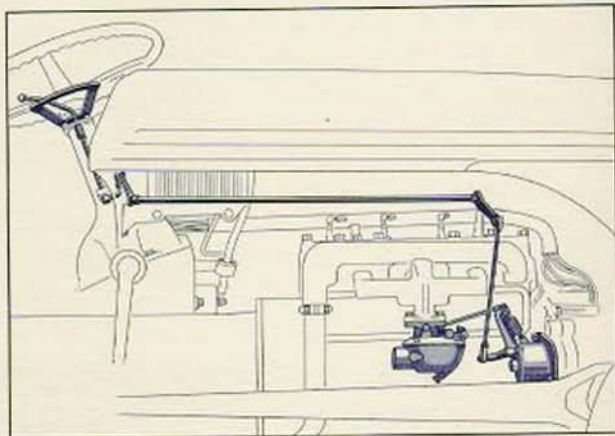




MAINTENANCE AND REPAIR

— OF —

THE GOVERNOR AND CONTROL LINKAGE



HARRY FERGUSON, INC. • DETROIT, MICHIGAN

OPERATION OF THE GOVERNOR

The function of the governor is to automatically control the throttle to maintain a constant engine speed under varying loads. The manner by which the governor accomplishes this function is more easily understood by discussing its operation.

When the throttle control rod is moved, it actuates the inner governor arm, which increases the tension on the governor spring. The governor spring opens the carburetor throttle. The balls inside the governor, "Part 1" Fig. 5, tend to close the throttle. The governor operation is to maintain a balance between these two forces. The spring opening the throttle allows more fuel to the engine, increasing the engine speed. As the engine speed increases, the speed of the governor drive shaft also increases, and gives more inertia or centrifugal force to the governor balls. This greater force in the balls overcomes or equals the tension of the governor spring, thus closing the throttle until a balance is achieved by the force of the balls tending to close the throttle and the spring trying to open the throttle.

As long as the load on the engine remains the same, the forces are balanced, and the engine will operate at a constant speed.

When a plow is dropping into the ground or any load is transmitted to the engine causing the engine speed to decrease, the force of the governor balls will decrease. The tension of the governor spring will then instantaneously open the throttle to prevent an appreciable loss in speed. This instantaneous opening of the throttle gives the engine more fuel, preventing any appreciable decrease of the engine speed. When the engine speed increases, the force is restored to the governor balls and they then counteract the tendency of the governor spring to continue opening the throttle and restores the balance, thus preventing the engine from overspeeding.

When the control rod is moved to open the throttle, it increases the tension on the spring and thus makes the spring stronger and requires the engine to run faster to build up sufficient centrifugal force in the governor balls to counteract or balance this in-

creased strength or tension that was put into the spring as the throttle was opened.

Any wear on the governor spring will reduce its tension or strength and thereby reduce the ability to counteract the governor weights. This reduced spring tension may then not have sufficient strength to counteract the force of the governor balls to permit reaching full engine speed. The correct adjustment of the governor and its linkage is necessary to obtain the full engine power.

Checking Engine Speed

1. Start the engine and, when it reaches the proper operating temperature, check the carburetor adjustments.

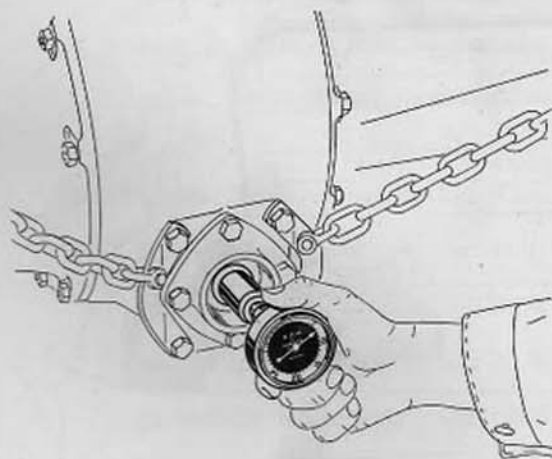


FIG. 1

2. Check the maximum engine speed as illustrated in Fig. 1. The correct speed, with the throttle control rod in last notch on the quadrant, is 2050 to 2200 R.P.M. Check at the Power Take-Off or Belt Pulley and the following table indicates the engine speed:

P.T.O. R.P.M.	Engine R.P.M.	Belt Pulley R.P.M.
727	2000	1358
736	2025	1375
745	2050	1392
754	2075	1409
763	2100	1426
772	2125	1442
782	2150	1460
791	2175	1478
800	2200	1494

3. If engine speed exceeds 2200 R.P.M., screw in the adjusting stop-screw, "A," Fig. 2, until full throttle speed is 2200 R.P.M. with the throttle control rod in the last notch on the quadrant.

