

ENGINE & CLUTCH

INSTALLATION

With the keys in place, start the gears by tapping with a mallet. Force the gears the remainder of the way by threading the nut on the camshaft to force the camshaft gear, and by threading the crankshaft starting jaw against the washer and pulley to force the crankshaft gear.

In order to assure the gears are correctly meshed for proper timing, the punch mark on the crankshaft gear tooth must be assembled between the two punch marks on the adjacent camshaft gear teeth, see Fig.100.

Note: The timing gears and thrust plate are interchangeable on all three model tractors.

GOVERNOR ASSEMBLY

Late TO-20 and most TO-30 tractor engines have a variable speed, centrifugal governor which regulates the engine speed as the load varies. The unit has ten evenly spaced ball-weights held in a metal retainer which is attached to the camshaft gear. The governor mechanism is enclosed in the timing gear cover and connected through its linkage to the throttle and the carburetor butterfly. The governor is lubricated by engine oil metered from the front camshaft bearing.

By use of the hand throttle, a selection of engine speeds from 400-2,200 RPM can be obtained. Also, any selected speed between 1,000-2,000 RPM can be maintained even though the load may vary.

ACTION

Opening the hand throttle increases the governor spring tension. This causes the governor linkage to overcome the force of the ball-weights, thereby, opening the carburetor throttle butterfly and permitting a greater amount of fuel mixture to enter the cylinder which increases the engine speed. The increase in speed gives greater force to the governor ball-weights, which begin to over-

come the spring tension and partially closes the throttle butterfly. A balance is reached between the action of the ball-weights and the spring tension, and is maintained until either the load or position of the hand throttle is changed.

When the hand throttle is set for a certain speed and the load increases, there is a tendency to reduce the relative force of the governor ball-weights, thereby, permitting the spring tension to open the throttle butterfly, compensating for the increased load. Exactly the opposite condition occurs if the load is decreased.

Proper governor action must be obtained to have steady and efficient lugging power. Any binding or maladjustment will result in faulty or erratic operation.

To check the governor action:

1. Start engine (must be at operating temperature).
2. Set hand throttle for 1,000 RPM. Use the engine tachometer in the On-The-Farm Service Unit. Engine should be "revved-up" then reduced to desired RPM.
3. Set master brake.
4. Shift to fourth gear.
5. Release clutch gradually, see Fig.107.
6. Observe the governor action. The governor lever should pull the throttle rod quickly forward without delay. If it does not, see if the bumper screw is backed away

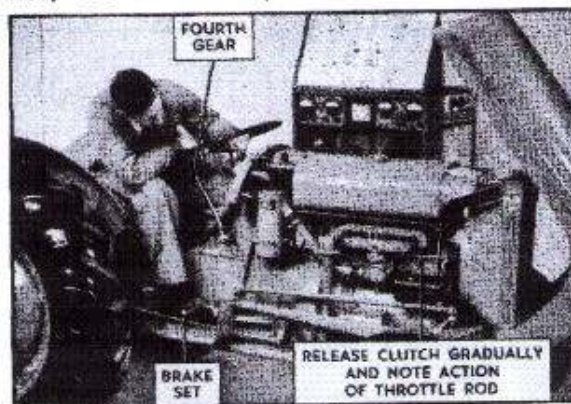


Fig. 107

from the bumper spring. This is accomplished by backing the bumper screw out till no spring tension can be felt.

7. Recheck operation procedure 1 through 5, if insufficient action is still present, check external governor linkage for binding and proper geometry as described under Governor Adjustment. If the governor action remains inoperative at 1,000 RPM, the difficulty probably results from internal binding of the mechanism or from the governor bumper spring extending too far away from the gear cover assembly. The latter condition can be checked by disconnecting the governor spring from the governor lever arm and pushing the governor lever to the idle position. If while in this position, springy action is noted, the governor bumper spring extends out too far and must be bent in towards the cover.

