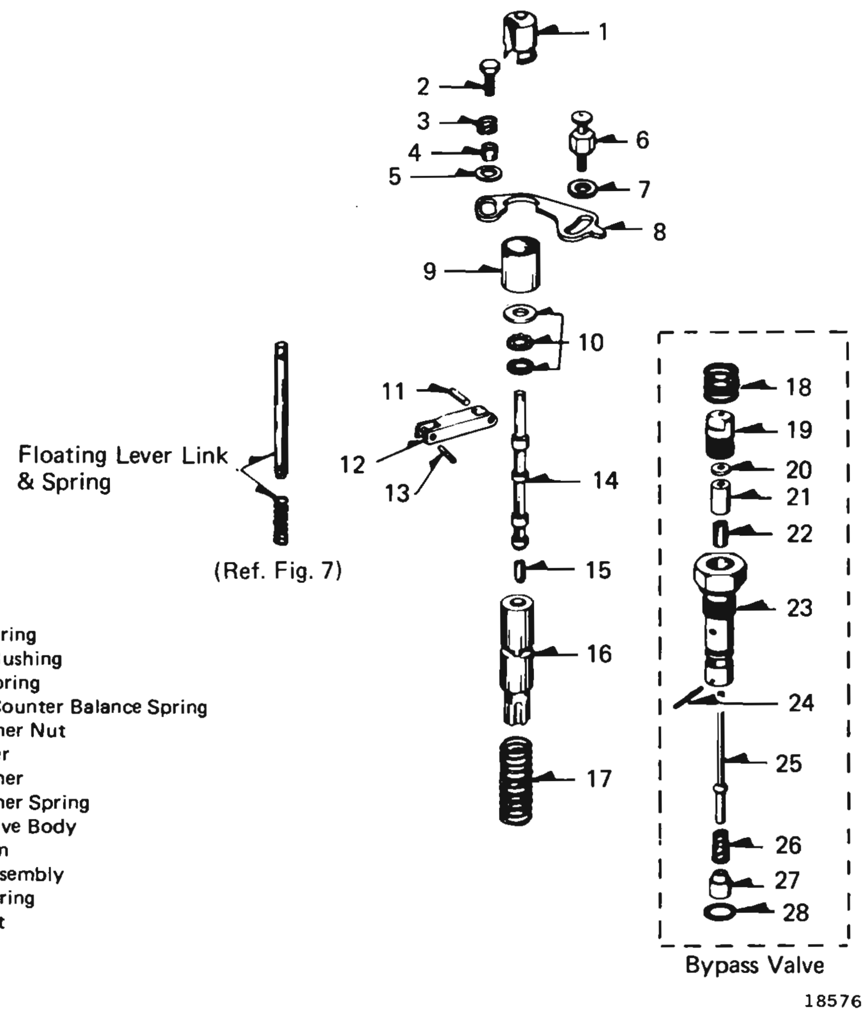
SPEEDER SPRING SERVO, Fig. 7

1. Remove locknut from shutdown rod and unscrew the shutdown block (4) from the rod.

16140

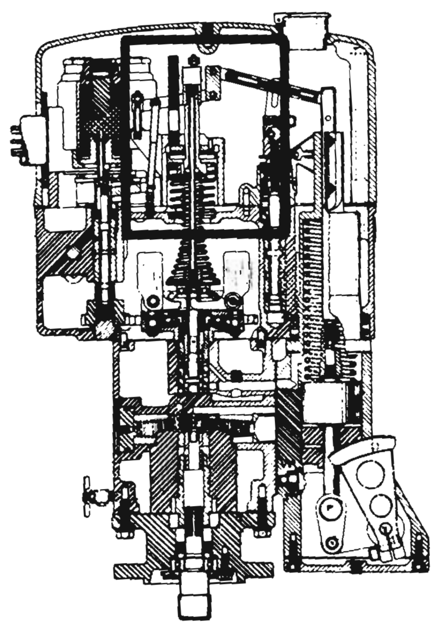
Fig. 5 – Load Control Pilot Valve Bushing Removal Tool

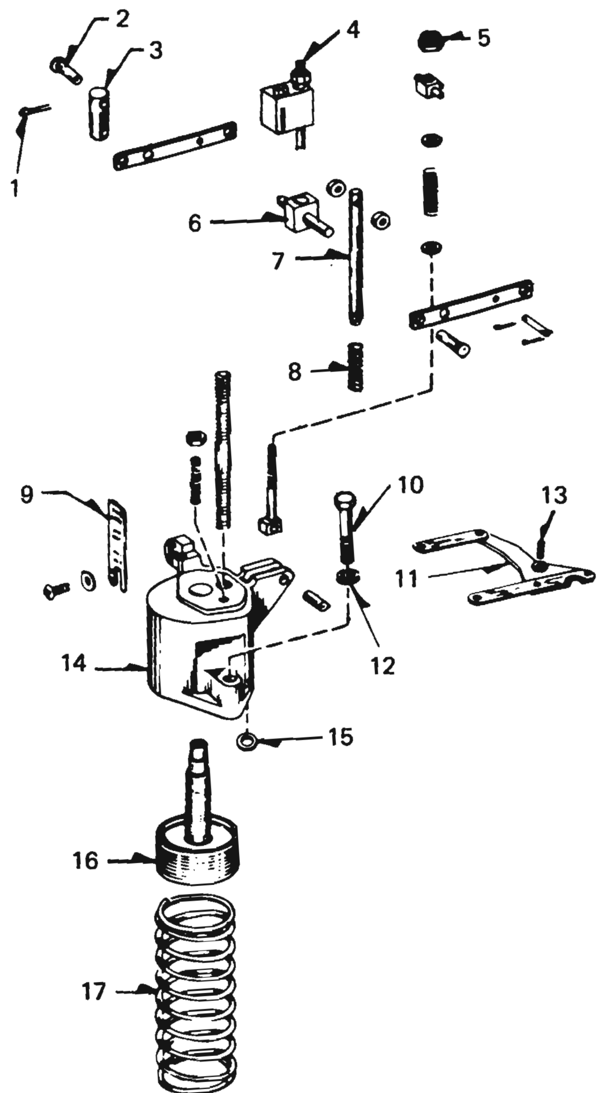




1. "D" Solenoid Cup Assembly
2. Retainer Bolt
3. Retainer Spring
4. Retainer Spring Collar
5. Retainer Washer
6. Special Retainer Screw
7. Washer
8. Regulating Bushing Retainer
9. Regulating Bushing
10. Thrust Bearing
11. Pilot Valve Pin
12. Lower Floating Lever
13. Straight Pin
14. Pilot Valve Plunger
15. Plunger Spring
16. Rotating Bushing
17. Bushing Spring
18. Solenoid Counter Balance Spring
19. Seal Retainer Nut
20. Seal Washer
21. Seal Retainer
22. Seal Retainer Spring
23. Bypass Valve Body
24. Straight Pin
25. Plunger Assembly
26. Plunger Spring
27. Spring Seat
28. "O" Ring

Fig. 6 – Speed Control Pilot Valve And Bypass Valve





1. Cotter Pin
2. Headed Pin
3. Pivot Pin Link
4. Shutdown Device (Nut, Block, and Rod)
5. Fulcrum Nut
6. Fulcrum Assembly
7. Floating Lever Link
8. Floating Lever Link Spring
9. Speed Indicator Scale
10. Servo Capscrew
11. Triangular Plate Assembly
12. Plain Washer
13. Bypass Valve Adjusting Screw
14. Servo Cylinder Assembly
15. "O" Ring
16. Speeder Servo Piston
17. Servo Spring

18577

Fig. 7 – Speeder Spring Servo

2. Remove the two bolts (10) retaining the speeder spring servo cylinder assembly (14) and the triangular plate assembly (11).

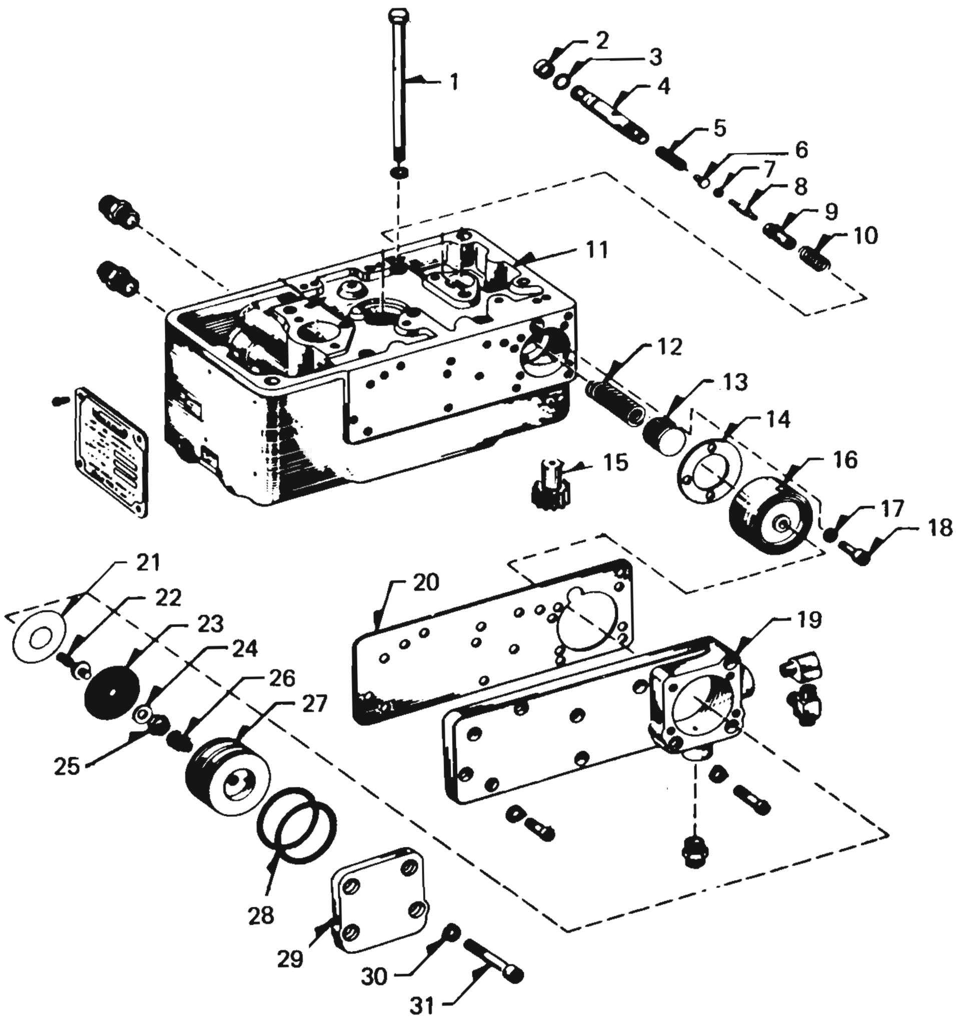
3. Remove the speeder spring servo assembly and attached linkage and the servo spring (17). Do not disassemble the speeder spring servo assembly at this time.

OIL FAILURE SHUTDOWN ASSEMBLY, Fig. 8

1. Remove filter assembly (9, Fig. 1), from lube oil diaphragm plate (19, Fig. 8).

2. Remove cap (29) from diaphragm plate.

3. Remove diaphragm plate and gasket (20), diaphragm spring (26), lube oil diaphragm



1. Column To Case Bolt
2. Tubing
3. "O" Ring
4. Shutdown Plunger
5. Spring
6. Spring Pin
7. Ball
8. Plunger Pin
9. Ball Valve Seat
10. Shutdown Plunger Spring
11. Column
12. Piston Spring
13. Oil Failure Piston
14. Oil Failure Bushing Gasket
15. Rotating Bushing Gear
16. Oil Failure Valve Bushing
17. Valve Bushing Washer
18. Valve Bushing Screw
19. Lube Oil Diaphragm Plate
20. Diaphragm Plate Gasket
21. Support Washer
22. Oil Failure Plunger
23. Oil Failure Diaphragm
24. Diaphragm Washer
25. Diaphragm Nut
26. Oil Failure Diaphragm Spring
27. Valve Body
28. "O" Rings
29. Diaphragm Cap
30. Lockwasher
31. Diaphragm Cap Screw

18578

Fig. 8 – Oil Failure Shutdown Assembly

(23) and plunger (22), and diaphragm support washer (21).

4. Remove valve body (27) from diaphragm plate.

5. Remove bushing retainer cap screw (18) and washer (17) from column.

6. Remove oil failure valve bushing (16), piston (13), piston spring (12), and valve bushing gasket (14) from column.

NOTE: To remove the oil failure valve bushing, insert a length of brass rod in the shutdown plunger bore until it bottoms in the oil failure piston and hit the rod sharply with a hammer to break the bushing loose.

7. Unscrew the tube nuts at both ends of the tube assembly, Fig. 14, connecting the time delay accumulator to the column.

8. Remove four column to case bolts (1, Fig. 8), and remove column assembly (11) from power case assembly.

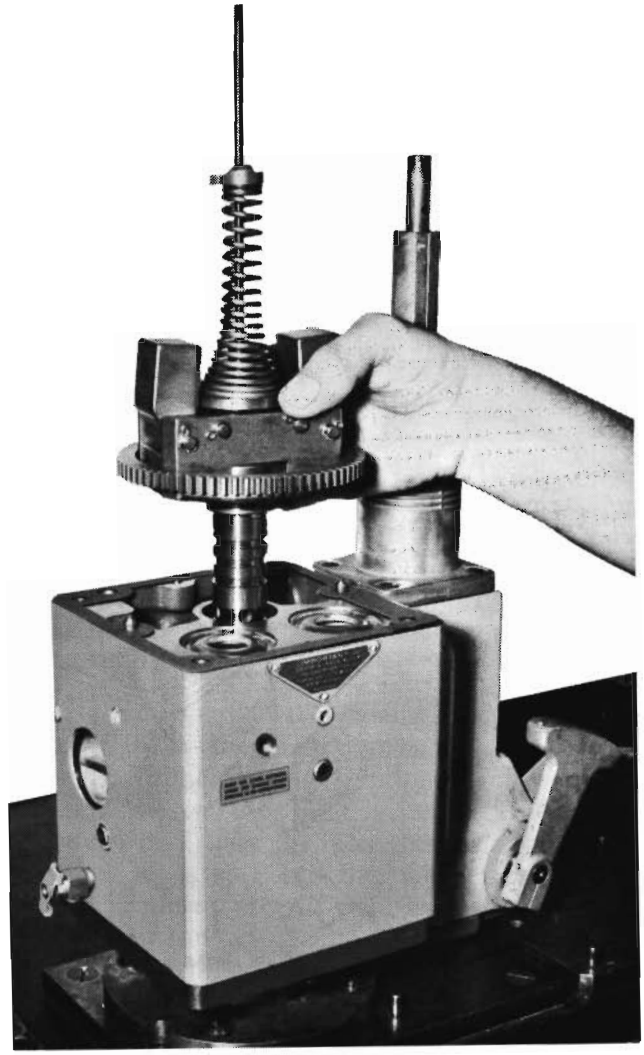
9. Remove rotating bushing drive gear (15) from inside of column assembly.

NOTE: Do not remove the two lockwired ballhead holddown screws (10, Fig.1) and block from the column. If the block is loose, cut lockwire, tighten screws, and install new lockwire.

10. Remove the tube assembly from the time delay accumulator and remove the accumulator assembly from the power case. Accumulator assembly is not disassembled at this time.

ROTATING SLEEVE ASSEMBLY

By lifting the ball head, all components of the rotating sleeve assembly, as shown in Fig. 9 will be removed from the power case.