4. If the speed exceeds 2200 R.P.M. before the throttle control rod reaches the last notch on the quadrant, bend the linkage so

NOTE: The Ford Tractor engine governor is set to allow 10% overrun. Therefore, the maximum governed speed is 2000 plus 10% or $2000 + 200 = 2200$ R.P.M.

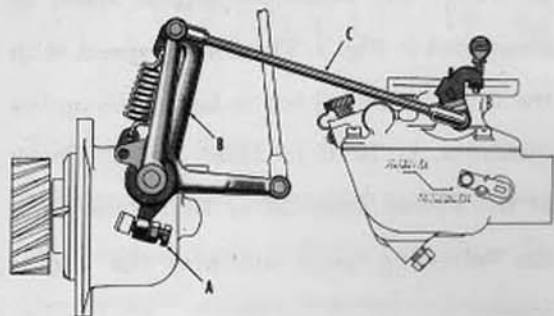


FIG. 2

the speed will be 2200 in the last notch. This is accomplished by holding the throttle

control rod in the closed position with one hand, and, while holding the throttle shaft lever at point "A," Fig. 3, open the throttle control rod, bending the control linkage until 2200 R.P.M. is obtained in last notch.

NOTE: The throttle control rod should be adjusted to obtain maximum speed in the last notch so that the proper idling speeds can be obtained in the closed position.

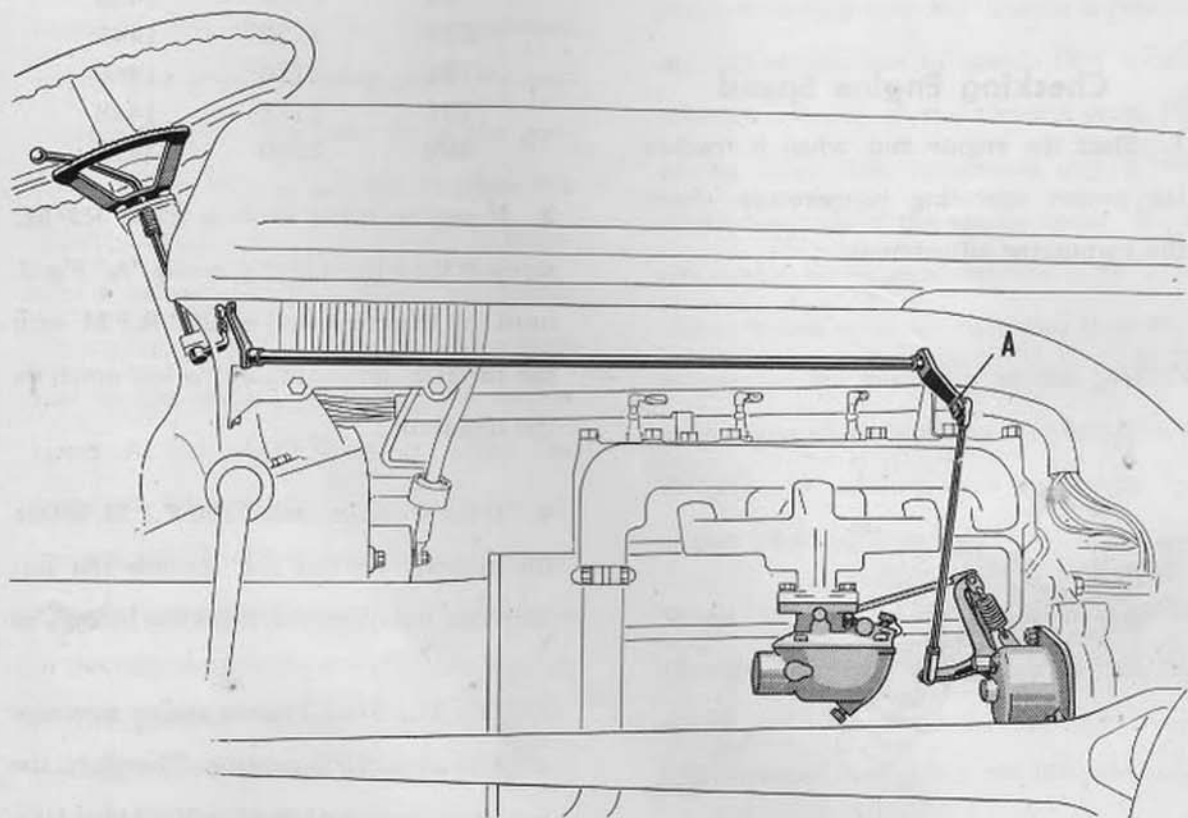


FIG. 3

5. If the engine speed does not come up to a minimum of 2000 R.P.M. with the throttle control rod in the last notch:

(a) Check governor adjusting stop screw, "A," Fig. 2. If the adjusting screw is against the governor stop, back out the screw until it does not make contact with the governor housing stop. Check the speed and if 2000 R.P.M. is not obtained, proceed with next step.