REMOVAL

To remove the governor mechanism from the tractor engine:

1. Remove the tractor hood, fuel tank and radiator.
2. Place a portable jack under the engine crankcase and remove the bolts attaching the front axle support to the engine block.
3. Raise the jack to a height sufficient to

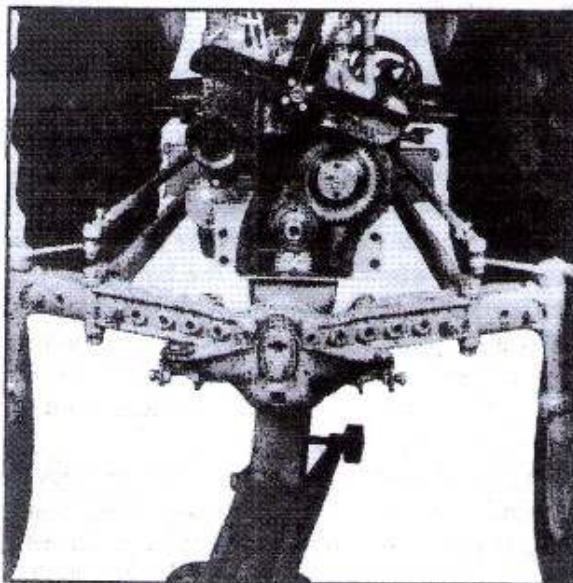


Fig. 108

allow removal of the crankshaft pulley. Remove the fan belt, the cranking nut and the pulley.

4. Disconnect the carburetor control rod and the governor spring from the governor lever assembly.

5. Remove the timing gear cover and the governor cup assembly, see Fig. 108. Remove the governor weight plate from the camshaft gear. To do this on the TO-30, it is necessary to first remove the timing gear retainer nut. On the TO-20 or TE-20, simply remove the four screws which attach the weight plate to the timing gear.

REASSEMBLY

The governor shaft assembly is supported in the timing gear cover by two sets of needle bearings. An oil seal and dust seal are installed in the housing around the governor shaft. The shaft is held in position in the housing by a pin through the governor lever and the shaft.

The flyweights for the flyweight type governors are sold as service items but in the case of the ball-weight type, the weight plate and weights must be replaced as a unit.

The governor bumper spring is riveted to the timing gear cover, the tapered bumper screw is threaded into the housing and is positioned in front of the bumper spring.

To replace the needle bearings, oil seal, dust seal or the governor shaft, it is necessary to remove the shaft from the cover assembly. To do this, carefully center punch the center of the pin retaining the rocker arm to the shaft and the pin positioning the inner bearing. Drill the pins out using a 5/32 in. drill, see Fig. 109. Withdraw the shaft from the housing and pry the oil seal out of the housing using a heavy screwdriver. The needle bearings may be driven out of the housing using a mandrel as shown in Fig. 110. Before reassembling, be sure that all the drill shav-



Fig. 109

ings are cleaned from the housing. When re-assembling the shaft in the housing, always use a new oil seal and dust seal; the old seals will be ruined while removing. New needle bearings can be driven into the housing with the same mandrel used to remove them. Carefully drive the first set into the housing until it just clears the pin hole in the housing. Drive the second set in until it is flush with the bottom of the counterbored oil seal hole. Drive the oil seal into position using a suitable bushing driver as shown in Fig.111. Replace the dust seal, governor shaft and rocker arm. Line up the holes in the shaft and rocker arm and insert a new pin. Carefully head the ends of the pin to hold it in position.