16144

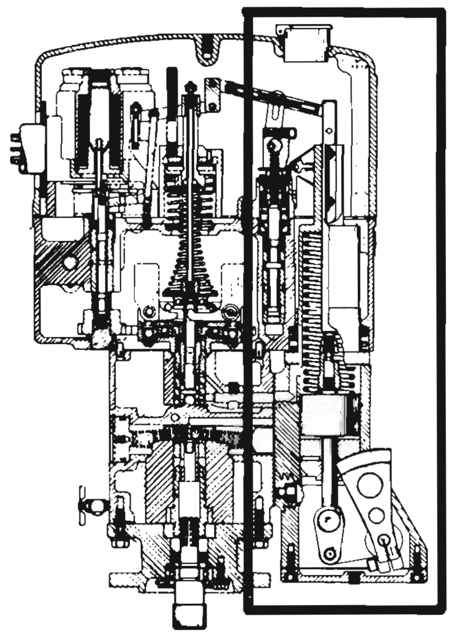
Fig. 9 – Rotating Sleeve Assembly

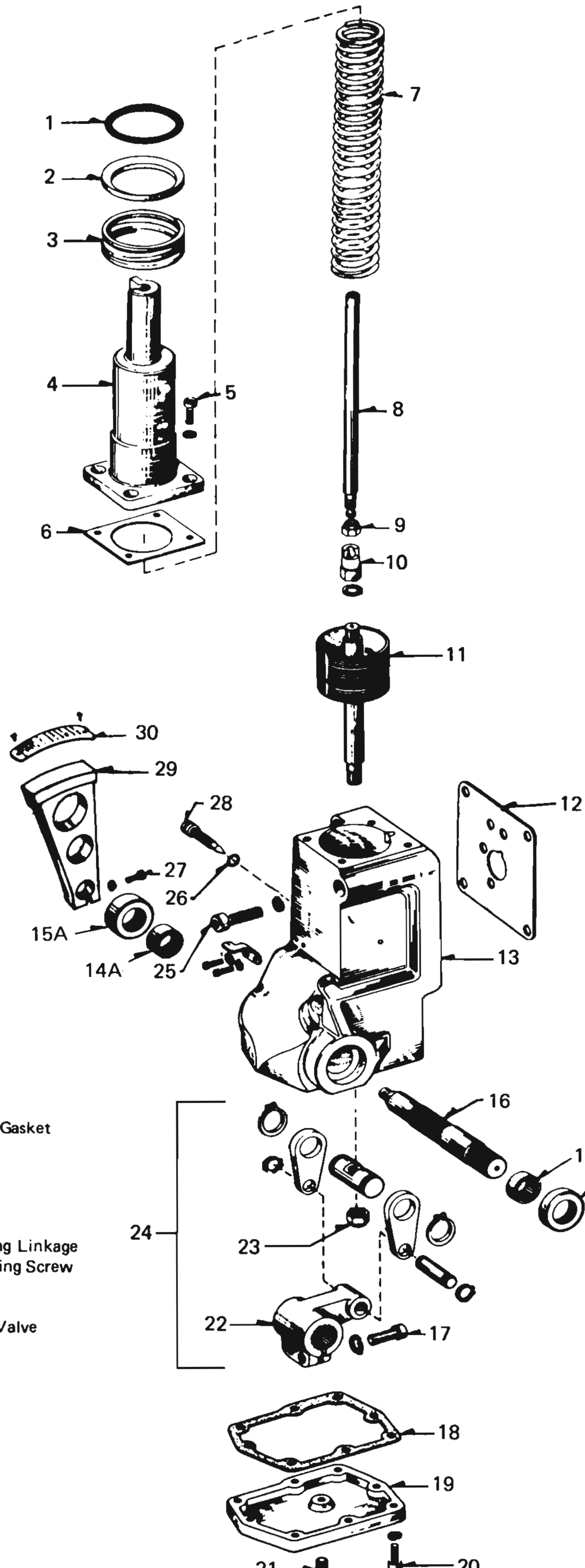
Do not disassemble the rotating sleeve assembly at this time.

POWER CYLINDER ASSEMBLY, Fig. 10

1. Remove spring guard "O" ring (1), seal ring (2), and spring (3).

2. Install power piston spring guard compressor on spring guard (4). Screw flanged pilot of





1. "O" Ring
2. Seal Ring
3. Seal Spring
4. Spring Guard
5. Spring Guard Screw
6. Gasket
7. Power Piston Spring
8. Power Piston Tail Rod
9. Tail Rod Nut
10. Tail Rod Lift Nut
11. Power Piston
12. Power Cylinder Gasket
13. Power Cylinder
14. Needle Bearing
15. Oil Seal
16. Terminal Shaft
17. Power Lever Screw
18. Power Cylinder Cover Gasket
19. Power Cylinder Cover
20. Cap Screw
21. Pipe Plug
22. Power Lever
23. Piston Rod Stop Nut
24. Power Lever Connecting Linkage
25. Power Cylinder Mounting Screw
26. "O" Ring
27. Rack Lever Screw
28. Compensating Needle Valve
29. Rack Dial Lever
30. Terminal Shaft Scale

Fig. 10 – Power Cylinder Assembly

18579

governor repair fixture down approximately 6" below slide, and insert pilot in spring guard compressor, Fig. 11.

3. Clamp repair fixture firmly on vertical and horizontal bars, and remove four screws (5, Fig. 10), holding spring guard in place.

4. Screw pilot upward until compression of power piston servo spring (7) is relieved.

5. Raise fixture out of way and remove spring guard compressor. If spring guard cannot be lifted off governor, press it down and to one side to disengage tail rod (8) from tail rod lift nut (10).

16146

Fig. 11 – Piston Spring Guard Compressor Tool Application

6. Remove four, large, hex, socket-head screws (25) holding power cylinder assembly to power case, and remove power cylinder assembly.

POWER CASE, BASE, AND DRIVE SHAFT, Fig. 12

1. Using snap ring pliers, remove buffer plug snap ring (8).

2. Remove buffer plug (6), buffer springs (9), buffer piston (10), and buffer spring seat (11) from power case.

NOTE: If buffer plug does not slide easily from case when snap ring is removed, install a cap screw in hole in center of plug and pull it from the case.

3. Install accumulator spring compressor through hole in accumulator spring seat (3) and position pilot of governor repair fixture on top of compressor.

4. Clamp fixture in place on vertical and horizontal bars and screw pilot down until spring seat is clear of snap ring (2).

5. Using snap ring pliers, remove snap ring from groove in power case.

6. Screw pilot upward until compression of accumulator springs is relieved.

7. Raise fixture out of way and remove spring compressor.

8. Remove snap ring (2), spring seat (3), and springs (1 & 5) from both locations in the case.

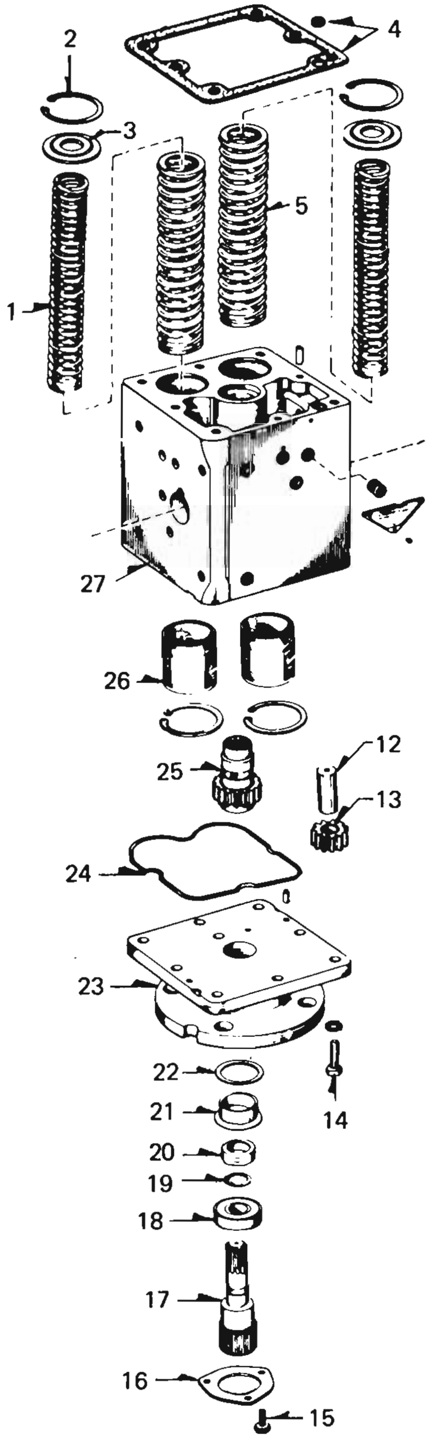
9. Invert power case on bench plate making sure that dowels in case enter matching holes in plate.

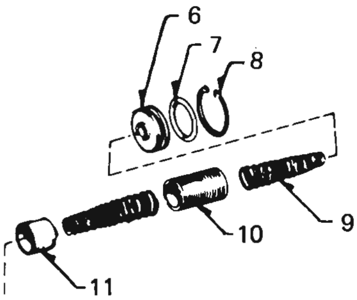
10. Cut lockwire and remove bearing retainer (16), drive shaft (17), bearing (18), oil seal (20), and oil seal retainer (21).

11. Remove eight base to case bolts (14), and remove base (23) from power case (27).

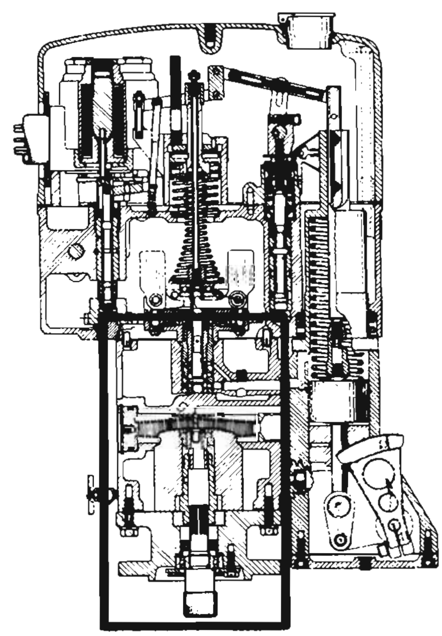
12. Remove idler gear (13) and drive gear (25) from case.

13. Remove accumulator pistons (26) from case.





1. Accumulator Spring – Inner
2. Snap Ring
3. Spring Seat
4. Column To Case Gaskets
5. Accumulator Spring – Outer
6. Buffer Plug
7. "O" Ring
8. Snap Ring
9. Buffer Spring
10. Buffer Piston
11. Buffer Spring Seat
12. Idler Stud
13. Idler Gear
14. Base To Case Bolt
15. Bearing Retainer Bolt
16. Bearing Retainer
17. Drive Shaft
18. Drive Shaft Bearing
19. Snap Ring
20. Oil Seal
21. Oil Seal Retainer
22. Oil Seal Retainer Gasket
23. Base
24. Case To Base Seal
25. Drive Gear
26. Accumulator Piston
27. Power Case Assembly



16147

Fig. 12 – Power Case, Base, And Drive Shaft Assemblies

14. Remove all 1/8" NPT allen head plugs in power case that are necessary to make connections for testing governor.

CLEANING

All parts, except the electrical equipment assembly and the shutdown solenoid valve, should be thoroughly cleaned prior to inspection or further disassembly.

CAUTION: Do not wash aluminum parts in caustic soda solution as they will be damaged.

ASSEMBLY

POWER CASE, BASE, AND DRIVE SHAFT, Fig. 12

1. Install power case assembly (27) upside down on bench plate and inspect rotating sleeve assembly bore, accumulator and buffer piston bores, idler gear stud (12), and gear pocket for scoring or excessive wear.

2. Inspect idler gear (13) and drive gear (25) for excessive wear or galling of teeth or sides.

3. Install idler gear and drive gear in power case and install new case to base seal (24) in case groove.

4. Inspect base (23) for damage to mounting flange or excessive wear at gear location.

5. Install base on power case and tighten the eight base bolts (14) finger tight.

6. Inspect drive shaft (17) for satisfactory operation of bearing (18) and for excessive wear at oil seal contact point. If excessive wear is observed, the shaft can be reused by locating the new oil seal in the retainer at a point which will ensure seal contact on a new area of the drive shaft. If necessary to replace bearing, use external snap ring pliers to remove and install snap ring (19).

7. Install new oil seal (20) in oil seal retainer (21), using oil seal removing and installing tool.

8. Place retainer to base gasket (22) in place.

9. Slide oil seal and retainer onto drive shaft and install drive shaft in base.

10. Install bearing retainer (16) and three bolts (15) and tighten bolts uniformly until retainer bends slightly. Install lockwire through the three bolt heads.

11. Turn base and case assembly upright and install on bench plate adjoining repair fixture.

ACCUMULATOR PISTONS, Fig. 12

1. Inspect accumulator pistons (26) for scoring or excessive wear.

2. Insert accumulator pistons (open end upward) and springs (1 & 5) in accumulator bores, and place spring seat (3) and snap ring (2) on top of springs.

3. Install accumulator spring compressor through hole in spring seat and position pilot or repair fixture on top of compressor. Slide fixture downward to compress springs somewhat and clamp in place on vertical bar. Screw pilot down until spring seat is below snap ring groove in bore, and install snap ring. Screw pilot upward until spring seat contacts snap ring. Repeat this procedure for other accumulator.

4. Insert rotating sleeve assembly, Fig. 9, in power case until it pilots in drive gear. Make certain that sleeve can be rotated freely in bore. Continue to check freeness of sleeve assembly as the eight base to case bolts (14, Fig. 12), are tightened uniformly. Remove sleeve assembly from power case.

BUFFER PISTON, Fig. 12

1. Inspect buffer piston (10) for excessive wear or dirt scoring and make certain that it is absolutely free in the buffer piston bore in power case.

2. Snap small end coil of one buffer spring (9) on buffer spring seat (11) and the other spring on the buffer plug (6). Insert spring seat and spring, buffer piston, spring and plug, with new "O" ring (7) into power case and secure in place with snap ring (8).

NOTE: Lubricate "O" ring, buffer plug, and bore in case with oil before installing buffer plug with new "O" ring.

POWER CYLINDER ASSEMBLY, Fig. 13

1. Remove compensating needle valve (28) from power cylinder assembly.

2. Remove power cylinder cover (19).

3. Loosen rack lever screw (27) and remove rack dial lever (29) from terminal shaft (16).

4. Loosen two power lever screws (17) and press terminal shaft out of cylinder, large diameter end first.

5. Remove piston rod stop nut (23) and remove power piston (11) and power lever connecting linkage (24) from cylinder assembly.

6. Using rotary shaft bearing removing and installing tool, press or drive needle bearings (14) and oil seals (15) from cylinder.

7. Clean all parts thoroughly and inspect piston and cylinder bore for excessive wear or dirt scoring.

8. If necessary to replace piston, remove tail rod lift nut (10) and install on new piston.

9. Inspect power lever connecting linkage (24) for excessive wear on links and pins. Inspect needle bearings (14) for excessively loose or missing needles.

10. Press needle bearings and new oil seals in cylinder.

11. Install power piston (11) in cylinder and install power lever and connecting linkage using piston rod stop nut (23).

12. Inspect terminal shaft (16) for excessive wear at bearing surfaces or damaged serrations.

13. Install terminal shaft (small diameter end first) in housing, making certain that the missing serration on center portion of shaft engages the single blank serration in power lever. Center terminal shaft in housing and tighten two power lever screws (17).

14. Locate rack dial lever (29) on terminal shaft so that the 1.96 mark on the scale is as near to the mid-point of the rack scale indicator as possible when the power piston is at the bottom of its travel. Tighten rack lever screw (27) to retain alignment of dial.

15. Install needle valve (28) with new "O" ring (26) in cylinder assembly.

16. Install pipe plug (21) in power cylinder cover (19) and install cover and new gasket (18) on power cylinder.

17. Install power cylinder assembly on power case using new gasket (12).

CAUTION: Make certain that gasket is installed according to directions printed on it. Improper application will result in malfunction of the governor.