(b) Loosen capscrews holding the throttle control rod quadrant and, while pulling the quadrant to rear, tighten the capscrews again. This will frequently increase the speed 60 R.P.M. Check the speed and, if 2000 R.P.M. is not obtained, proceed with next step.

(c) Check the governor spring. This spring should be snug but without tension. If loose, squeeze the hook on the spring, as shown in Fig. 4, to reduce its length. (On used governors, replace the spring 9N-18196 with a new one.) This

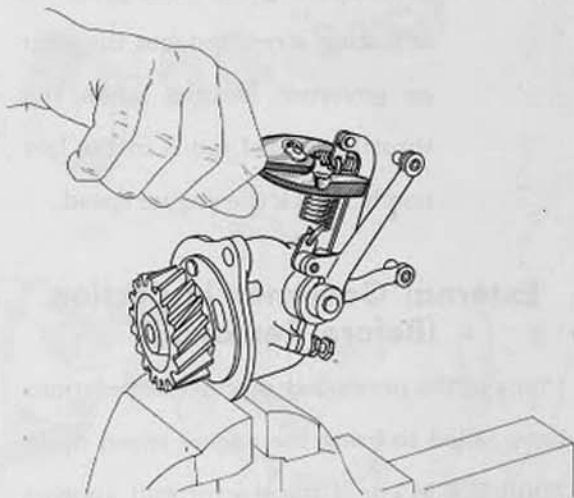


FIG. 4

will frequently increase the speed 50 R.P.M., depending on the looseness of the spring. Check the speed and if 2000 R.P.M. is not obtained, proceed with next step.

(d) With the throttle control rod in the last notch, check the governor adjusting stop screw. If it is not touching the stop, bend the control linkage as follows: With the throttle control rod in the open position, hold the throttle shaft lever at point "A," Fig. 3, and,

while holding the rod in this position, close the throttle control rod with the other hand, bending the control linkage until the governor adjusting screw touches the stop on governor housing when the throttle control rod is in the last notch. Check the engine speed.

External Governor Inspection (Before Removal)

If any of the previously discussed operations have failed to bring the engine speed up to 2000 R.P.M., or if the tractor still appears to be sluggish when under load, or the governor hunts and operates erratically, or has had long service, the following outlined external and internal governor inspections should be performed in the order as listed:

1. Disconnect the governor to carburetor rod "C," Fig. 2, at the carburetor.
2. Inspect the carburetor throttle fly shaft for binding. **IT MUST WORK FREELY.**
3. Inspect the carburetor to governor rod, "C," Fig. 2. Check to see that the ball joint springs in each end of rods are free from rust, paint, or foreign material. These springs must act freely. They must *not* bind where

the rod attaches to the governor and carburetor. If it binds or has excessive drag, replace the rod. **THIS ROD MUST BE STRAIGHT.**

Internal Governor (Inspection)

1. Remove the governor from the engine.
2. Remove the shaft and driver unit from the governor body, "Part 2," Fig. 5. This is accomplished by removing the screw, "Part 15," Fig. 5, and pulling the body and driver unit apart.
3. Shaft and Driver Unit
 - (a) Remove the hair pin clip, "Part 12," Fig. 5, and disassemble the parts.
 - (b) Check the balls, "Part 7," Fig. 5, for wear, flat spots, pitting, etc. Replace them if not in good condition. Discoloration of the balls is a chemical reaction and does not affect their serviceability.
 - (c) Check the conical shaped race, "Part 8," Fig. 5, for grooves or wear. Remedy: Replace.