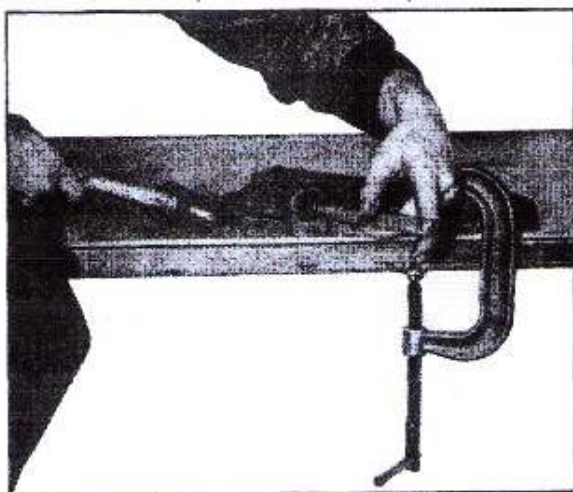


Fig. 110

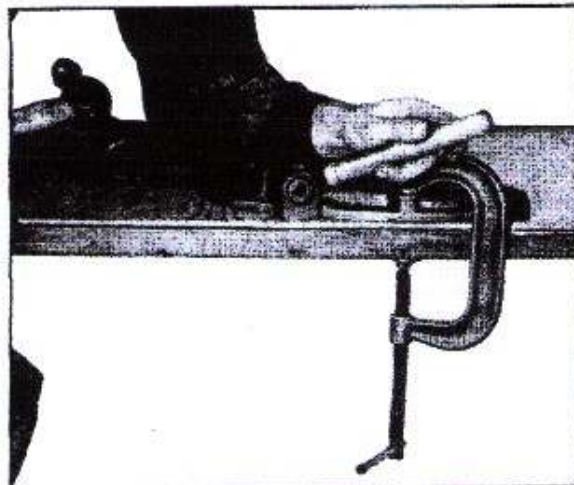


Fig. 111

ADJUSTMENT

After the governor mechanism and linkage is completely assembled, see Fig.112, check the bumper screw to make sure it is not interfering with the bumper spring. The screw should be locked approximately one turn out from the spring. Next, check the exterior governor linkage for binding by opening and closing the hand throttle and noting the points listed below. If interference is present in the geometry of the linkage, adjust to obtain the desired results as a proper functioning governor is dependent upon complete freedom of all component parts.

1. Governor spring and engine block. Move the U-bolt assembly forward on torque rod, being careful not to have interference between compensating spring and water outlet elbow housing.

2. Throttle rod and governor plate. Place the tractor wrench against the bottom of the vertical part of the governor lever arm and bend it outward until binding is eliminated.

3. Vertical arm of governor lever and fan belt. The throttle rod should be shortened to prevent interference.

4. Governor lever shaft and front cover housing. Remove governor spring from governor rod slot and move lever back and forth to check for binding. Binding may be due to dirt or a damaged shaft. The latter will re-