18. Tighten the four cylinder mounting screws (25) securely to prevent oil leaks at the gasket.

SPRING GUARD, Fig. 13

1. Loosen the rack stop screw locknut, Fig. 3, and adjust the rack stop screw so that the top of the screw is at least 1" above the machined surface against which the locknut seats. Tighten the locknut securely.

2. With power piston tail rod (8, Fig. 13), in spring guard (4), engage lower end of tail rod in lift nut (10) on power piston, and position spring guard firmly in place on power cylinder. Tail rod should rotate freely but should have no appreciable end play.

3. Remove spring guard and tail rod and turn rod nut (9) down slightly.

4. Reapply spring guard to power cylinder with tail rod engaged with lift nut, and again check end play and rotation of tail rod.

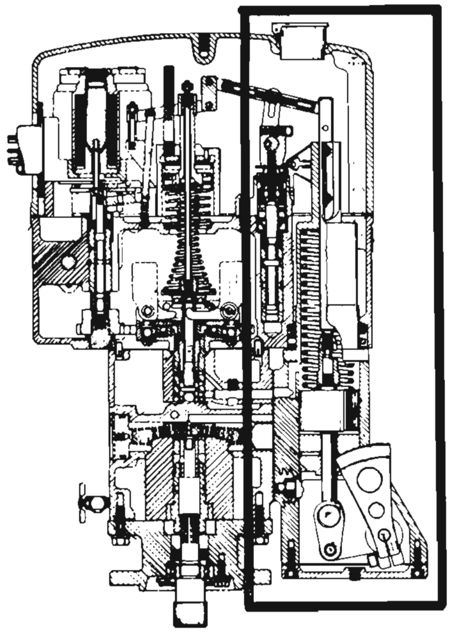
5. Repeat procedure until minimum amount of end play is obtained, which will still permit free rotation of tail rod.

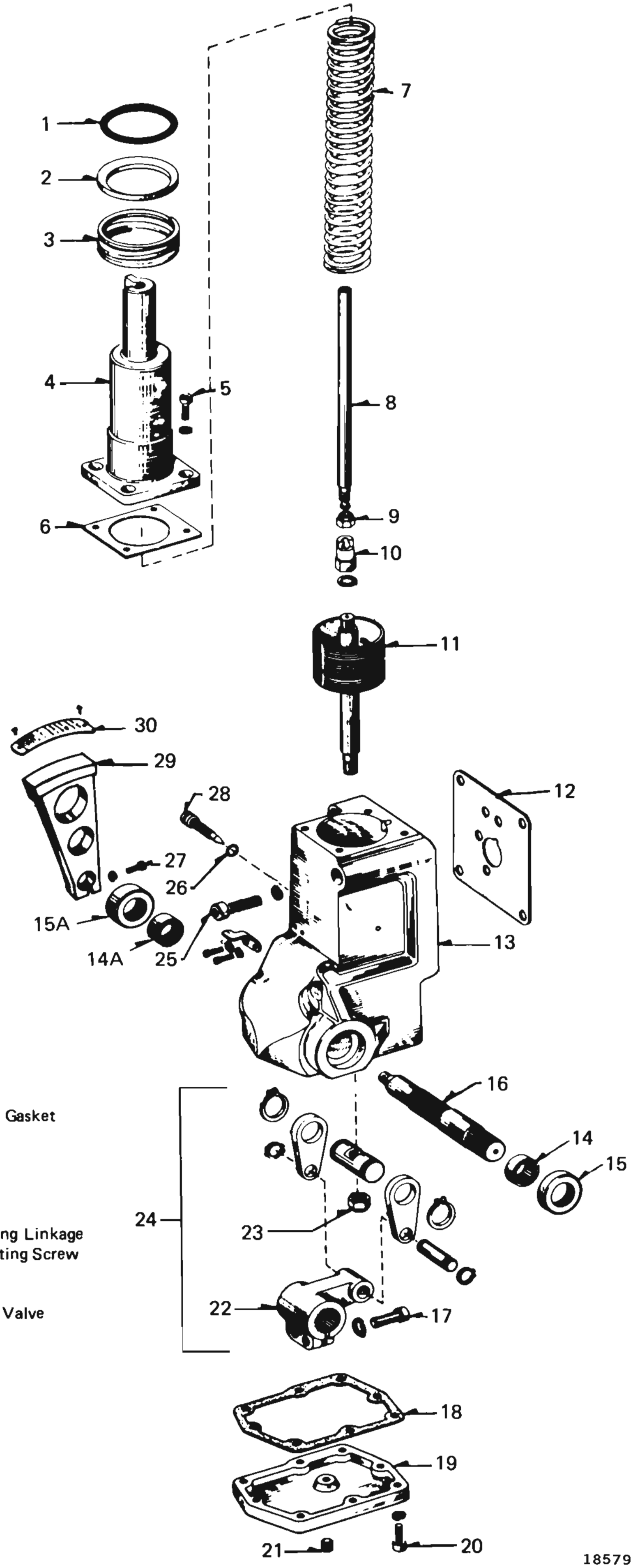
6. Remove spring guard and tail rod and install gasket (6) and spring (7).

7. Install spring guard and tail rod, compressing spring as necessary to engage tail rod with lift nut.

8. Install power piston spring guard compressor on spring guard and insert pilot of governor repair fixture in compressor, Fig. 11.

9. Force fixture downward and clamp in place on vertical bar.





1. "O" Ring
2. Seal Ring
3. Seal Spring
4. Spring Guard
5. Spring Guard Screw
6. Gasket
7. Power Piston Spring
8. Power Piston Tail Rod
9. Tail Rod Nut
10. Tail Rod Lift Nut
11. Power Piston
12. Power Cylinder Gasket
13. Power Cylinder
14. Needle Bearing
15. Oil Seal
16. Terminal Shaft
17. Power Lever Screw
18. Power Cylinder Cover Gasket
19. Power Cylinder Cover
20. Cap Screw
21. Pipe Plug
22. Power Lever
23. Piston Rod Stop Nut
24. Power Lever Connecting Linkage
25. Power Cylinder Mounting Screw
26. "O" Ring
27. Rack Lever Screw
28. Compensating Needle Valve
29. Rack Dial Lever
30. Terminal Shaft Scale

Fig. 13 – Power Cylinder Assembly

10. Screw pilot downward until spring guard contacts gasket on power cylinder.

11. Back pilot up very slightly until spring guard can be turned to line up four holes for installation of screws (5, Fig. 13).

12. Tighten screws securely, remove compressor, and check to see that tail rod can still be rotated freely.

13. Install seal spring (3), seal ring (2), and "O" ring seal (1) over spring guard.

NOTE: Lubricate "O" ring seal and large diameter of spring guard with oil before installing "O" ring seal.

TIME DELAY ACCUMULATOR, Fig. 14

1. Remove four screws, nuts, cylinder caps, and gaskets from accumulator cylinder.

2. Remove piston and spring from cylinder.

3. Clean all parts thoroughly and check piston for free fit in cylinder.

4. Assemble spring, piston, and cylinder caps to cylinder block using new gaskets, and tighten screws securely.

5. Install accumulator assembly on power case using new gasket.

ROTATING SLEEVE ASSEMBLY, Fig. 15

1. Remove speeder spring (2) and plug (1) from speeder spring seat (6).

2. Remove cotter pin (3), plunger nut (4), spring (5), and shutdown rod (7).

3. Remove speeder spring seat (6), thrust bearing (8), washer (9), and spring (10).

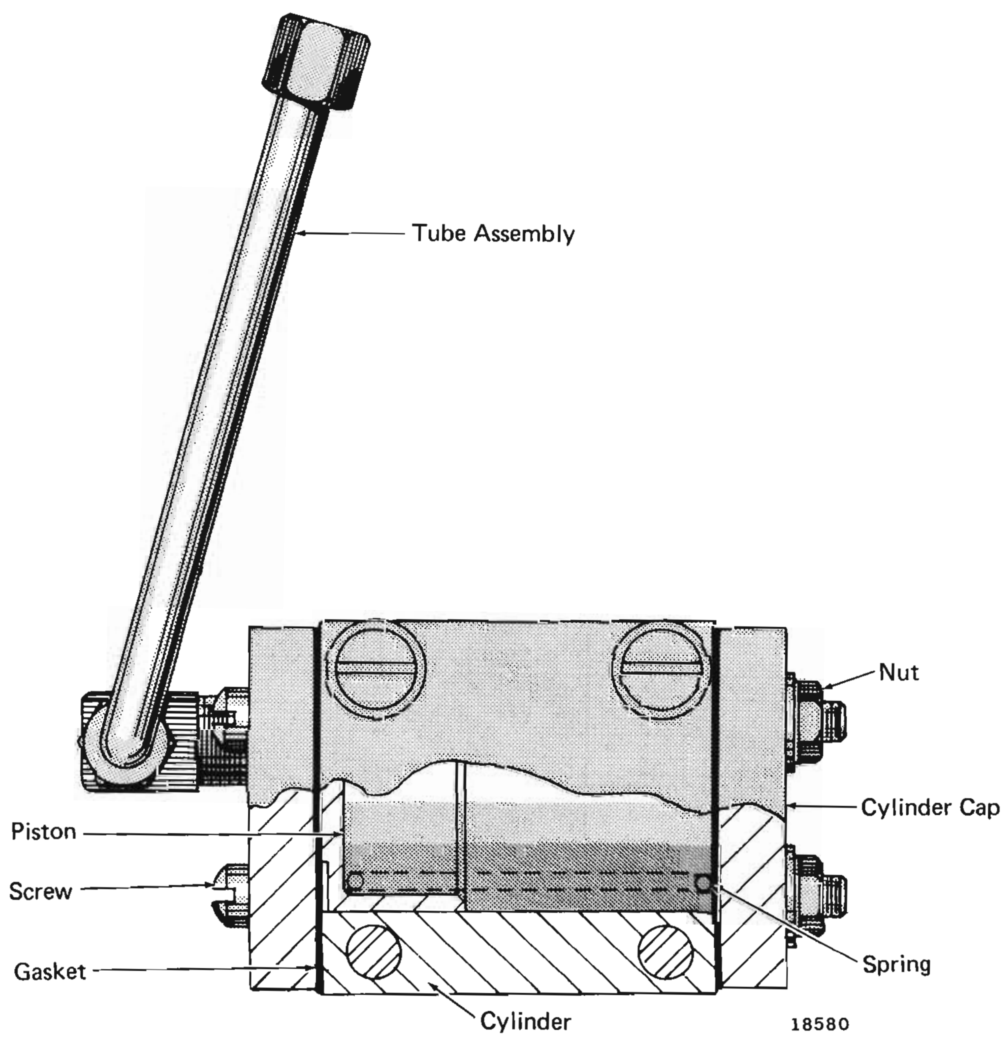
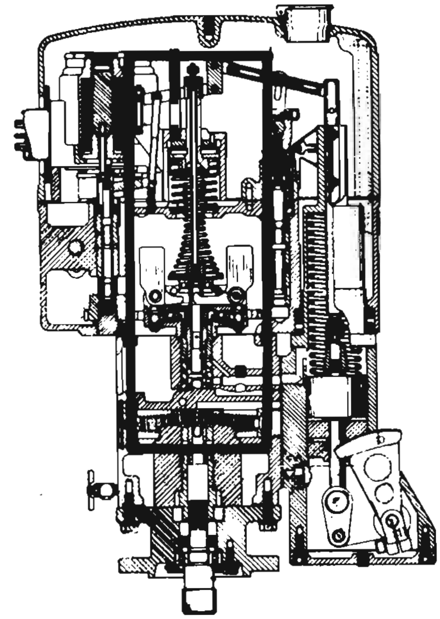
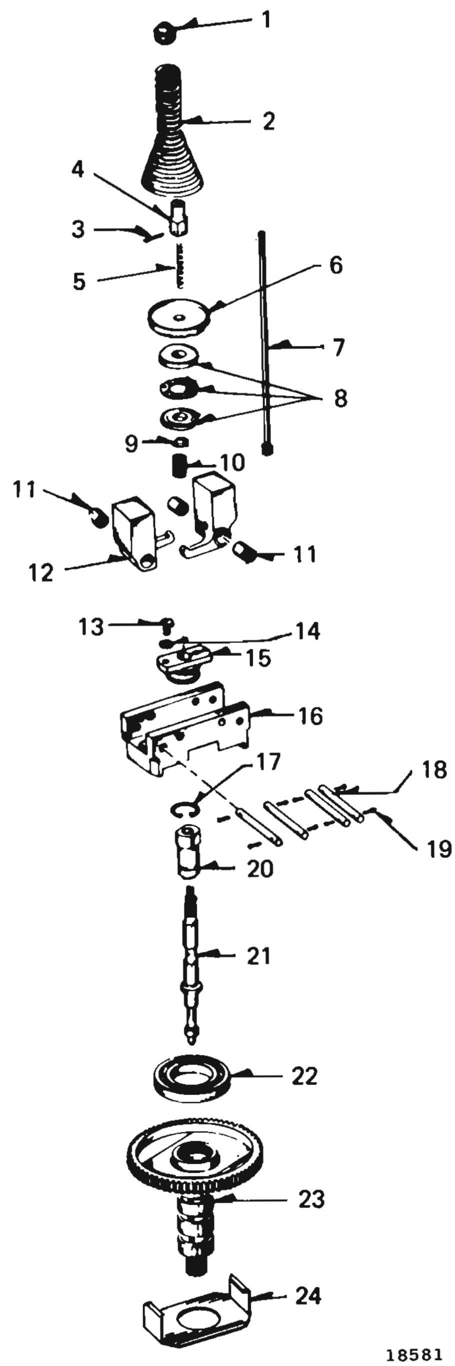


Fig. 14 – Time Delay Accumulator





1. Spring Check Plug Assy.
2. Speeder Spring
3. Cotter Pin
4. Plunger Nut
5. Spring
6. Speeder Spring Seat
7. Shutdown Rod
8. Thrust Bearing
9. Washer
10. Adjusting Spring
11. Needle Bearing
12. Ball Arm
13. Screw
14. Lockwasher
15. Coupling Assy.
16. Ball Head
17. Snap Ring
18. Ball Arm Pin
19. Cotter Pin
20. Compensating Bushing
21. Pilot Plunger
22. Bearing
23. Sleeve And Gear Assembly
24. Retainer

Fig. 15 – Rotating Sleeve Assembly

4. Insert screwdriver tip beneath ball arm pivot points and pry retainer (24) loose from both ends of the ball head assembly. Remove retainer and ball head (16) from sleeve assembly.

5. Using snap ring pliers, remove snap ring (17) from sleeve (23) and remove pilot plunger (21) and compensating bushing (20).

6. Thoroughly clean all parts and inspect. Shutdown rod must be straight.

7. Check ball head bearing for roughness or binding.

8. Inspect ball head gear for excessive wear of teeth.

9. Inspect pilot plunger and compensating bushing for heavy dirt cuts, nicks, or scratches. The plunger control lands must have sharp corners. Wear, which is evidenced by roundness of land corners, is cause for replacement. Plunger must move freely in compensating bushing and sleeve bore.

10. Install pilot plunger (21), compensating bushing (20), and snap ring (17) making certain that plunger and bushing do not bind.

11. Inspect ball head assembly for free operation of ball arm bearings (11). Any binding or tightness of these bearings is cause for replacement. If bearings must be replaced, use ball arm bearing installing and removing tool.

12. Remove ball arm pins (18) and interchange the two center pins with the outer pins. If wear marks on pins indicate that they have previously been interchanged, install four new pins.

13. If flats wider than 1/32" are worn on ball arms (12), they should be replaced. Flats less than 1/32" wide may be reworked to a radius by honing with a fine stone.

CAUTION: Make certain that cotter pins (19) which retain ball arm pins are spread enough so that they cannot fall out.

14. Install ball head assembly on sleeve making certain that the missing serration on the serrated spring drive coupling (15) aligns with the blank serration in the inside diameter of the sleeve.