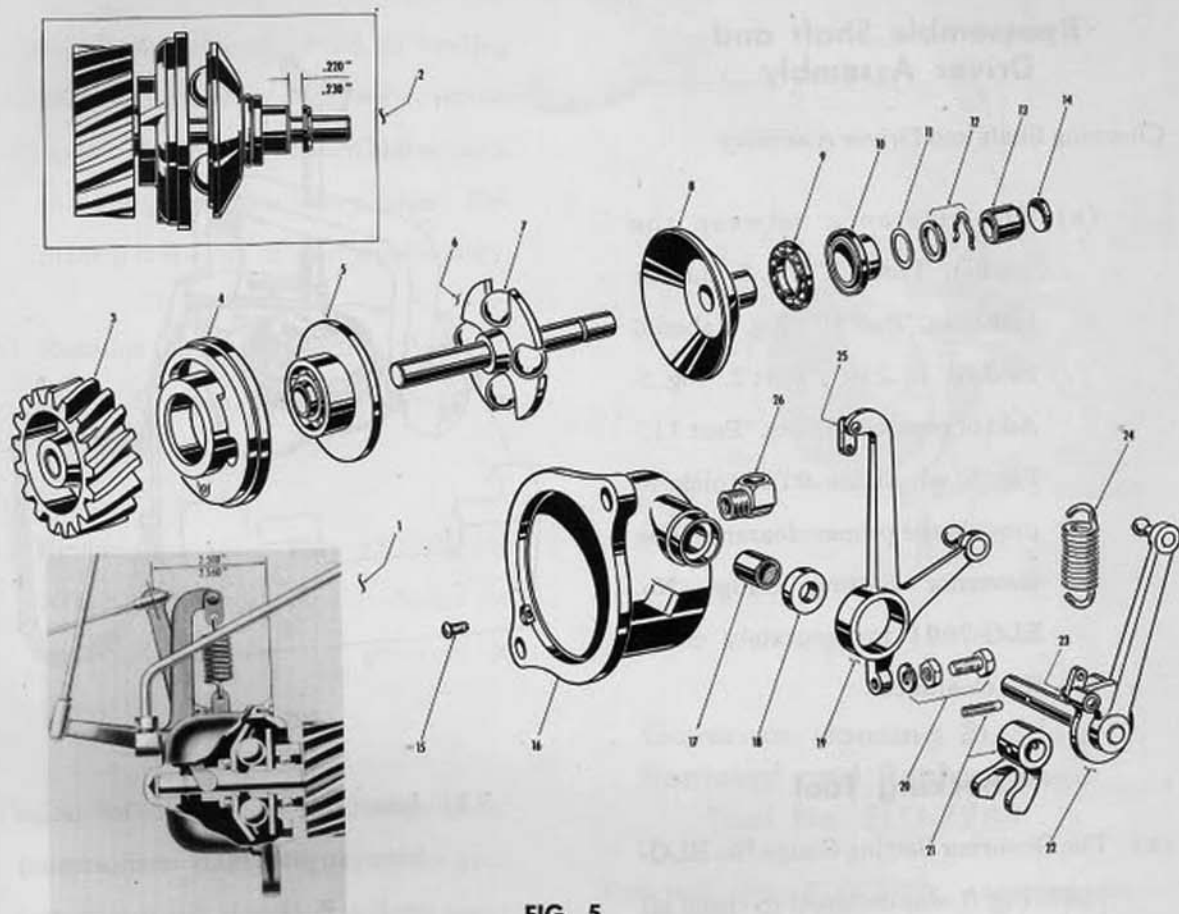


FIG. 5

NOTE: If the flat race, ball driver, shaft, bearing base, bearing and gear are in good condition, it will not be necessary to disassemble the gear and shaft. If any of these items are not in good condition, replace them.

- (d) Gear Replacement, "Part 3," Fig. 5. Press gear on shaft until flush with end of the shaft.
- (e) Check thrust bearing assembly, "Part 9," Fig. 5. If it is not in good condition, replace.

Reassemble Shaft and Driver Assembly

Checking Shaft and Driver Assembly

- (a) The clearance between the washer, "Part 12," Fig. 5, and the fork base, "Part 10," Fig. 5, should be .220" to .230", "Part 2," Fig. 5. Add or remove spacers, "Part 11," Fig. 5, which are .010" thick, to provide the proper clearance. Use Governor Setting Gauge No. ELO-7691 to accurately check the clearance.