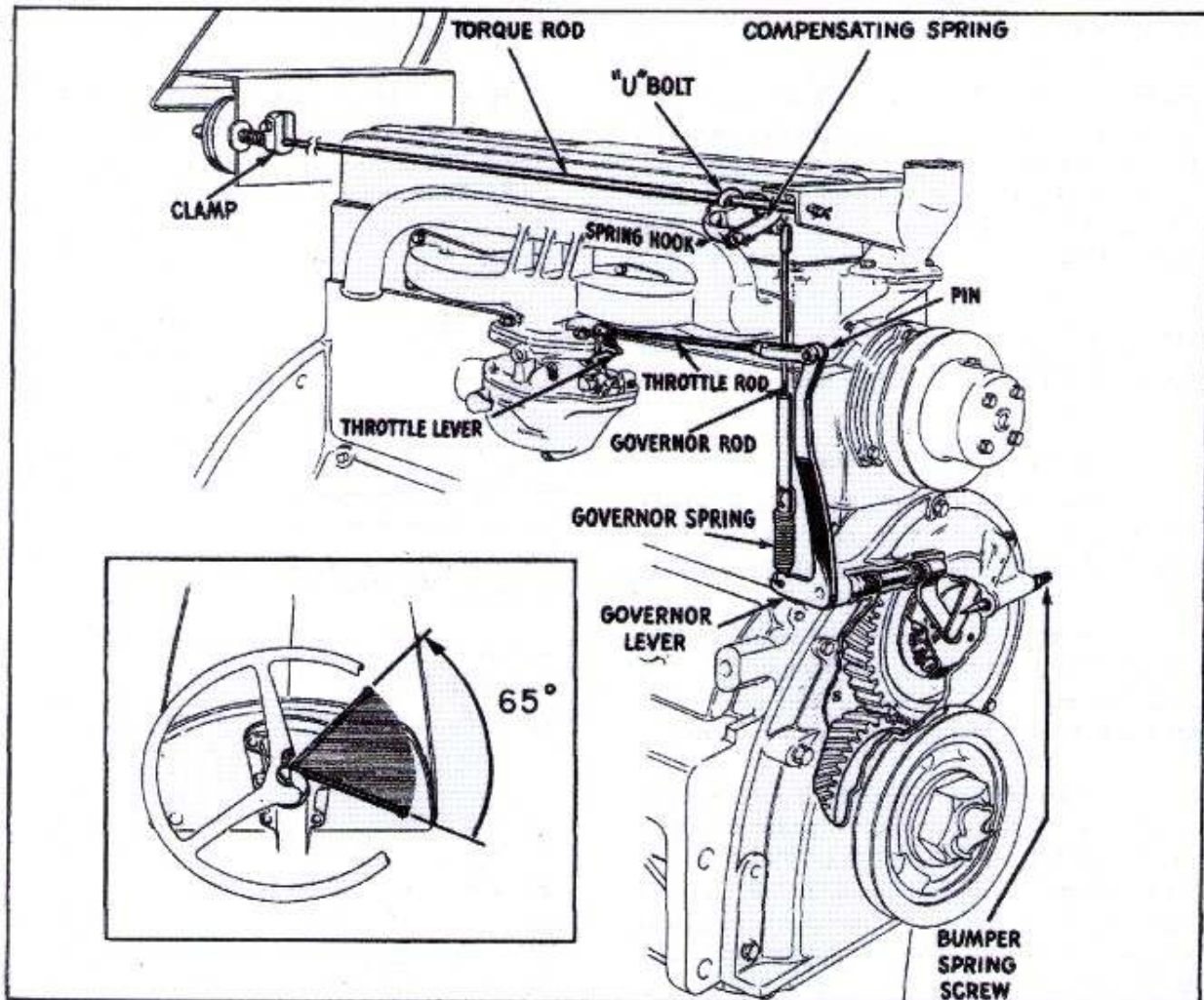


Fig. 112

quire removing the front cover to correct.

5. Compensating spring on top of governor rod and water outlet elbow housing. Move U-bolt assembly back on torque rod until binding is eliminated. Recheck Step (1).

6. Throttle rod clevis pin and governor arm. Loosen lock nut and retighten, holding clevis in a position where no binding occurs.

7. Cotter pin on carburetor end of throttle rod and throttle lever assembly. Cotter pin should be installed from the top of the throttle rod with the pin neatly wrapped around the throttle rod.

Before checking linkage for length, check engine idling speed as follows:

1. Disconnect throttle rod from governor lever.
2. Start engine.

Caution: Care should be taken to hold throttle rod in an idle position when starting engine. If this precaution is not taken, the engine will speed beyond its normal maximum engine RPM.

3. Hold throttle rod against idling stop and adjust idle speed screw until 400-450 engine RPM is obtained.
4. Stop the engine.

To adjust throttle rod length:

1. Open hand throttle fully to create ten-

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sion on governor spring.

2. Adjust throttle rod length until it is necessary to move the rod back slightly (1/32 in. or less) in order to insert the pin through the throttle rod clevis and governor lever.

3. Lock clevis in position. Make sure pin fits freely and that clevis does not bind against governor lever.

NOTE: If governor arm interferes with the fan belt, shorten the throttle rod.

To adjust governor rod length:

1. Place hand throttle lever in idle position, i.e., about 65 degrees forward from the "full-open" position against the steering wheel.

2. Observe if the governor compensating spring link is touching the torque rod. If not, loosen U-bolt assembly and rotate on torque rod until it does. Retighten U-bolt.

3. Observe if governor rod is long enough to contact horizontal arm of governor lever and hold throttle against the idle stop. If not, loosen lock nut on governor rod, remove governor spring and adjust rod until it touches the arm of the governor lever and holds it in the "idle" position.

4. Recheck top engine speed, if not 2,100-2,200 RPM loosen U-bolt on torque rod and adjust. If hand throttle interferes with hood, a weak governor spring is indicated. Spring should be replaced or shortened slightly. If governor surges, it will be necessary to loosen bumper screw and screw it in until surging is eliminated. This adjustment should be made with engine running at 1,000 RPM.

Caution: Do not turn bumper screw in any farther than necessary as it will deaden the action of the governor.

To remove hand throttle creep:

1. Increase spring compression on friction disc under dashboard. If this does not remove

creep, replace friction disc.

NOTE: Care must be taken not to position clamp where it will strike the battery.

2. Shorten compensating spring.

To correct hand throttle arc:

1. Remove and shorten governor spring.
2. If Step (1) did not correct, replace spring.

To check engine speeds without a tachometer or revolution counter, jack one rear wheel up off the ground, place a mark on the tire and count revolutions per minute, while operating the tractor in first gear.

With a rear wheel RPM of	Engine RPM is	PTO Shaft is	Pulley RPM is
10	400	145	270
12 1/2	500	181	338
25 1/2	1000	363	676
38	1500	543	1014
51	2000	727	1358
56	2200	800	1493

MODEL DIFFERENCE

The major portion of all TO-20 and TE-20 tractor engines are equipped with a flyweight type governor which has four evenly spaced die-cast weights. TO-30 engines from Nos. 333437 to 334669 and from Nos. 334699 to 334742 have the flyweight type governor. The weights are attached to the governor weight plate by clevis pins and are free to pivot on these pins. The weight plate is attached to the camshaft gear. The action, service and adjustment of both types of governor is basically the same. The TO-30 governor assembly (Part No. Z-120 S-3080) may be used to replace similar parts of the flyweight type governor.