15. With ball head in place, check that spring drive permits approximately equal travel of ball head in both directions until stops are contacted. If spring coupling holds ball head nearly against the stop at either end of the travel, the coupling should be replaced.

16. Install retainer (24) on sleeve assembly and snap tips in place over ends of ball head assembly.

17. Install pilot valve adjusting spring (10), flat washer (9), thrust bearing (8), speeder spring seat (6), shutdown rod spring (5), shutdown rod (7), and pilot valve plunger nut (4).

NOTE: If thrust bearing races have different size inside diameters, the one with the smallest inside diameter should be on top.

18. The pilot valve plunger nut should be adjusted to center the lower land of the pilot valve plunger (21) directly behind the port in the sleeve assembly (23) when the ball arm centering tool is installed across the tops of the ball arms.

NOTE: If ball arm centering tool is not available, the pilot plunger nut may be adjusted to give equal travel of the lower land on the plunger above and below the port in the sleeve when both ball arms are moved through their full travel.

19. Install cotter pin (3) through holes in nut and slot in top of plunger.

20. If necessary to turn nut to align holes with slot in plunger, turn in the direction which requires the least amount of travel to install cotter pin.

21. Lubricate rotating sleeve assembly and bore in power case and install sleeve assembly with splined end engaged in drive gear (25, Fig. 12).

22. Install speeder spring (2, Fig. 15), and plug (1) over shutdown rod and snap bottom coil of spring into spring seat (6).

SPEED CONTROL PILOT VALVE, Fig. 16

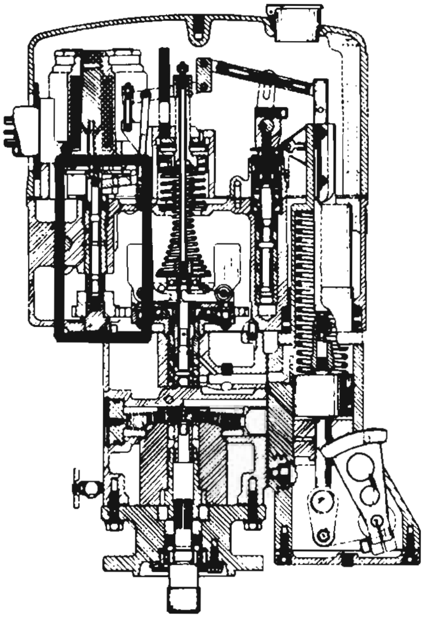
1. Inspect pilot valve bushing drive gear (15, Fig. 8), for excessive wear of teeth or excessive clearance between gear and stud inside column. If thrust shoulder of stud is worn to one-half of thickness of shoulder on a new stud, replace stud.

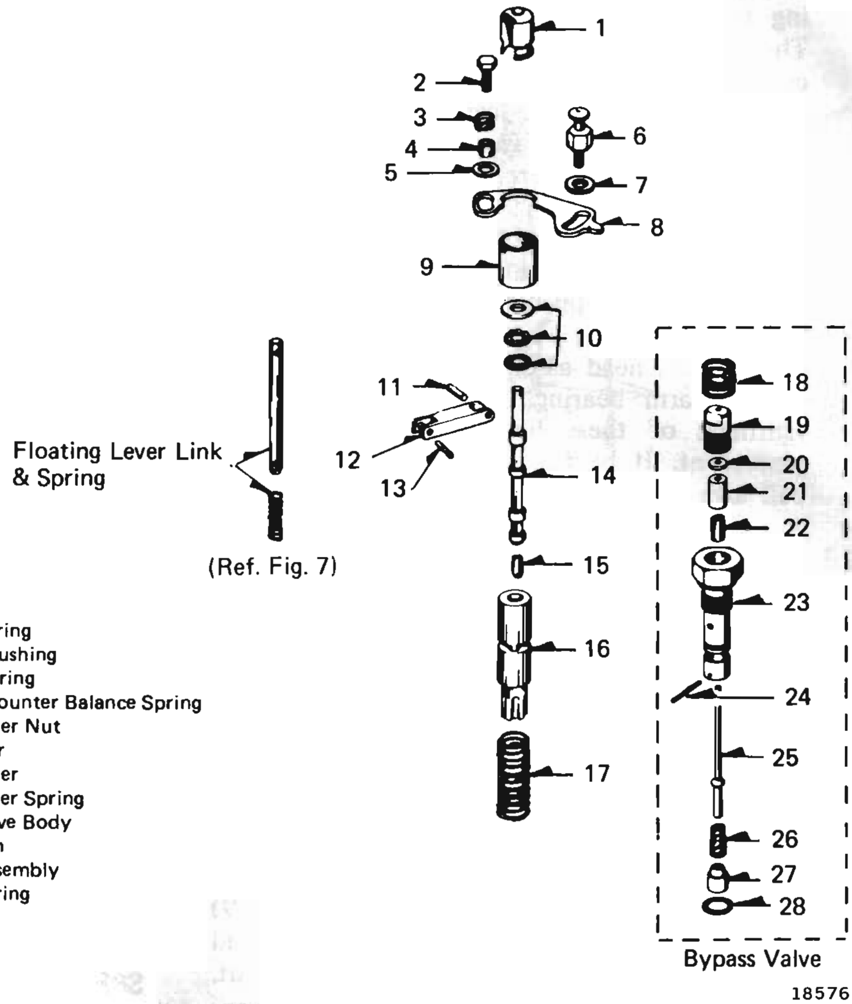
2. Lubricate stud and gear and install gear.

3. Install column on column holding fixture.

4. Inspect pilot valve plunger (14, Fig. 16), rotating bushing (16), and regulating bushing (9) for heavy dirt cuts, nicks, or scratches. The plunger must move freely in the rotating bushing and the control land must have sharp corners. Wear, which is evidenced by roundness of land corners, is cause for replacement. The regulating bushing must slide freely over the upper portion of the rotating bushing.

5. Install pilot valve bushing spring (17), lubricate rotating bushing, and regulating bushing, and install in column.





1. "D" Solenoid Cup Assembly
2. Retainer Bolt
3. Retainer Spring
4. Retainer Spring Collar
5. Retainer Washer
6. Special Retainer Screw
7. Washer
8. Regulating Bushing Retainer
9. Regulating Bushing
10. Thrust Bearing
11. Pilot Valve Pin
12. Lower Floating Lever
13. Straight Pin
14. Pilot Valve Plunger
15. Plunger Spring
16. Rotating Bushing
17. Bushing Spring
18. Solenoid Counter Balance Spring
19. Seal Retainer Nut
20. Seal Washer
21. Seal Retainer
22. Seal Retainer Spring
23. Bypass Valve Body
24. Straight Pin
25. Plunger Assembly
26. Plunger Spring
27. Spring Seat
28. "O" Ring

Fig. 16 – Speed Control Pilot Valve And Bypass Valve

6. Lubricate pilot valve plunger and install with pilot valve plunger spring (15) attached.

7. Place rotating bushing thrust bearing (10) in place on pilot valve plunger with large diameter race on top.

8. Inspect lower floating lever (12) for grooves or wear step where triangular plate pivot ball contacts it. If grooves or wear step are evident, turn opposite side upward and connect lever to pilot plunger with pin (11).

9. Place "D" solenoid cup assembly (1) over pilot plunger. Push down until tangs on regulating bushing retainer (8) can be slipped around smallest diameter of cup and engage slots of regulating bushing (9).

10. Install special retainer screw (6) and washer (7) in slot at pointer end of retainer and tighten down finger tight to hold retainer in place.

11. Insert collar (4) in other slot in retainer, fit washer (5) over collar, and install spring (3) and retainer bolt (2). Tighten bolt down against collar.

12. Position pointer opposite punch mark on column and tighten special retainer screw.

BYPASS VALVE ASSEMBLY, Fig. 16

1. Remove seal retainer nut (19) from bypass valve and remove seal washer (20), retainer (21), and seal retainer spring (22).

2. Drive straight pin (24) from valve body (23) and remove spring seat (27), spring (26), and plunger assembly (25). Thoroughly clean all parts.

3. Inspect plunger assembly for smoothness of spherical plastic seat. Any grooves, flat spots, or imbedded particles on this surface are

cause for replacement of the plunger assembly. The pin must be straight and must not be burred or peened at the upper end.

4. Reassemble the bypass valve and install a new "O" ring (28) in the groove after lubricating both the valve body and "O" ring.

5. Lubricate the bypass valve bore in column and install bypass valve and tighten securely.

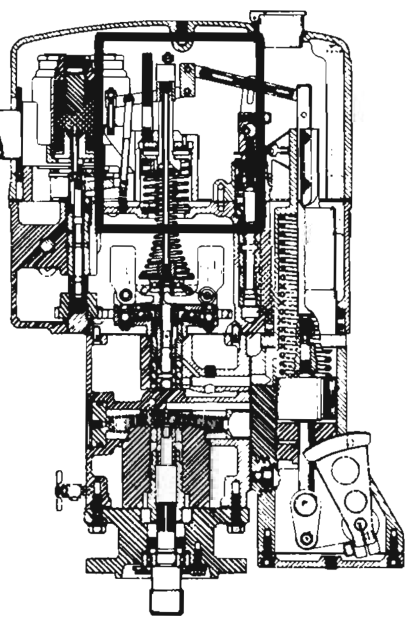
SPEEDER SPRING SERVO ASSEMBLY,
Fig. 17

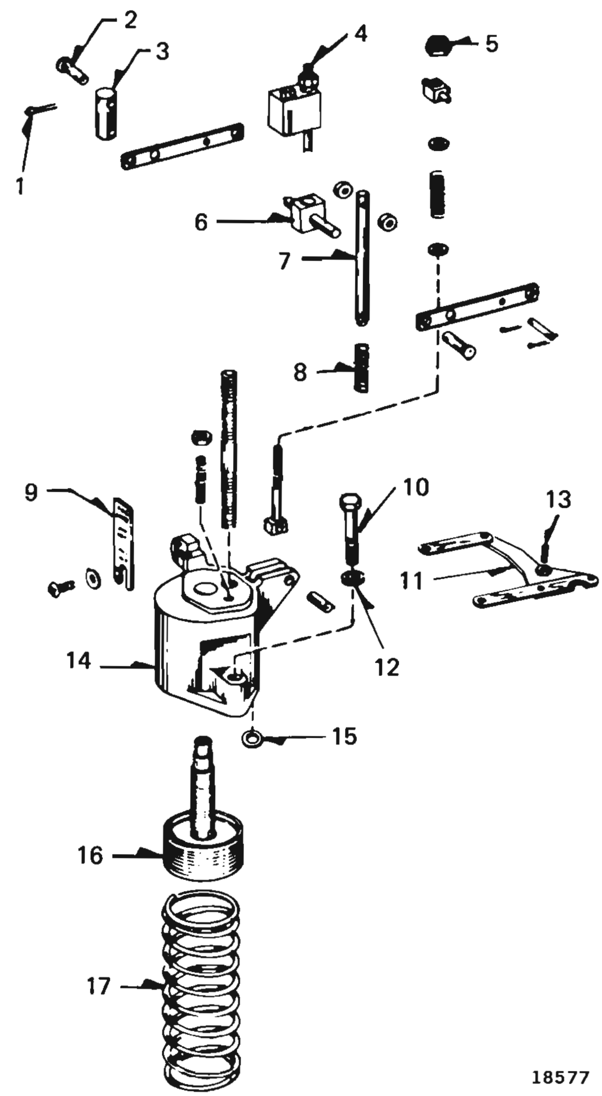
1. Check compression of speeder spring servo cylinder (14) by placing finger over small hole on bottom of cylinder and pulling and pushing rapidly on linkage to move piston up and down in cylinder. If reasonable resistance to piston movement is noted, it will not be necessary to replace piston or cylinder. It is seldom necessary to change out these pieces on the basis of this test, but occasionally operation of the governor on test with hot oil will reveal poor speed control associated with excessive leakage at the piston stem, which then requires that the piston, or the cylinder, or both, be changed out.

2. If necessary to remove speeder servo piston (16), the piston stem must be pressed out of the fulcrum assembly (6) and a new piston pressed in.

3. Install servo spring (17) in place in recess on top of column and install "O" ring (15) in small recess adjacent to spring.

4. Inspect triangular plate assembly (11) to make certain that the spring straps do not have any kinks or bends, which are cause for replacement, and that the flat surface of the pivot ball is not scored or grooved. The





1. Cotter Pin
2. Headed Pin
3. Pivot Pin Link
4. Shutdown Device (Nut, Block, and Rod)
5. Fulcrum Nut
6. Fulcrum Assembly
7. Floating Lever Link
8. Floating Lever Link Spring
9. Speed Indicator Scale
10. Servo Capscrew
11. Triangular Plate Assembly
12. Plain Washer
13. Bypass Valve Adjusting Screw
14. Servo Cylinder Assembly
15. "O" Ring
16. Speeder Servo Piston
17. Servo Spring

Fig. 17 – Speeder Spring Servo

pivot ball must move freely in the plate assembly.

5. Insert servo cap screws (10) with plain washers (12) through spring straps of triangular plate and holes in servo cylinder (14). Flatted ball side of triangular plate must be down.

6. Press down on cylinder, compressing servo spring until cap screws can be threaded into column. Before tightening screws, make certain that "O" ring (15) is still in position in recess in column, and that floating lever link spring (8) is not caught under edge of cylinder.

7. Tighten cap screws securely, being careful not to kink or bend spring straps or triangular plate. If screws cannot be tightened without bending spring straps, use new plain washers and place a drop of oil under them before tightening.

8. Connect lower floating lever (12, Fig. 16), to floating lever link (7, Fig. 17), using pin (13, Fig. 16), and cotter pins and engage lower end of floating lever link spring (8, Fig. 17), in recess in column.

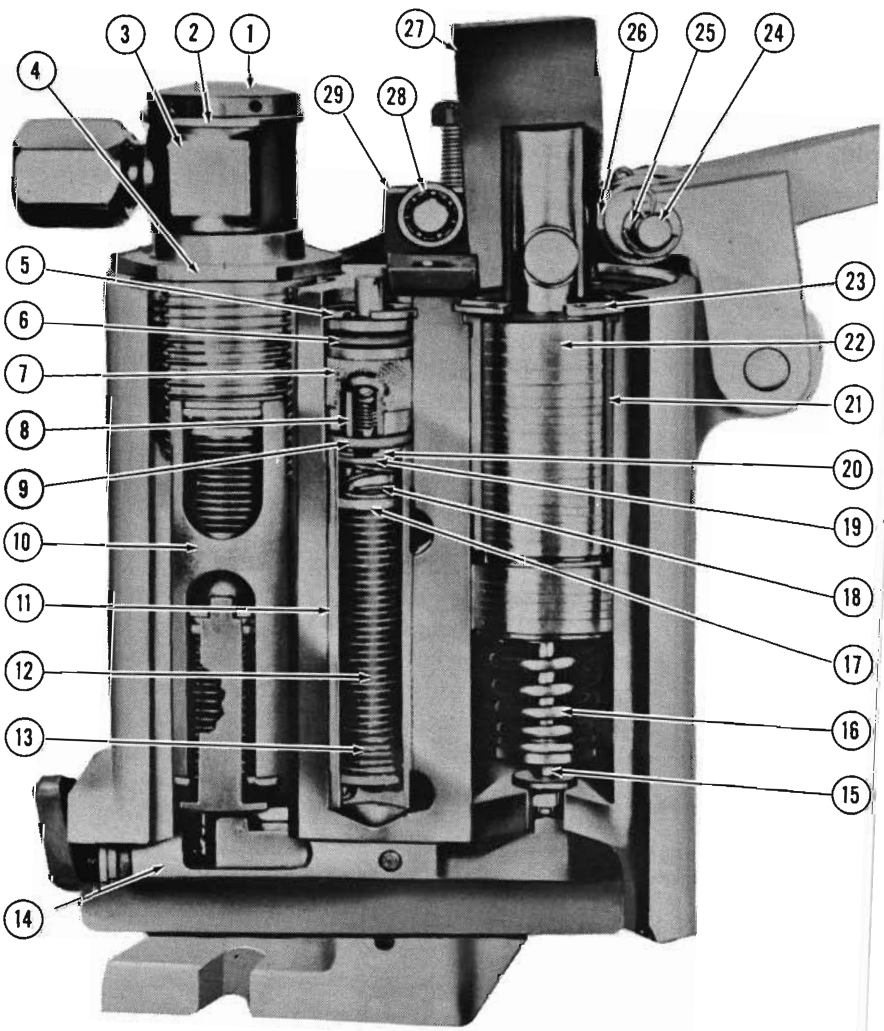
9. Place solenoid counterbalance spring (18, Fig. 16), on top of bypass valve, and bend spring straps of triangular plate to place notch in long strap under head of special bushing retainer screw (6).