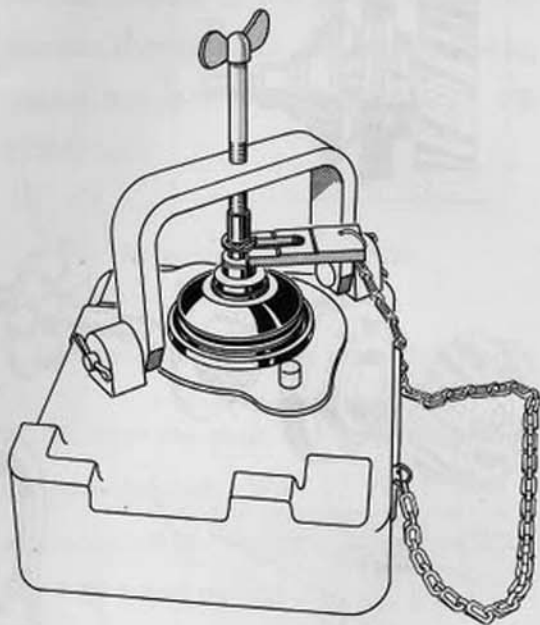


FIG. 6

Checking Tool

- (a) The Governor Setting Gauge No. ELO-7691, Fig. 6, was designed to check all the governor adjustments.
- (b) To check the clearance between washer and fork base, proceed as follows:
- (1) Clamp the shaft and driver assembly in the Governor Setting Gauge as shown in Fig. 6.
 - (2) To measure accurately, the lower race must be held against driver tightly.

- (3) Insert the "Go and No Go" gauge between the shims as illustrated in Fig. 6. If only the thin end of gauge can be inserted, the clearance is satisfactory. If the thick end of gauge can also be inserted, the clearance is excessive and ball stop shims (9N-18241) should be added until thin end of gauge, only, can be inserted. The shims are .010" thick.

Governor Housing Unit

- (a) Check the governor shaft, "Part 22,"

Fig. 5. A corroded, pitted, or binding shaft will interfere with free governor operation. Remedy: Clean and smooth the shaft with fine emery paper. Replace if it is loose or worn appreciably.

- (b) Examine the needle bearing, "Part 17," Fig. 5. Replace if they show wear or are faulty.

- (c) Replace the seal, "Part 18," Fig. 5. NOTE: This seal should always be replaced whenever the governor is disassembled.

- (d) Check the looseness of inner governor arm assembly, "B" Fig. 2, on the governor housing. If loose, make and insert a shim as illustrated in Fig. 7. The shim size is $\frac{1}{2}$ " wide, $2\frac{7}{8}$ " long, and sufficiently thick to eliminate the looseness. If the complete shim cannot then be inserted, cut the length in half and insert only half of the shim.

- (e) Examine the governor shaft bushing in the end of governor housing, "Part 13," Fig. 5. Replace if it is scored or worn. Use the following tools.

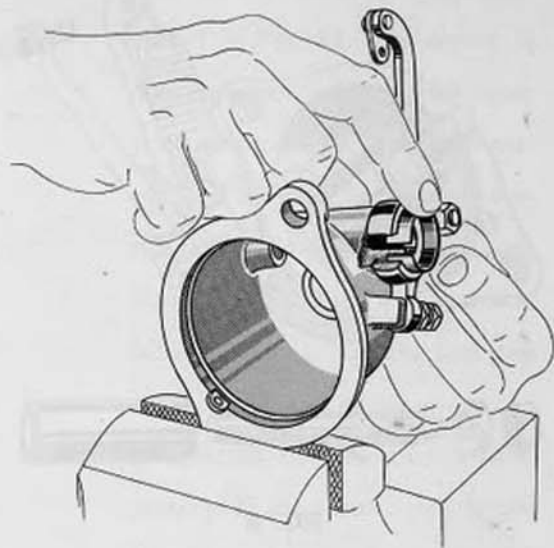


FIG. 7

Governor Housing Bushing Removal and Replacement Tool No. ELO-7789

The tool, No. ELO-7789, was designed especially to remove and replace the governor housing bushing and should be used for this purpose.

- (a) To remove the governor bushing. Disassemble the bushing removal tool. Screw the taper threaded end of the forcing screw into the bushing until it is tight as shown in Fig. 8. Install the tube, thrust washer and the nut. Tighten the

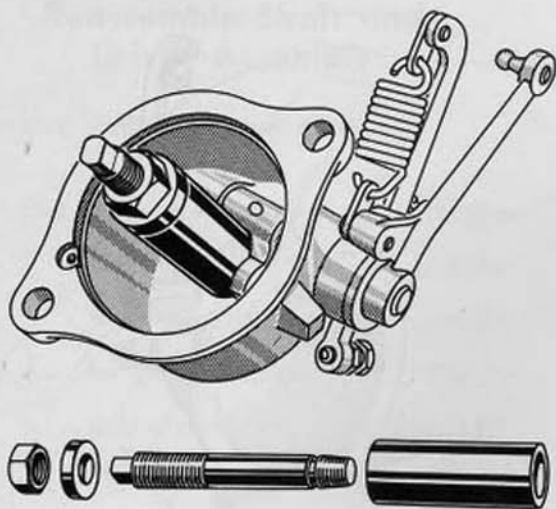


FIG. 8

nut gradually with a wrench until the bushing is drawn from governor housing.

(b) Replacing a new bushing. Place

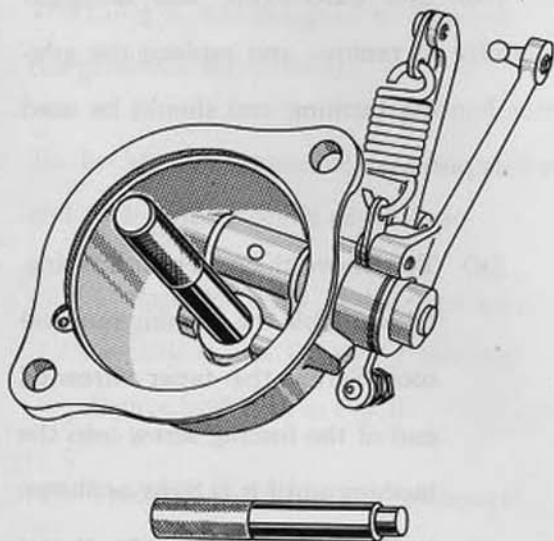


FIG. 9

the bushing (9N-18184) on the small end of bushing replacement tool. Then with a light hammer, drive the bushing into position, as shown in Fig. 9.

CAUTION: The thrust washer, "Part 14," Fig. 5, frequently drops out while removing the bushing. Be sure that it is in place when the new bushing is pressed in.

(c) Reassemble the Shaft and Driver Unit in the Governor Housing.

Check Governor Arm For Correct Adjustment

Governor Setting Gauge No. ELO-7691 should be used to check this adjustment for accuracy. Proceed as follows:

- (a) Install the assembled governor on the governor setting gauge as illustrated in Fig. 10.
- (b) Tighten the wing nut finger tight.

CAUTION: The governor base must be pressed in and held securely and exactly in position, the same as when bolted to the engine.

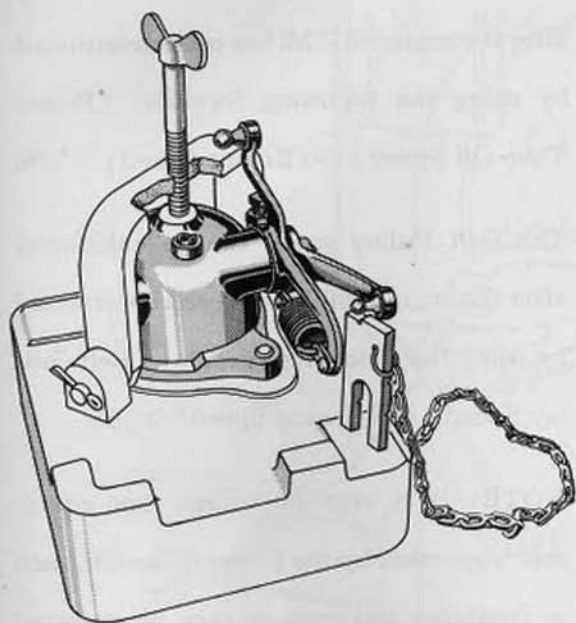


FIG. 10

(c) Then holding the outer governor arm in wide-open position, insert

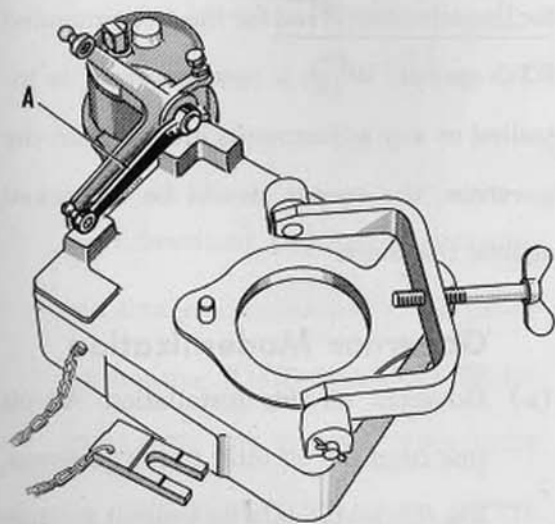


FIG. 11

the "Go and No Go" gauge as illustrated in Fig. 11. The center of the governor arm in wide-open position should be, in a horizontal plane, 2.50" to 2.56" from governor body face, Fig. 5. If the gauge cannot be inserted, the clearance is insufficient. If only the first step on the thick end of the gauge can be inserted, the clearance is satisfactory. If the second step of the thick end of the gauge can be inserted, the clearance is excessive.