10. Make sure that the lower end of the triangular plate screw (13, Fig. 17), is inside the solenoid counterbalance spring. With the triangular plate in position, there should be no kinks in the spring straps.

LIMITER SERVO ASSEMBLY, Fig. 18

DISASSEMBLY

1. Clamp limiter servo assembly in vise.



1. Banjo Fitting Body Screw
2. Copper-Rubber Gasket
3. Banjo Fitting
4. Bellows Locknut
5. Snap Ring
6. "O" Ring
7. Fuel Limiter Screen Assembly
8. Check Valve Assembly
9. "O" Ring
10. Bellows-Absolute Pressure Sensor
11. Orifice Assembly
12. Orifice Plate
13. Gasket
14. Guide - Rocker Arm Assembly
15. Cone Valve
16. Piston Spring
17. Thick Washer
18. Spring
19. Washer
20. Snap Ring
21. Piston Sleeve
22. Limiter Piston
23. Snap Ring
24. Spring Anchor Pin
25. Spring Anchor Pin Washer
26. Cam Follower Bearing
27. Cam
28. Cam Guide Bracket Bearing
29. Cam Guide Bracket

18582

Fig. 18 – Limiter Servo Assembly

2. Unscrew banjo fitting body screw (1) and remove banjo fitting (3) from bellows-absolute pressure sensor assembly (10).

3. Unscrew bellows locknut (4) from bellows assembly.

4. Unscrew bellows-absolute pressure sensor assembly from limiter body.

5. Remove the spring anchor screws, tension springs, Fig. 19, washers (25, Fig. 18), and spring anchor pin (24), cam follower bearing (26), and cam guide bracket (29).

6. Pry the notched end of the coiled snap ring (23) out of the groove in the limiter piston cylinder, and uncoil the snap ring from the groove.

7. Remove the limiter piston and cam assembly (22) and the piston sleeve (21) from the cylinder.

NOTE: The spring seat usually remains stuck in the limiter piston when the piston is removed and often requires considerable force to break the seal formed by the film of oil between the spring seat and the bottom of the piston.

8. Remove the spring seat from the cylinder if it was not removed with the limiter piston.

9. Remove the piston spring (16) and the cone valve (15).

10. Using snap ring pliers, remove fuel limiter screen snap ring (5).

11. Pull fuel limiter screen assembly (7) from limiter body.

12. Bend a short right angle hook at the end of a piece of stiff wire and, using the hook, depress the ball in the check valve assembly (8) and pull the assembly from the limiter body.

13. Slip the hook through the washer (19) in the top of the orifice assembly (11) and pull the "O" ring (9) and orifice assembly from the limiter body.

14. Remove retaining screw and lockwasher and pull the guide and rocker arm assembly (14) from limiter body.

CLEANING AND INSPECTION, Fig. 18

General

1. All parts of the limiter servo assembly should be thoroughly cleaned prior to inspection or further disassembly. The seal rings should be scrapped.

2. Check to be sure that all dirt and lint has been removed from the limiter screen assembly (7).

3. Inspect the check valve assembly (8) by blowing through the end opposite the ball to be sure that the ball seats properly.

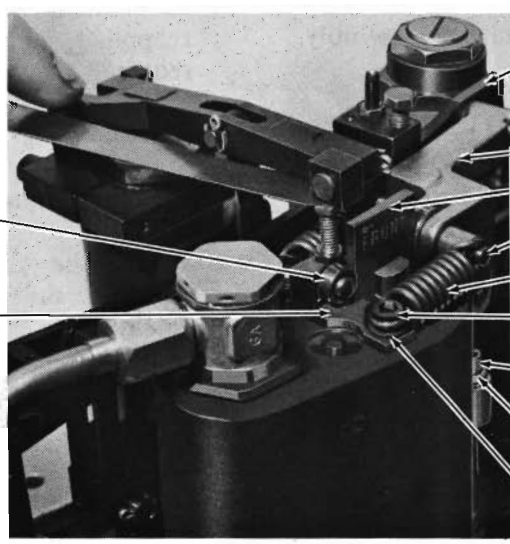


Fig. 19 – Limiter Servo Linkage

4. Inspect the radius on the two contact points of the rocker arm assembly (14). Replace the lever if flat areas are worn on the contact points which are too wide to be worked back to a radius by honing with a fine stone.

5. Qualify the bellows-absolute pressure sensor assembly (10) by blowing into the upper or air pressure bellows as if inflating a balloon. If the bellows does not hold pressure, the sensor assembly must be replaced. To check the lower or aneroid bellows, compress the assembly by hand and measure the difference between the free length and the compressed length. If the difference is less than 1/16", the sensor assembly must be replaced.

NOTE: Final qualification of the bellows-absolute pressure sensor assembly can only be determined by performance during governor test.

6. Inspect the limiter piston (22) for free fit in the cylinder and piston sleeve (21).

7. Inspect the cone valve (15) and the valve seat in the limiter body for nicks or cuts. Replace the valve if the sealing surface is damaged. If the valve seat is damaged, the limiter body must be replaced.

8. Inspect the cam guide bracket bearing (28) and the cam follower bearing (26) for satisfactory operation. Since these bearings are heavily loaded by the tension springs at assembly, binding may be observed at that time which cannot be detected at this point. If the cam guide bearing is found to be defective, the cam guide bracket assembly must be replaced.

9. Inspect the orifice assembly (11) for general cleanliness. It is not necessary to disassemble unless it appears to be plugged with foreign material when air pressure is applied to one end. If the orifice assembly is not disassembled and there is clearance between the top flat washer and the snap ring, add additional orifice plates and gaskets to the assembly as described in Steps 4 and 5 of "Orifice Assembly" below.

Orifice Assembly, Fig. 18

If the orifice assembly appears to be plugged, it must be disassembled, cleaned, and assembled as follows:

1. Using snap ring pliers, remove the snap ring (20).

2. By pushing on the thick washer inside the end opposite the snap ring, push all internal pieces out of the orifice case.

3. Separate all orifice plates (12) and gaskets (13), and clean the 32 orifice plates, making sure that the hole in each one is clear. It is not necessary to scrap the gaskets unless they are split or torn.

4. When reassembling the orifice stack, install the thick bottom washer in the case, followed by a gasket, an orifice plate, and another gasket. Install the next orifice plate with the hole located approximately 180° from that of the first plate. Each succeeding orifice plate should have its hole located approximately 180° from that of the preceding plate, and there must be gaskets on both sides of every orifice plate.

5. Following installation of the last orifice plate and gasket, install in order, a thick flat washer (17), spring (18), and a thin flat washer (19). If there is a space between the top washer and the snap ring groove, remove the spring and the two washers and add extra orifice plates and gaskets to the orifice stack until, with the spring and the two washers reapplied, some compression of the spring is required in order to install the snap ring (20).

ASSEMBLY, Fig. 18

1. Clamp the limiter servo body in vise.

2. Install the guide and rocker arm assembly (14) in the limiter body, and install the retainer screw and lockwasher.

3. Install the orifice assembly in limiter body bore.

4. Slip "O" ring (9) into bore and push it down flat on top of orifice stack being careful not to cut "O" ring on sharp edges of drilled passages intersecting the bore.

5. Install check valve assembly (8) in bore and push it down so that it slips inside "O" ring and seats on orifice assembly.

6. Oil "O" ring (6) and groove in limiter screen assembly (7) and roll "O" ring into groove.

7. Oil upper portion of orifice assembly bore and install limiter screen assembly in bore until it seats on lower "O" ring.

8. Using snap ring pliers, install snap ring (5) in bore making certain that it is fully seated in the groove.

9. Insert the cone valve (15) and spring (16) in the limiter piston cylinder with the valve stem through the hole in the cone valve seat.

10. Install the spring seat, limiter piston (22), and piston sleeve (21) in the cylinder.

NOTE: If the piston cannot be pushed down into the cylinder, remove the piston, piston sleeve, and spring seat and try to align the valve and spring so they are centered in the cylinder, then reapply the spring seat, piston, and sleeve. Repeated trials may be necessary to get the upper portion of the valve stem to slip inside the guide portion of the spring seat to allow the piston to be fully depressed.

11. Push the piston below the snap ring groove and install the coiled snap ring (23).

12. Install the cam follower bearing (26), spring anchor pin (24), and spring anchor spacer washers (25) in the cam follower arm.

13. Hook the tension springs, Fig. 19, on the spring anchor pin, slip the spring anchor screws through the eyes in the other end of the springs, apply flat washers on the screws, and fasten the cam guide bracket to the limiter body with the straight edge of the cam in the slot and against the bearing.

14. Screw the bellows-absolute pressure sensor assembly (10, Fig. 18), into the limiter body and apply bellows locknut (4).

15. Screw the bellows assembly into the limiter body until the locknut stops with approximately 1/16" gap between the bottom of the hexagonal nut surface and the top of the limiter body. Do not tighten the locknut at this time.

16. Apply new copper-rubber gasket (2) to banjo fitting body screw. Insert screw in banjo fitting and apply "O" ring to end of screw.

17. Install banjo fitting on bellows-absolute pressure sensor assembly with banjo fitting body screw only finger tight.

18. Remove limiter servo assembly from vise and set aside for application to column assembly.

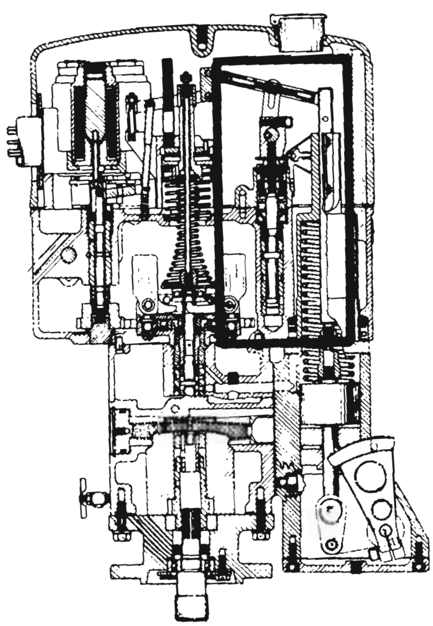
LOAD CONTROL PILOT VALVE, Fig. 20

1. Inspect load control plunger (19) and bushing (21) for heavy dirt cuts, nicks, or scratches. The plunger must move freely in the bushing, and the control lands must have sharp corners. Wear, which is evidenced by roundness of land corners, is cause for replacement. If a new bushing is used, the retaining ring (22) may be removed from the old bushing, using snap ring pliers, and applied to the new one.

2. Install new oil seal gasket (18) in recess at top of pilot valve bore and install bushing (21), spring (20), and plunger (19).

3. Slide oil seal (17) over plunger stem and down against gasket. The oil seal should have the smooth metal surface facing upward.

4. Install "O" ring (16) in recess in column near pilot valve bore.



1. Eccentric Lock Screw
2. Adjusting Block
3. Indicator Washer
4. Locknut
5. Snap Ring
6. Spring Retainer
7. Outer Spring
8. Inner Spring
9. Locknut
10. Spring Collar
11. Overriding Piston
12. Overriding Valve Plunger
13. Capscrew
14. Overriding Plunger Spring
15. Overriding Cylinder
16. "O" Ring
17. Oil Seal
18. Oil Seal Gasket
19. Pilot Valve
20. Pilot Valve Bushing Spring
21. Pilot Valve Bushing
22. Retaining Ring
23. Pivot Link Pin
24. Cotter Pin
25. Floating Lever Assembly

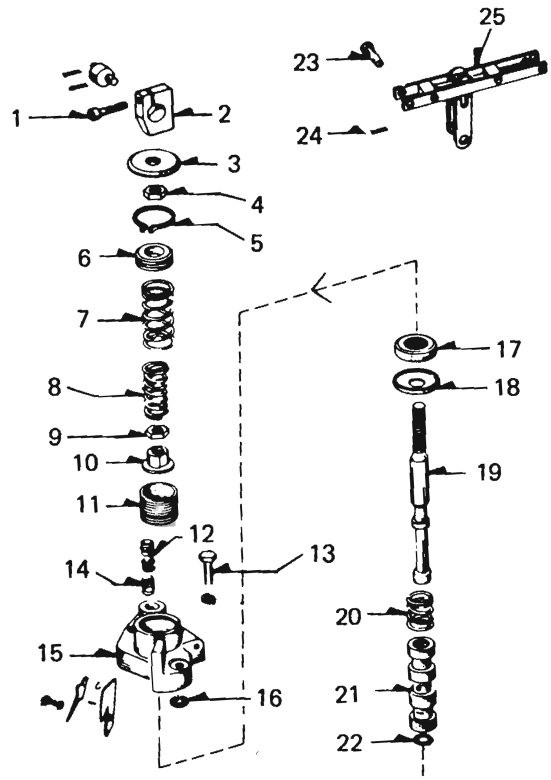


Fig. 20 – Load Control Pilot Valve

NOTE: If adjustable floating lever assembly (25) and connected linkage was disconnected from pivot pin link (3, Fig. 17), it must be installed at this time. Headed end of pin must be to the right when facing nameplate end of column, and flat washer must be installed between cotter pin and linkage.

5. Install one of the column to power case bolts in the through hole nearest the load control pilot valve bore. This bolt must be installed before the limiter servo assembly is applied to the column, as the servo partially covers the bolt hole when it is in place.

6. Position short hold down cap screw (13, Fig. 20), and washer in slot in limiter servo body, and install limiter servo assembly over pilot plunger. Push down on servo assembly and engage cap screw in column.

7. Install second hold down cap screw and tighten screws securely after making certain that "O" ring (16) is still positioned in recess in column under servo assembly.

8. Install overriding piston (11) in cylinder and run spring collar (10) down on threaded plunger stem (19) until it bottoms in piston while plunger is held down tightly against retaining ring (22) in bushing. Back collar off one-half turn. Lift plunger until wrench can be applied to flats on spring collar. Run locknut (9) down on plunger stem to contact collar, and lock in place.

CAUTION: Avoid lifting pilot plunger any more than necessary to apply wrench to spring collar, upper control land on plunger can damage oil seal if raised too high.

9. Install two springs (7 & 8) in cylinder and secure with spring retainer (6) and snap ring (5), making certain that snap ring is fully engaged in groove in cylinder.

10. Run second locknut (4) down on plunger stem until top of nut is nearly flush with top of retainer. Apply indicator washer (3) over stem with the concave side facing downward.

11. Engage adjusting block (2) seven full turns on threaded plunger stem.

12. Lift up on adjusting block until upper locknut can be run up to tighten indicating washer against adjusting block.

13. Apply wrench to locknut and, using another wrench on adjusting block, lock securely in position.

14. Install eccentric, Fig. 21, in adjusting block so that sides are flush with sides of block and install and tighten lock screw (1, Fig. 20), to hold eccentric in place. Lock screw should face toward nameplate end of column.

LOAD CONTROL PILOT VALVE LINKAGE, Fig. 21

1. Install flat washers on eccentric pins on both sides of eccentric, and swing adjustable floating lever assembly and connected linkage into place above eccentric block.

2. Remove wire from cotter pin holes and remove horizontal strap. Slip other horizontal strap with connected linkage over eccentric pin adjacent to limiter servo body.