(d) If the clearance is excessive, remove the governor from the tool and lay the governor arm across the bosses at end of the tool body as illustrated in Fig. 11. If the clearance is insufficient, turn the governor upside down from position shown in Fig. 11. Then with light hammer, strike the center of governor arm, "A," Fig. 11, so as to bend it slightly. Then recheck as indicated in step (c) above, until the proper adjustment is obtained.

- (e) Install the Governor on Engine.
- (f) Check the Engine speed. Follow the procedure outlined at the beginning of this manual.

Checking The Engine Speed Without A Speed Indicator

To determine the engine revolutions per minute at any throttle control rod setting, put the tractor in low or second gear, drive straight forward on level ground, and count the revolutions of a rear wheel for one minute. Then by multiplying the wheel revolutions per minute by the engine to axle ratio, which is listed below, the engine R.P.M. will be obtained. Formula: (Engine R.P.M.) = (Ratio engine to rear axle) \times (Number of rear wheel revolutions).

EXAMPLES:

Gear	Ratio Engine to Rear Axle	Rear Wheel R.P.M.	Engine R.P.M.
1st	73.3	27.3	2000
2nd	57	35.0	2000
2nd	57	26.0	1482

To determine the engine speed at other positions of the throttle control rod, repeat the above operations.

The Power Take-Off speed can be calculated after the engine R.P.M. has been determined by using the following formula: (Power Take-Off Speed) = (Engine Speed) \times .36.

The Belt Pulley speed can be calculated after the engine R.P.M. has been determined by using the following formula: (Belt Pulley Speed) = (Engine Speed) \times .68.

NOTE: It is very important that equipment, operated by the Power Take-Off, such as combines and corn pickers, be operated at their recommended speed of 535 R.P.M. Therefore, when checking the tractor for the recommended speed, a notch should be marked on the quadrant to show the position for throttle control rod for the recommended PTO speeds. When a new governor is installed or any adjustments are made on the governor, the speeds should be rechecked against this mark.

Governor Modernization

- (a) Governor oil line installation. An oil line from the oil filter to the governor, Fig. 12, is standard on present production tractors to provide better gover-