3. Install loose horizontal strap on linkage pins, and install cotter pins.

NOTE: Vertical link must extend upward between sides of adjustable floating lever assembly adjacent to knurled knob.

4. Apply load control indicator to limiter servo body with screw and lockwasher. Do not tighten screw fully at this time as indicator will have to be repositioned during governor test. The pointer should be placed in the vertical position.

5. Install overriding pilot valve plunger (12, Fig. 20), and spring (14) in bore in limiter servo assembly body.

OIL FAILURE SHUTDOWN ASSEMBLY, Fig. 22

1. Install oil failure bushing gasket (14) in column, making sure that holes in gasket are aligned with holes in column.

2. Install oil failure piston spring (12), oil failure piston (13), and oil failure valve bushing (16) in column. Retain in place with valve bushing screw (18) and washer (17).

3. Remove diaphragm nut (25), washer (24), and old diaphragm from oil failure plunger (22).

CAUTION: Use brass or copper caps on bench vise jaws when holding plunger to remove and install diaphragm nuts.

4. Inspect oil failure plunger for heavy dirt cuts, nicks, or scratches and check for freeness in oil failure valve bushing.

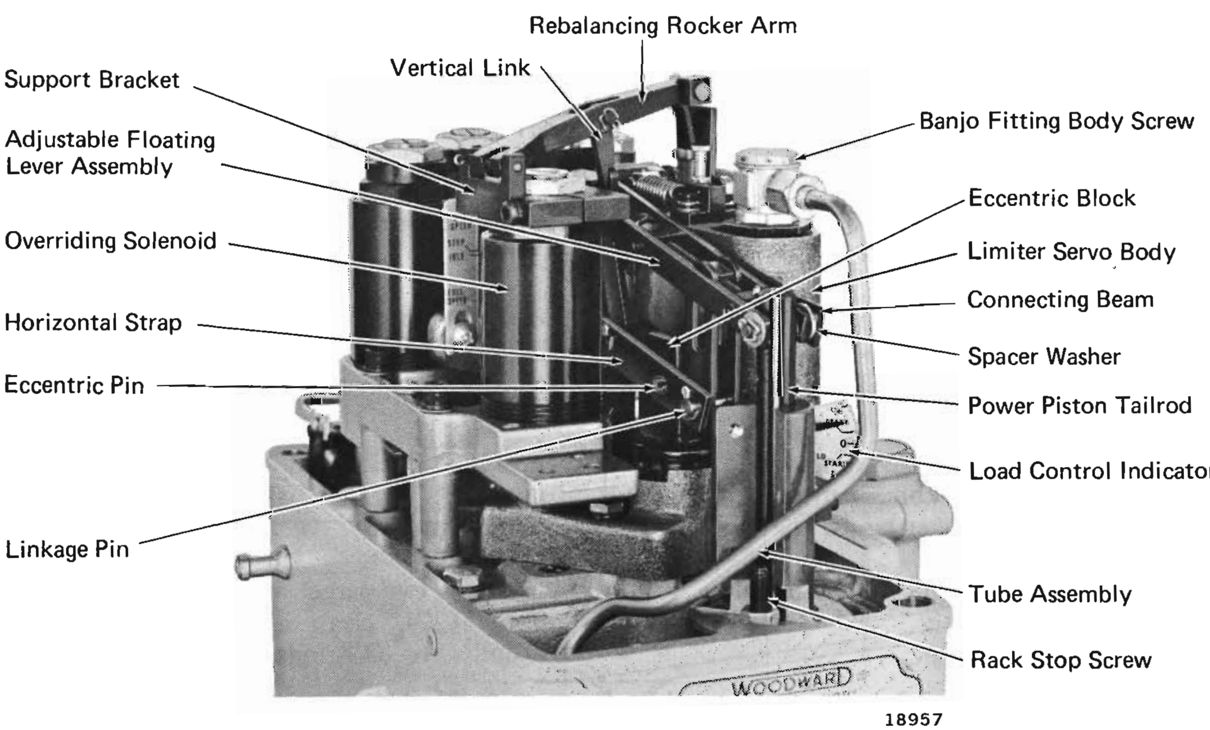
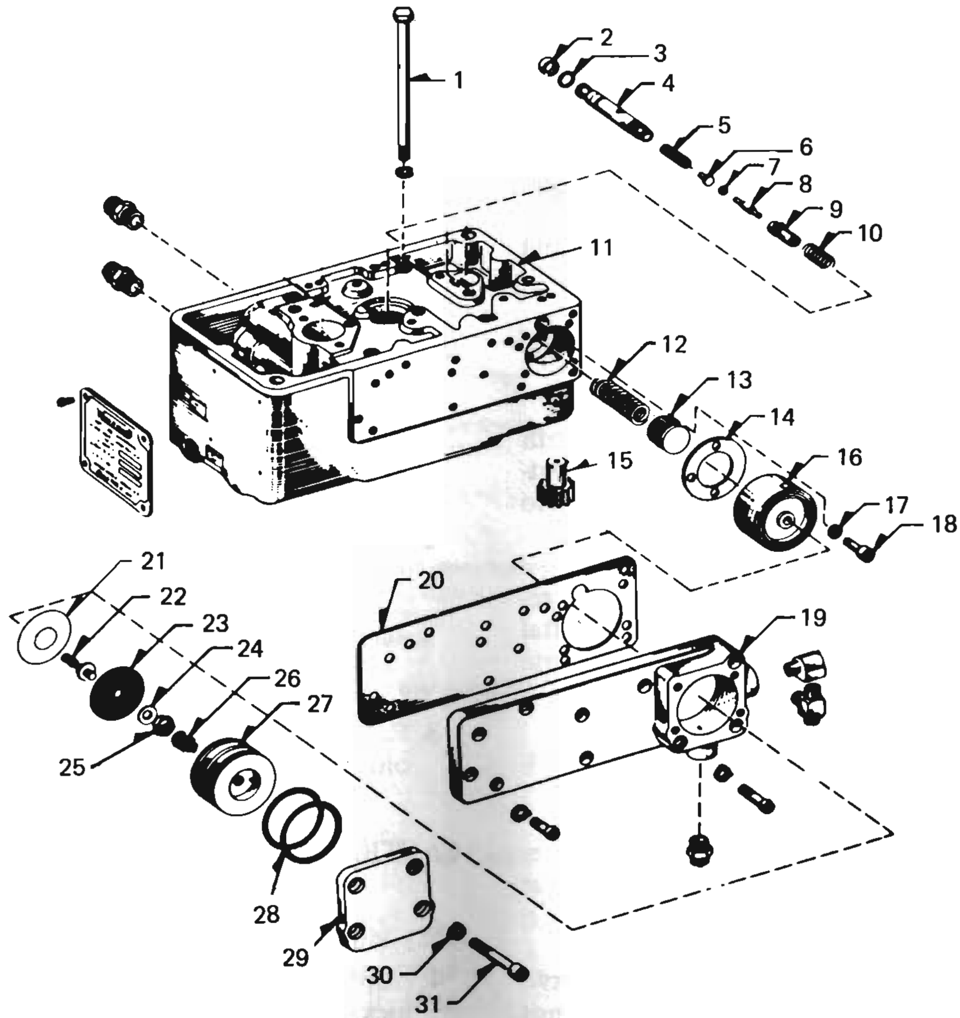


Fig. 21 – Load Control Pilot Valve Linkage



1. Column To Case Bolt
2. Tubing
3. "O" Ring
4. Shutdown Plunger
5. Spring
6. Spring Pin
7. Ball
8. Plunger Pin
9. Ball Valve Seat
10. Shutdown Plunger Spring
11. Column
12. Piston Spring
13. Oil Failure Piston
14. Oil Failure Bushing Gasket
15. Rotating Bushing Gear
16. Oil Failure Valve Bushing
17. Valve Bushing Washer
18. Valve Bushing Screw
19. Lube Oil Diaphragm Plate
20. Diaphragm Plate Gasket
21. Support Washer
22. Oil Failure Plunger
23. Oil Failure Diaphragm
24. Diaphragm Washer
25. Diaphragm Nut
26. Oil Failure Diaphragm Spring
27. Valve Body
28. "O" Rings
29. Diaphragm Cap
30. Lockwasher
31. Diaphragm Cap Screw

18578

Fig. 22 – Oil Failure Shutdown Assembly

5. Install new oil failure diaphragm (23) on plunger with smooth rubber surface of diaphragm away from plunger lands.

6. Apply diaphragm washer (24) with rounded edge toward diaphragm, and install and tighten nut (25).

7. Install diaphragm support washer (21), plunger, and diaphragm in oil failure valve bushing. The smooth, rounded surface of the support washer should be against the diaphragm.

8. Remove two large "O" rings (28) from valve body (27), clean and lubricate body, and install new "O" rings.

9. Lubricate valve body bore in lube oil diaphragm plate (19) and insert valve body so

end with drilled oil passage is flush with gasket surface of plate.

10. Snap large coil end of spring (26) into counterbore at drilled oil passage end of valve body.

11. Apply lube oil diaphragm plate (19) and gasket (20) to column, making certain that the lube oil diaphragm spring fits over the diaphragm nut and that the diaphragm support washer is properly located in the recess behind the diaphragm. Tighten all plate to column screws securely.

12. Install cap (29) over valve body bore, apply screws (31) and lockwashers (30), and tighten securely.

13. Clamp filter assembly (9, Fig. 1), in vise and remove filter from filter body.

14. Clean filter and filter body, and inspect filter screen to be sure there are no torn or broken areas.

15. Replace two "O" rings on filter, and install filter in filter body, tightening securely.

16. Oil two "O" rings and place in recesses in diaphragm plate, Fig. 22.

17. Install filter assembly on diaphragm plate, and tighten the three mounting screws securely.

INSTALL COLUMN ON CASE

1. Apply time delay accumulator tube assembly, Fig. 14, to fitting on accumulator body and tighten with fingers until the open end of the tube remains pointing upward when released.

2. Apply column to case gaskets (4, Fig. 12), on top of power case (27), and install column assembly.

NOTE: When installing column, the shutdown rod (7, Fig. 15), must pass through the hole in the center of the speeder spring servo piston (16, Fig. 17). Care should be taken that the rod does not get bent.

3. As the column is lowered onto the power case, guide the time delay accumulator tube assembly into the fitting on the column.

4. Before tightening the four column to case bolts (1, Fig. 22), check to see that the rotating bushing drive gear (15) is meshed with the ball head gear. This can be determined by shining a light into the column through the cavity at the rear, and observing the gears.

5. If the gears are not meshed, turn the rotating bushing drive gear with a long screwdriver until it drops into position.

6. Tighten the four column to case bolts securely.

7. Tighten the tube nuts on the time delay accumulator tube assembly.

8. Thread the shutdown block assembly (4, Fig. 17), on the shutdown rod and screw it down until the end of the rod extends 3/8" above the shutdown block.

9. Install locknut on shutdown rod, and tighten it securely against the shutdown block assembly.

10. Connect the adjustable floating lever assembly, Fig. 21, to the power piston tail rod with long headed pin.

11. Install spacer washer on pin and apply connecting beam, followed by a flat washer and cotter pin.

NOTE: The connecting beam must be installed with the edge having the cutout radius facing upward, and the cutout radius should be in the slot of the shutdown block assembly.

12. Connect the slotted end of the connecting beam to the cam follower arm, Fig. 19, with headed pin, spacer washer, and cotter pin. The spacer washer is installed between the cam follower arm and the connecting beam.

13. Check to see that the connecting beam does not bind in the shutdown block assembly. There should be clearance on both sides of the connecting beam. If interference is observed, loosen the hold down bolts of the speeder spring servo and limiter servo assemblies and move the assemblies slightly to eliminate the interference, then tighten the hold down bolts.

14. Install tube assembly, Fig. 21, connecting the limiter servo to the bulkhead fitting in column. Tighten tube assembly nuts and banjo fitting body screw on servo assembly.

SHUTDOWN PLUNGER ASSEMBLY, Fig. 22

1. Clamp shutdown plunger assembly in a vise having copper or brass caps on jaws.

2. Remove ball valve seat and spring (9 & 10), plunger pin (8), steel ball (7), spring pin (6), and spring (5).

3. Thoroughly clean all parts.

4. Inspect ball valve seat for damage. If necessary to replace seat, remove spring (10) and install on new seat.

5. Inspect plunger pin for any damage to end surfaces, and make certain that pin is straight.

6. Replace red plastic tubing (2) if cracked or discolored.

NOTE: New tubing is easily installed if both tubing and plunger are heated to 150° - 200° F, and are well lubricated.

7. Reassemble shutdown plunger assembly, install new "O" ring seal (3), and insert in column assembly.

ELECTRICAL EQUIPMENT ASSEMBLY, Fig. 23

1. Remove wiring cover (15) from electrical equipment assembly.

2. Hi-pot test all solenoids at 1500 volts for one minute. The resistance of each coil should be 600 - 800 ohms.

3. Check toggle switch (19) for tightness, and for proper operation.

4. Check connector assembly (18) for damage.

5. Loosen plunger stop plug locknut (1) and remove stop plug (2), plunger (8), plunger rod (10), retaining ring (9), and plunger washer (11) from all solenoids.

6. Thoroughly clean all parts.

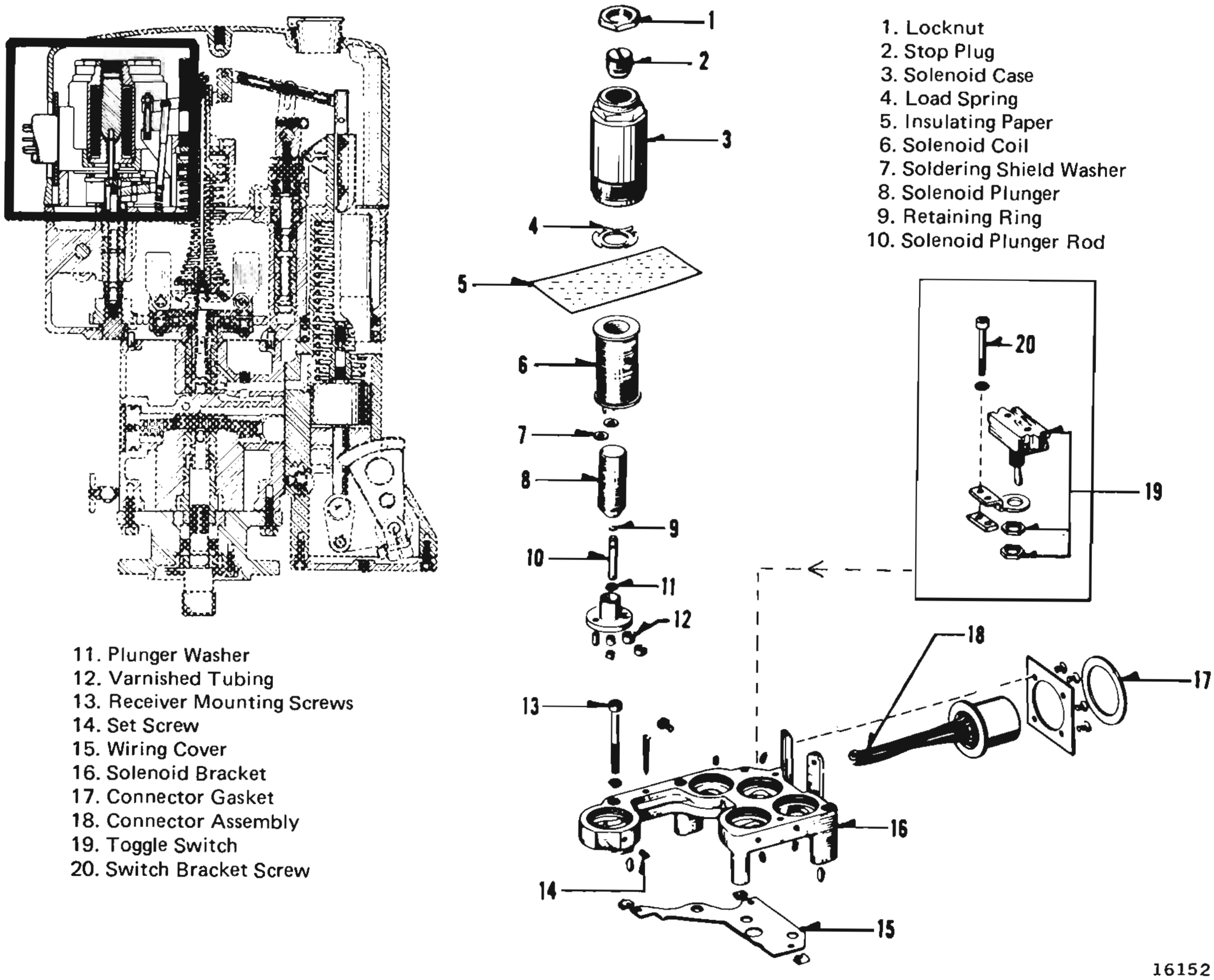


Fig. 23 -- Electrical Equipment Assembly

7. Check plungers for wear and pounding in bottom of plunger rod hole. If depth of hole is greater than .389", the plunger must be replaced.

8. If hi-pot resistance check showed defective coil, loosen setscrew (14) and remove solenoid case (3), load spring (4), and insulating paper (5).

9. Unsolder wires from solenoid coil terminals and remove coil (6), soldering shield washers (7), and varnished tubing (12).

10. Install new coil, varnished tubing, and soldering shield washers, and solder wires to coil terminals.

11. If wires are broken or insulation is cut, a new wire must be run to pin in connector plug or to the next coil terminal. No wire splices should be made between coils or between connector and coils.

12. Reassemble solenoid assemblies, making certain that the tangs of the coil to case load springs (4) are against the case rather than against the coil. Also make sure that the plunger washers lie flat on top of the solenoid guides, with the plunger rods extending through them. The retaining rings on the rods must rest on top of the washers. Tighten solenoid cases and secure with setscrews.

13. Install new gasket (17) over connector, replace wiring cover, and fasten in place with screws.

NOTE: The small coil spring which was removed from the "D" solenoid plunger rod, when the electrical equipment assembly was removed from the governor, does not have to be reapplied for proper operation of the governor. The purpose of the spring is to prevent the contact button on the "D" solenoid cup from slipping out from under the "D" solenoid plunger rod, if the governor is subjected to rough handling during shipment. If this occurs, the engine speeds will be found to be 40 or 50 RPM low when the governor is in operation on an engine. This can be corrected by removing the governor cover, depressing the "D" solenoid cup with a screwdriver, and straightening it up so the contact button is under the "D" solenoid plunger rod.

14. If the "D" solenoid plunger spring is applied, install it over the plunger rod with the small closed-in coil end slipped on first. Care must be taken, when the electrical equipment assembly is installed on the governor, to see that the spring sits squarely over the contact button on the "D" solenoid cup.

15. Install electrical equipment assembly on column, engaging toggle switch lever with recess in shutdown plunger assembly.

16. Tighten equipment assembly mounting screws (13) securely and, with shutdown plunger assembly held in by toggle switch (19), loosen switch bracket screws (20) and position switch so that shutdown plunger has 1/64" end play in column. Tighten bracket screws.

17. Loosen the locknut on the overriding solenoid, Fig. 21, and screw the plunger stop plug down until it bottoms. Back the stop plug out two and one-half turns and tighten the locknut.

18. Apply rebalancing rocker arm and support bracket to the overriding solenoid case. Before tightening the support bracket clamp screw, make certain that the bracket is seated squarely on the solenoid case and that the opposite end of the rocker arm is centered on the limiter servo piston stem.

19. Connect the vertical link of the pilot valve linkage in the slot at the center of the rebalancing rocker arm, using straight pin and two cotter pins.

NOTE: If the hole in the vertical link is out of alignment with the holes in the rocker arm so that the straight pin cannot be installed, loosen the rocker arm support bracket clamp screw and turn the bracket until the pin can be installed. With the vertical link connected to the rocker arm, turn the bracket so that the opposite end of the rocker arm is as nearly centered on the limiter piston stem as possible without causing the linkage to bind, when the rocker arm is lifted by hand and, when the servo piston is depressed as far as possible by hand.

20. Install oil level gauge assembly and cover assembly.

TESTING

The following instruction covers test of the governor on a Woodward Governor Co. test stand. All references to test stand gauges, valves, controls, etc., are as labeled on the Woodward stand.

PREPARATION

1. The governor should be tested with oil heated to maintain a governor power case temperature of 190°-200° F.

   The recommended oil for all governor applications is a heavy SAE30 or light SAE40 turbine-type oil containing rust and oxidation prohibitive additives, which conforms to the following specifications:

Method of Test	ASTM Designation	Limits
Saybolt Universal Seconds at 210° F	D88* or D216*	65 Min. 75 Max.
Viscosity Index	D567*	100 Typ.
Pour Point, °F	D97*	0°F Max.
Rusting-Distilled Water	D665*	No Rust

*Latest Revision

2. The governor test stand air motor reversing valve should be set for clockwise rotation.

3. The test stand vacuum connection must be capped or plugged, and the vacuum control valve should be fully open.

4. Install governor on test stand, tighten hold down clamps, and connect linkage from test stand air control valve lever to governor.

5. Connect test stand hoses to governor at points indicated in Fig. 24.

6. Leave cover on governor and connect 16-point electrical connector from test stand to governor receptacle.

7. Turn on test stand oil pump.

8. Fill governor with oil, and regulate valves in drain and fill lines to maintain oil level between lines on sight glass, while circulating hot oil from the test stand through the governor and back to the oil sump tank.

9. With oil failure shutdown plunger pulled out, adjust control knob on test stand air control valve lever to admit air to air motor and start governor running.

10. Adjust air valve lever control knob to maintain speed of approximately 30 RPM.

11. Open test stand load control pressure valve to admit oil to load control pilot valve assembly.

12. Open test stand lube oil pressure supply valve, and close lube oil pressure bleed valve to establish oil pressure to lube oil diaphragm.

13. Open control air pressure valve and use pneumatic transmitter control valve to establish 52" Hg. pressure on absolute pressure manometer or gauge with the air-bleed valve open only enough to give very slight leak to atmosphere.

14. Operate in this condition for approximately five minutes to allow oil to circulate through all passages of governor.

15. Set test stand speed selector switch at IDLE position.

16. Reset oil failure shutdown plunger by pushing it in, and adjust control knob on air control valve lever to increase test stand speed until governor oil pressure increases markedly, and governor terminal shaft lever moves to control test stand speed.

17. Adjust test stand control knob to position governor terminal shaft scale at approximately 1.75. Test stand RPM should now be controlled by turning the speed selector switch but, since governor has not yet been set, the speeds at various throttle positions will not agree with the specified speeds.

18. Place selector switch in No. 4 position and operate at this setting until the governor is thoroughly heated to the operating temperature of 190°-200° F.

19. When governor has reached operating temperature, turn selector switch to IDLE position.

20. Disconnect electrical cable from governor, remove governor cover, and reconnect electrical cable.

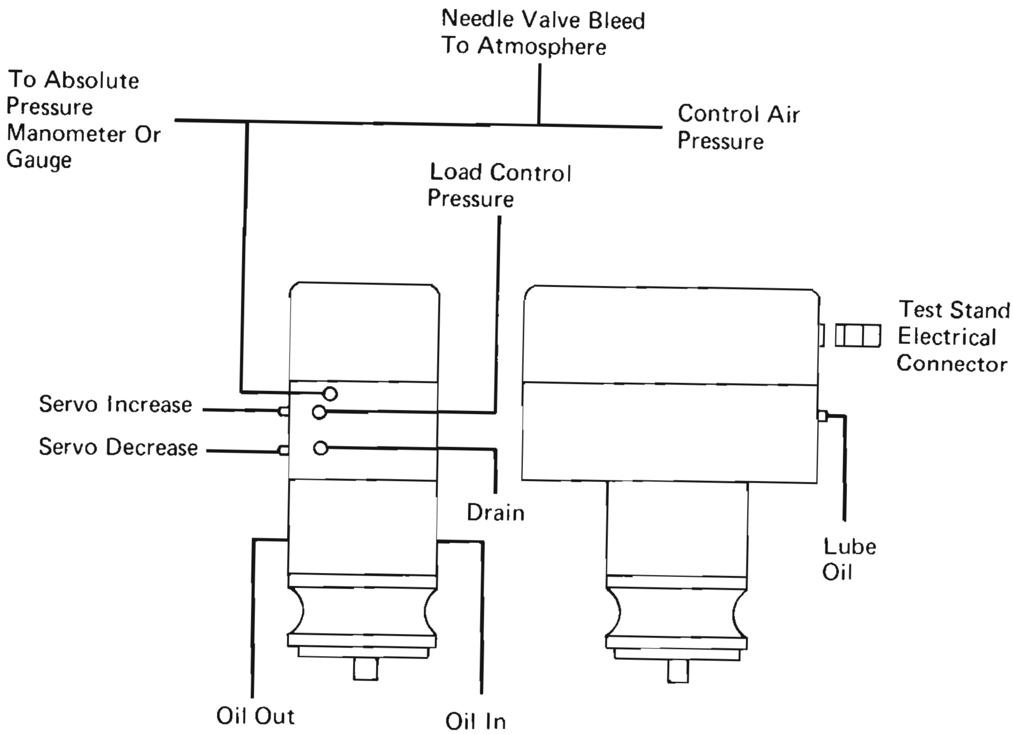


Fig. 24 – Test Stand Connections To Governor

21. Loosen the compensating needle valve several turns, and allow the governor to surge for about 30 seconds.

22. Close the needle valve until the hunting stops. Keep the needle valve as far open as possible to prevent sluggishness and still have stability. Check stability by disturbing the speed and noting that the governor returns to a steady speed.

PRESSURE CHECKS

1. Governor oil pressure should be 90 - 100 psi at idle.

2. Governor pump action should develop enough oil pressure to raise the power piston at 60 RPM cranking speed.

OVERRIDING SOLENOID Fig. 21

1. Place speed selector switch at IDLE position, and operate governor with terminal shaft scale at approximately 1.75.

2. Close and open the overriding solenoid switch on test stand panel, and check to see that the load control pilot valve snaps up immediately when the solenoid is energized, and drops rapidly when the solenoid is de-energized.

NOTE: Governor oil pressure at idle may momentarily drop as low as 60 psi, but should not remain below 85 psi when overriding solenoid is energized.

If the pilot valve action is sluggish when the solenoid is energized or de-energized, proceed as follows:

1. Remove the rebalancing rocker arm support bracket from the solenoid, loosen the plunger plug locknut and, with the solenoid de-energized, run the plunger stop plug down until the load control pilot valve moves up.

2. Carefully back off the stop plug until the pilot valve starts down, then back off plug 1/4 turn more, and tighten the locknut.

3. Again, close and open the overriding solenoid switch on the test stand panel to ensure that the load control pilot valve now moves up and down rapidly.

4. Re-apply the rebalancing rocker arm support bracket to the overriding solenoid case. Before tightening the support bracket clamp screw, make certain that the bracket is seated squarely on the solenoid case, and

that the opposite end of the rocker arm is centered on the limiter servo piston stem.

SETTING RACK STOP, Fig. 21

1. With the governor operating at IDLE on speed selector switch, adjust the control knob of the test stand air control valve lever to position the terminal shaft scale at .62. It may be necessary to loosen the rack stop screw locknut and back off the screw to achieve this setting.

2. Run the rack stop screw down until it contacts the power piston at .62 rack length, then back off the screw 1/4 turn, and tighten the locknut.

ABSOLUTE PRESSURE SENSOR ADJUSTMENT, Fig. 18

1. Using the transmitter control valve, raise and lower the absolute air pressure from atmospheric pressure to 52" Hg., four or five times. This will cause the limiter piston to move up and down, purging any air which might be trapped in the servo mechanism.

2. Fully close the control air valve and open the air-bleed needle valve several turns, so that the absolute pressure sensor-bellows assembly is at atmospheric pressure.

3. Measure the height of the limiter cam (27) or servo piston from some reference surface, such as, the top of the cam guide bracket (29). Record this measurement.

4. Close the air-bleed valve to a position which will provide a very slight leak to atmosphere, when the air control valve is opened. Then establish a pressure of 36" Hg. absolute with the transmitter valve.

5. Again measure the height of the limiter cam or servo piston above the reference surface, as in Step 3. The difference between this measurement and the recorded measurement should be 3/32" ± 1/64".

6. If the piston travel is within these limits, tighten the bellows locknut (4), and recheck the setting by lowering the air pressure to atmospheric pressure and raising it again to 36" Hg. absolute.

7. If the piston travel is not within the prescribed limits, loosen the banjo fitting body screw (1) just enough that the bellows assembly can be turned without losing air pressure. Turn the bellows assembly (10) clockwise to increase travel, or counter-clockwise to decrease travel. Very little movement of the bellows assembly is needed to effect a change.

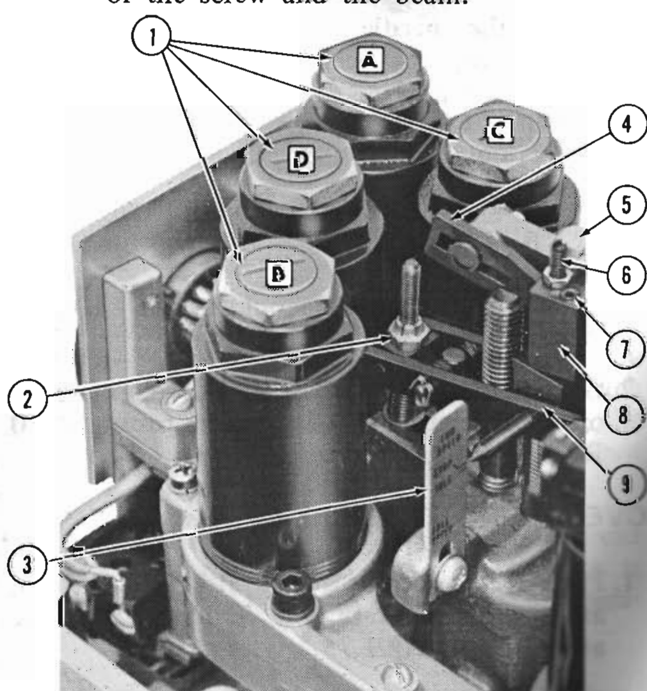
8. Tighten the locknut and the banjo fitting body screw, and recheck the setting, as in Step 6.

9. Rapidly increase and decrease the absolute pressure to the bellows and check to be sure that the servo piston moves rapidly and precisely with the changes in air pressure. Sluggish action may be caused by partially plugged orifices or orifice screen.

SETTING SPEEDS, Fig. 25

1. Establish 52" Hg. absolute air pressure to the bellows assembly.

NOTE: If, at any time during the following settings, the governor does not respond to increase speed when required, it is probable that the connecting beam (4) is contacting the limiter adjusting screw (5). If so, back out the adjusting screw until there is clearance between the end of the screw and the beam.



1. Solenoids
2. Fulcrum Nut
3. Speed Scale
4. Connecting Beam
5. Limiter Adjusting Screw
6. Shutdown Rod
7. Shutdown Adjusting Lock Screw
8. Shutdown Block
9. Fulcrum Assembly

18958

Fig. 25 -- Speed Control And Shutdown Adjustment Points

If the governor will not go to the idle speed setting without shutting down, remove the lock screw (7) above the shutdown adjusting screw, and back out the adjusting screw until there is clearance between the end of the screw and the speed setting piston fulcrum assembly (9). Reinstall and tighten the lock screw.

2. Place test stand selector switch in No. 6 position, and bring speed to 796-804 RPM by adjusting fulcrum nut (2) at the end of the linkage. Raising the fulcrum nut increases speed.