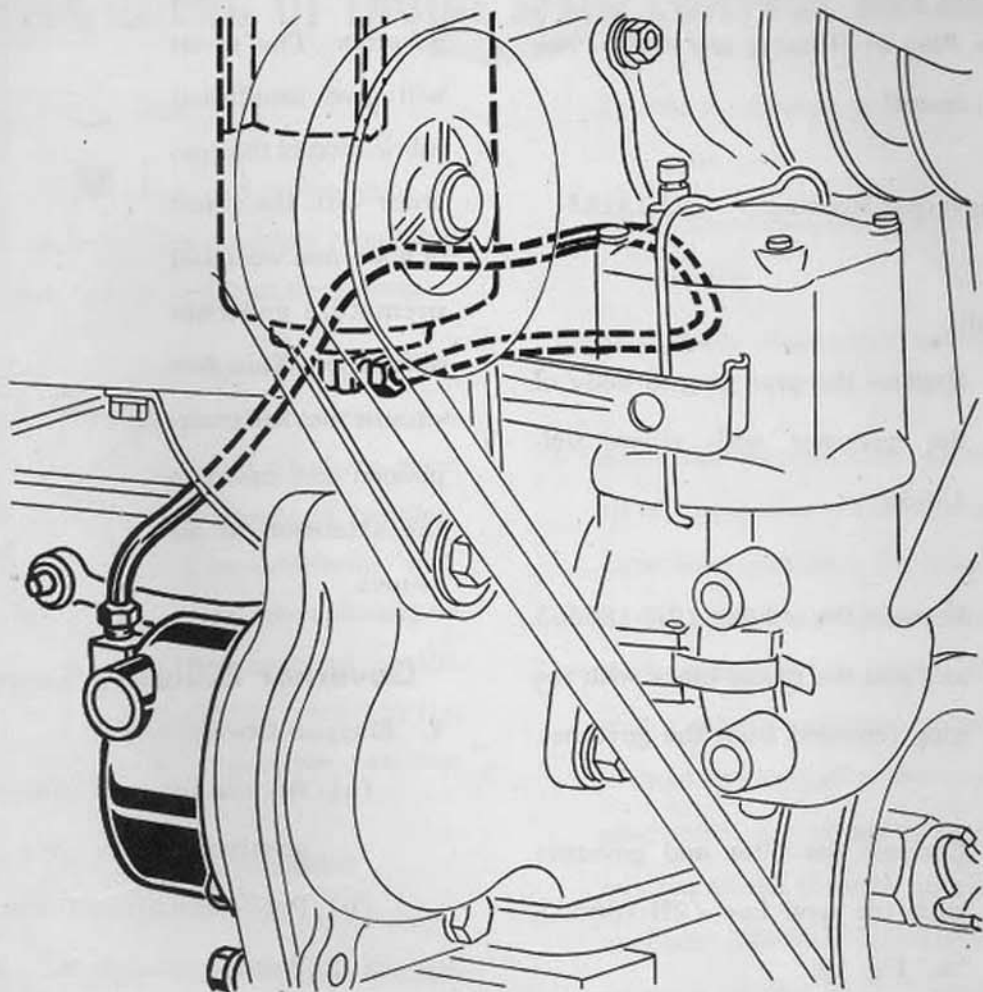


FIG. 12

nor lubrication, prevent condensation and sludge accumulating in the governor housing. THIS SHOULD BE INSTALLED ON EVERY TRACTOR IN THE FIELD THAT IS WITHOUT THIS OIL LINE.

Parts Required to Install on the Tractors in Field

<u>Quantity</u>	<u>Item</u>	<u>Part No.</u>
1	Tube Oil Filter to Governor	2N-18666
1	Elbow	9N-18686

On Old-Style Governors that Do Not Have the Pipe Plug in Housing and Built Prior to 1943, Install

- 1 Governor Housing 9N-18185

To Install:

1. Replace the pipe plug in body of the governor with elbow 9N-18686.
2. Remove the old line (9N-18666) and seal the motor block with the plug removed from the governor.
3. Connect the filter and governor with the new line (2N-18666), "A," Fig. 13.

Engine Oil Filter

The crankcase oil filter cartridge or element, "B," Fig. 13, must be changed in accordance with the instructions. The filtered oil is returned to the crankcase through the governor. If the filtered element becomes clogged and inoperative, it will reduce or stop this

supply of oil to the governor. The result will give insufficient lubrication of the governor with the result of abnormal wear and premature governor difficulties. This fact should be fully explained and called to the attention of all owners.

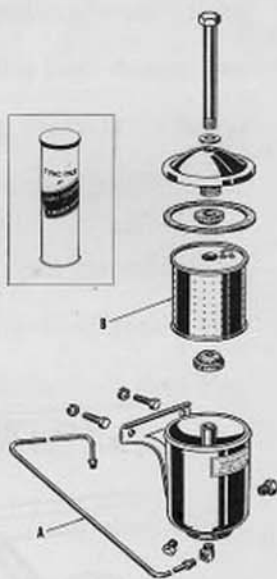


FIG. 13

Governor Difficulty Summary

1. Sluggish Governor.
 - (a) Accumulation of sludge in the governor.
 - (b) Poor carburetor adjustment.
 - (c) Worn internal parts.
2. Erratic Action.
 - (a) Loose or worn linkage.
 - (b) Binding linkage.
 - (c) Worn internal parts.
3. Poor Control.
 - (a) Loose governor spring.
 - (b) Linkage incorrectly adjusted.
 - (c) Linkage interference or binding.

RECONDITIONING OF ENGINE SPEED CONTROL MECHANISM

We would recommend:

1. The disassembling and replacing of all worn parts and the complete rebuilding of the governor in the dealer's shop.
2. The reconditioned governor should actually be installed on the tractor by a qualified mechanic and all of the parts showing wear or evidence of bending, distortion, rubbing or interfering with free movement at any place should be replaced. We would recommend that the following parts should be carried by the mechanic to permit replacement and the correct field installation:

Tachometer or Speed Indicator

9N-18196—Spring, Governor Lever

9N-9815-B—Rod Assembly, throttle shaft to governor

9N-9818-A—Rod Assembly, governor to carburetor

9N-9581-A—Carburetor Shaft and Lever Assembly

9N-9591—Shaft Packing Retainer

9N-9622-A—Throttle Shaft Packing

NOTE: If the throttle binds, the above three parts should be replaced in the carburetor.

9N-6022—Gasket, governor to timing gear cover

9N-9827—Governor Compensating Spring

9N-18649—Cartridge Assembly

3. After the reconditioned governor and all of the necessary speed control parts have been installed, the engine speed should be checked and the adjustments made as outlined on page 2. Do not install a rebuilt governor on any tractor without checking all of the speed control mechanism and checking the speed in relation to the throttle position on the quadrant. The installation of the rebuilt governor on the Ford Tractor without checking the remainder of the speed control mechanism will, in many cases cause the owner to blame you for doing an improper reconditioning job and the result will be a dissatisfied customer and your reputation as a dealer will suffer. It is better to never go near the tractor than not to do a satisfactory or a complete job.