3. Move selector to No. 8 position, and set speed at 981-990 RPM by adjusting the "D" solenoid stop screw. Back off stop screw to increase speed.

4. With selector in No. 5 position, adjust the "A" solenoid stop screw to set speed at 703-712 RPM. Turn stop screw in to increase speed.

5. Place selector in No. 3 position, and set speed at 518-526 RPM by adjusting the "B" solenoid stop screw. Turn stop screw in to increase speed.

6. With selector in No. 2 position, adjust "C" solenoid to set speed at 425-434 RPM. Turn screw in to increase speed.

7. Check above settings and, if correct, all other speeds should be within limits shown in the following table.

ENGINE GOVERNOR SPEED SETTINGS

Throttle Position	Governor RPM Min.	Max.	Solenoid Energized A	B	C	D	Solenoid Adjustment Sequence
STOP						*	
IDLE	334	352					
1	334	352					
2	425	434	*				"C" 5
3	518	526			*		"B" 4
4	594	626	*		*		
5	703	712		*	*	*	"A" 3
6	796	804	*	*	*	*	Fulcrum Nut 1
7	872	904		*	*		
8	981	990	*	*	*		"D" 2

8. Note speed at each throttle position from IDLE through No. 8 and decreasing again to IDLE. Speeds must repeat within 3 RPM at each position. If speeds do not repeat within this limit, check for binding in the linkage between the speed setting piston fulcrum assembly and the speed control pilot valve plunger. Also, check to see that the triangular plate spring straps are not kinked, resulting in a snap action of the straps at certain throttle changes.

9. The speed pointer should register at correct mark on the speed scale when selector is at IDLE and FULL SPEED positions. If not, and scale cannot be relocated so that pointer and scale correspond at both idle and full speed, a new scale should be installed. Position new scale so pointer and scale correspond at idle and scribe a mark on the scale opposite the pointer at full speed.

SHUTDOWN ADJUSTMENT, Fig. 25

1. Place the speed selector switch in IDLE, and operate governor at this setting.

2. Loosen the locknut on the speeder spring piston stop screw, Fig. 19, and run the screw down until it contacts the top of the speed setting piston.

3. Back the screw off two and one-half to three turns, and tighten the locknut.

4. Remove the allen head setscrew (7, Fig. 25) adjacent to the shutdown rod in the shutdown block. This is a locking screw which retains the setting of the shutdown adjusting screw directly below it.

5. Insert allen wrench in the head of the shutdown adjusting screw, and adjust it to provide 1/32" clearance between the bottom of the screw and the top of the speed setting piston fulcrum assembly. When checking the clearance, do not touch the allen wrench, as any downward pressure on the shutdown rod will change this dimension.

6. Turn the selector switch to OFF position, and check to see that the speed indicating pointer moves up to, or slightly above, the stop mark on the speed scale, and that the

terminal shaft scale moves all the way to the 1.96 mark.

NOTE: In order to actually bring the governor to a stop on the test stand, it may be necessary to adjust the control knob of the test stand air control valve lever to shut off air to the air motor, when the governor terminal shaft scale is at 1.96. Place the selector at IDLE, restart governor by pulling up on air control valve cable without changing control knob adjustment, and repeat Step 6.

7. Install the shutdown adjustment lock screw, and tighten it securely against the adjusting screw.

8. Recheck the 1/32" clearance at idle, after tightening the lock screw.

FUEL LIMITER ADJUSTMENT, Fig. 25

1. Establish exactly 52" Hg. absolute pressure to the sensor-bellows assembly.

2. Place the test stand selector switch in No. 8 position, and adjust the test stand air valve lever control knob to position the terminal shaft scale at approximately .92 rack length.

3. Very slowly adjust the air valve control knob to move the terminal shaft scale to .83 rack length. At this rack length, a speed reduction of 15-20 RPM below full speed should be obtained.

4. If a 15-20 RPM speed reduction is not obtained at the above setting, readjust the air valve control knob to again position the terminal shaft at approximately .92 rack length, and turn the limiter adjusting screw down about one-half turn. If more than 15-20 RPM speed reduction was obtained, follow the same procedure but back off the limiter adjusting screw.

5. Repeat Steps 3 and 4 until the 15-20 RPM speed reduction is obtained, and can be repeated several times with no further adjustment.

6. Adjust the air valve lever control knob to position the terminal shaft scale at approximately 1.08 rack length.

7. Establish exactly 42" Hg. absolute pressure to the sensor-bellows assembly.

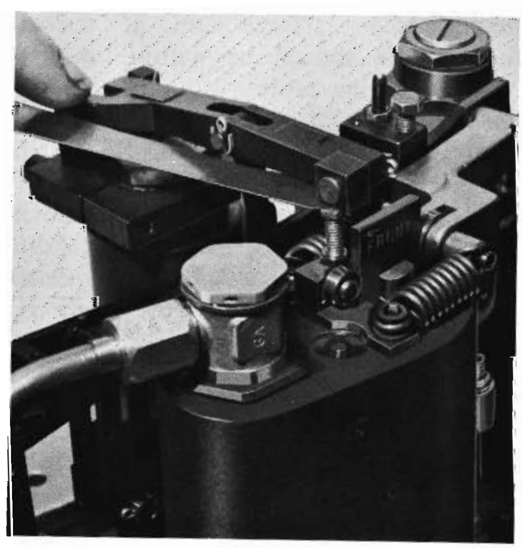
8. Very slowly adjust the air valve control knob to move the terminal shaft scale toward .95 rack length. When a speed reduction of 15-20 RPM is obtained, the terminal shaft scale should be at some point between .99 and .95 rack length. If this condition cannot be achieved, the calibration of the sensor-bellows assembly is incorrect, and it must be replaced.

SETTING REBALANCING ARM STOP SCREW, Fig. 26

1. Place selector in No. 8 position, and adjust the control knob on test stand air valve lever to position governor terminal shaft scale at approximately .92 with 52" Hg. absolute pressure to the sensor-bellows assembly.

2. Lift up on the rebalancing rocker arm to make sure there is tension on the rocker arm. If there is no tension on the rocker arm, loosen the pilot valve eccentric lock screw, and turn the eccentric until the pilot valve is lifted, and the rebalancing rocker arm is pulled down firmly against the limiter servo piston or against the rebalancing arm stop screw. Tighten the eccentric lock screw.

3. Make certain that the absolute pressure is established at exactly 52" Hg.



17188

Fig. 26 – Rebalancing Arm Stop Screw Adjustment

4. Loosen the locknut on the rebalancing rocker arm stop screw and, using a .001"-.002" feeler gauge between the rebalancing rocker arm block and the top of the stop screw, adjust the stop screw until a drag is felt on the gauge as it is pulled from under the block. Tighten the locknut.

NOTE: Since the stop screw is now set to limit the downward movement of the rebalancing rocker arm at 52" Hg. absolute pressure, all remaining governor settings which specify 52" Hg. absolute pressure may be made with the pressure established at 53" to 54". This will ensure that the rocker arm is resting on the stop screw as it would normally do at throttle position No. 8 in actual locomotive operation, and it eliminates the necessity of continually checking to see that the absolute pressure remains at exactly 52" during the time that the settings are being made.

SETTING PILOT VALVE LINKAGE, Fig. 27

1. Remove cotter pin from block at end of floating lever adjusting screw.

2. Place the selector switch at No. 8 position, establish 53" to 54" Hg. absolute pressure, and adjust the control knob on the test stand linkage to position the governor terminal shaft scale at approximately .96.

3. Install tail rod jack and tighten until terminal shaft scale is at specified full load rack length of .92.

NOTE: Governor speed will increase as tail rod jack is tightened, but this will not affect pilot valve setting.

4. Loosen the eccentric lock screw, and adjust the eccentric to stop the movement of the test stand excitation servo indicator pointer at some point well away from either end of its travel.

5. Tighten eccentric lock screw, making sure that test stand servo indicator pointer remains stationary.

6. The pilot valve indicator pointer should indicate "0" (balance position). If the pointer does not correspond with actual balance, the scale must be relocated to position the pointer at "0". Remove tail rod jack.

7. Place selector switch in IDLE position, and adjust air valve control knob to position governor terminal shaft scale at or slightly below 1.79.

8. Fully close the control air valve, and open the air-bleed needle valve several turns so that the absolute pressure sensor-bellows is at atmospheric pressure.

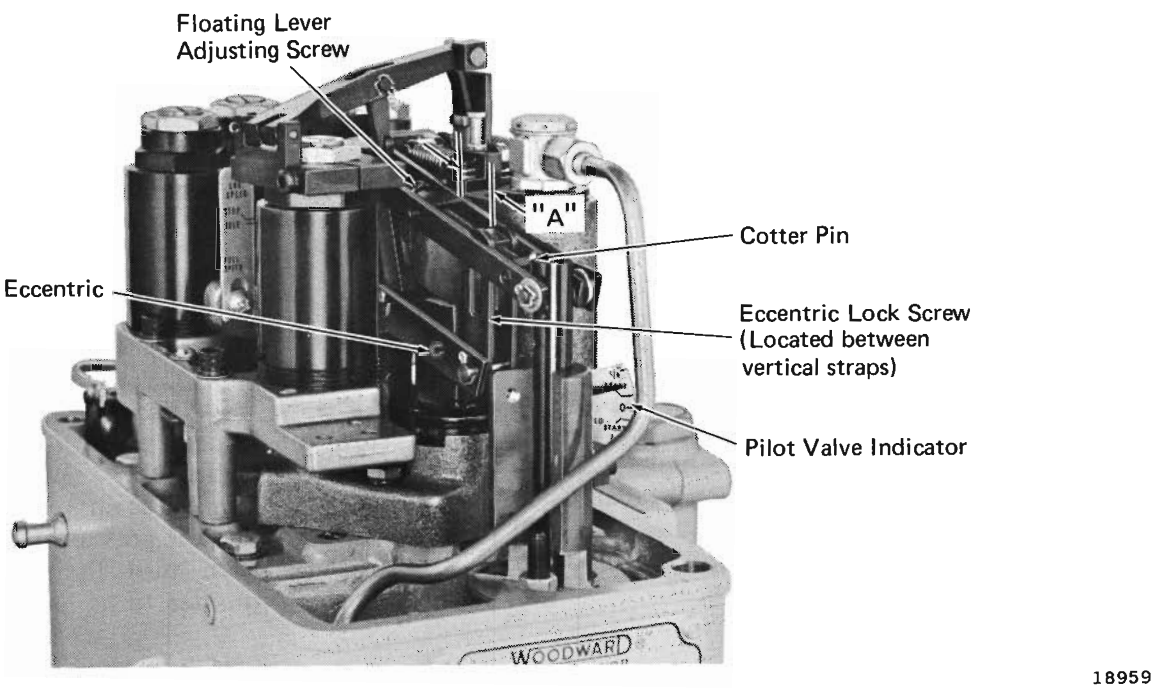


Fig. 27 -- Pilot Valve Adjustment Points

9. Install tail rod jack and tighten until terminal shaft scale is at 1.75. Pilot valve indicator pointer should indicate maximum field start.

10. If pilot valve indicator pointer is below the maximum field start mark, dimension "A" should be lengthened by turning the floating lever and adjusting screw. If above the maximum field mark, dimension "A" should be shortened. For these corrections, adjust dimension "A" to move the pilot valve indicator pointer only one-half the required distance.

11. Re-establish 53" to 54" Hg. absolute pressure, return the governor to full speed and full load rack length conditions, and again adjust eccentric to balance the test stand excitation servo indicator, as in Steps 1 thru 6.

12. Recheck settings at IDLE speed and 1.75 rack length at atmospheric pressure, as in Steps 7 thru 9.

13. Repeat the above procedure until the pilot valve indicator pointer indicates maximum field start at IDLE speed; 1.75 rack length and atmospheric pressure and the test stand excitation servo indicator is balanced at full speed; and full load rack length at 53" to 54" Hg. pressure with no further adjustment necessary. Apply cotter pin in block at end of floating lever adjusting screw to retain this setting.

OIL FAILURE SHUTDOWN ASSEMBLY

1. With governor operating, close test stand load control pressure valve, and "oil in" and "oil out" valves.

2. With speed selector switch in No. 8 position, open test stand lube oil pressure bleed valve, and close lube oil pressure supply valve to slowly reduce engine lube oil diaphragm pressure. Governor shutdown plunger should move out rapidly, and governor should shut down at 25-29 psi.

NOTE: No adjustment can be made to the low oil pressure shutdown. To change the shutdown pressure, a new diaphragm spring and/or speed setting servo spring must be installed.

3. Close test stand lube oil pressure bleed valve, open lube oil pressure supply valve, and reset shutdown plunger.

4. Start governor, and place speed selector switch in IDLE position. Open test stand lube oil pressure bleed valve, and close lube oil pressure supply valve to reduce engine lube oil diaphragm pressure to approximately 15 psi.

5. Reduce lube oil diaphragm pressure in 1 psi increments, waiting approximately 30 seconds between pressure reductions. Hold finger lightly on shutdown plunger to determine when it starts to move. Plunger should start to trip at 8-12 psi.

SETTING TIME DELAY BYPASS

1. Operate governor with selector switch in No. 3 position, and test stand load control pressure valve and "oil in" and "oil out" valves closed.

2. Open lube oil pressure bleed valve, and close lube oil pressure supply valve to drop oil pressure to zero as rapidly as possible. This should cause the shutdown plunger to trip within 2 seconds.

3. Back off several turns on the bypass valve adjusting screw (13, Fig. 17), located in the triangular plate between the "A," "C," and "D" solenoids. Re-establish test stand oil pressure to diaphragm, and reset the shutdown plunger. Operate the governor at selector switch position No. 3, and again reduce oil pressure to the diaphragm as rapidly as possible. The shutdown plunger should now move out slowly instead of tripping within 2 seconds.

4. Turn the bypass adjusting screw in slightly, and repeat the above procedure until the shutdown plunger again trips in 2 seconds or less, after the oil pressure is rapidly dropped to zero. Then turn the screw in an additional one-quarter turn.

SETTING TIME DELAY

1. With the test stand load control pressure valve, and "oil in" and "oil out" valves closed, operate the governor with the selector switch in IDLE position.

2. Open lube oil pressure bleed valve, and close lube oil pressure supply valve to drop the oil pressure to zero as rapidly as possible. This should cause the shutdown plunger to move out slowly, requiring 50-60 seconds to trip.

3. If the time delay is not within the 50-60 second limit, loosen the regulating bushing retainer screw (6, Fig. 16), and adjust the retainer. Movement of the pointer in a counterclockwise direction increases the time delay. Tighten the retainer screw, and repeat Step 2.

4. A punch mark on the column casting at the end of the pointer shows the original factory setting. If the above adjustment results in a new pointer location, it should be indicated by two punch marks in line with the end of the pointer.

Since the time delay will vary with temperature of the oil and elapsed time since the previous shutdown, the following setting and acceptance limits have been established:

Initial Setting on Test Stand	50-60 Seconds
Acceptance on Engine	35-90 Seconds

COMPLETION OF TESTING

1. Shut governor down, turn off test stand oil pump, and drain oil from governor.

2. Disconnect all hoses from governor, and install pipe plugs and drain cock.

3. Disconnect electrical cable from governor, and install cover assembly.

4. Remove governor from test stand.

SERVICE DATA

EQUIPMENT LIST

Pilot valve bushing removal tool	8208520
Oil seal removing and installing tool	8208889
Ball arm centering tool	8208890
Column holding fixture	8209602
Ball arm bearing installing and removing tool	8209807
Repair fixture	8210888
Power piston spring guard compressor	8210889
Accumulator spring compressor	8210891
Rotary shaft bearing removing and installing tool	8225658
External snap ring pliers	8228031
Internal snap ring pliers (No. 1)	8237117
Internal snap ring pliers (No. 3)	8237118
Tail rod jack	8330230