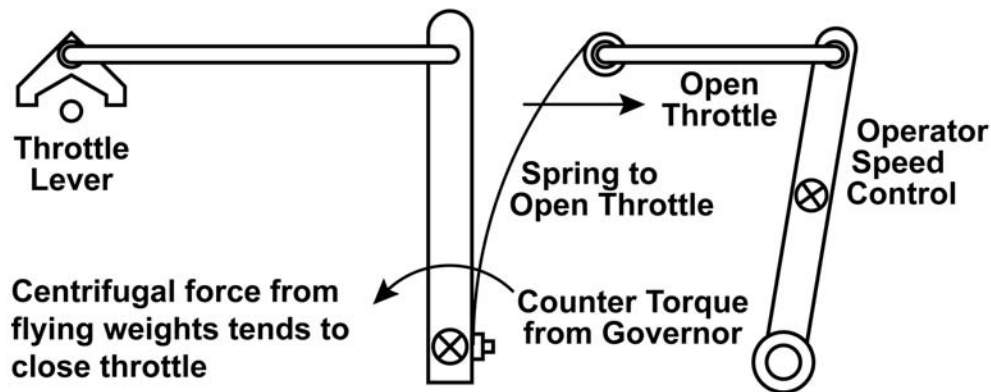


The Governor-2, All Tractors

(JD-H Tractors, Part 2 of 2)

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Governor -- JD tractors use a flying-weight design to control engine speed over a wide range of varying load conditions. This is accomplished via a fairly simple relationship between the governor shaft and throttle lever. Most speed-control troubles are a direct result of binding linkages or improper linkage adjustment between the governor and throttle. The assembly is lubricated by a line from the oil pump.



Schematic Diagram, Typical JD Governor

General -- The JD governor is a multi-function assembly. Its primary function is to control engine speed over a wide range of varying load conditions. For best governor action, there should be no significant play in the fly-weight mounting brackets nor in the weight pins. Bearings are to be examined in accord with criterion set forth earlier in this chapter. Look for excessive wear of the lever driving the throttle control shaft. Finally, quality performance depends on the linkage adjustment between the governor and carburetor throttle. Secondary functions are to drive the cooling fan (plus the generator if tractor is so equipped), and the magneto via a coupling at the end of the governor shaft. Inspect the magneto flange and renew as needed. As always, a thorough cleaning makes inspection more effective. The governor-fan shaft interface is a complex and challenging area to restorers of JD tractors.

Governor Functional Test – Grasp the governor throttle arm in your right hand, then the carburetor throttle lever in your left. Advance (open) the throttle lever and immediately observe the counter torque of the governor (right hand). The higher the engine RPM, the greater should be the governor's counter torque – trying to close the throttle lever.

Warnings!

WARNING # 1 -- Avoid Cracking Governor Case – Either dowel pins pressed into the main case (JD-H) or special shoulder bolts are used to ensure the precise position and alignment needed for the fan drive and pinion gears. In tractors using dowel pins, avoid damage to the governor case casting by raising governor up evenly, that is, by equal amounts for each side until clear of dowel pins. For tractors using special shoulder bolts, be sure to bag & tag these bolts so that they ARE USED during final assembly.

WARNING # 2 -- The left-hand (L.H.) governor bearing housing should NEVER be removed and then reinstalled without first removing the magneto from the tractor. When the L.H. governor bearing housing is loosened from the governor, the governor bearing spring forces the governor drive flange away from

the impulse coupling of the magneto. When this separation occurs, the impulse coupling on the magneto rotates to release any pressure built up by the impulse spring, changing the alignment of these parts. Most likely, the impulse coupling drive lugs are no longer in mesh with the drive slot of the governor drive flange. To install and tighten the L.H. governor bearing housing under this condition produces sufficient force to break the magneto mounting flange, body or impulse coupling (FSB 96-S, 4-15-39).

Disassembly and Overhaul -- Overhaul (mainly renewal of governor bearings) requires more than an average over-the-counter gear puller. After six decades together, these parts are likely to resist being separated. Disassembly of the governor was also challenging to JD technicians; so much so as to warrant issue of Field Service Bulletins describing special tooling and detailing its use. For removing and installing fan drive and governor gears, FSB 84-S (4-15-38) was issued for A, B and G tractors. This FSB was cited in FSB 121-S (5-15-41) for use with Model "H" tractors with an additional instruction to remove a particular snap ring not found on the other tractors.

In view of such detailed guidance from Deere & Co. to its repairmen, it is concluded that governor overhaul is a job (generally) best farmed out to a machinist having pulling and pressing equipment on hand for this mission. It is always my recommendation to prepare a Statement of Work (SOW) whenever you seek the specialized services of a service provider. This SOW should document in detail what you want done and specify the parts that accompany the SOW. This written document fosters understanding and agreement. Ambiguities will be ironed out as you consult with your machinist.

SPECIAL NOTE: In the SOW, spell out the significance of the woodruff keys (three for JD-H) and the snap rings (also three for the JD-H) because the resultant position of key parts depend on their use. The magneto drive flange must end up in a precise position. This is to preclude magneto drive issues during final assembly. Attach a copy of applicable pages of your (JD-H) Parts Catalog, and service manual or service guide.

Governor Lubrication – One of the oil pump outputs is to the governor. Oil rises inside the governor case to a point defined by presence of the 1/8" NPT plug, rear side of governor casting. From that point, the oiling channel is horizontal to the fan pinion & drive gears. Ensure this path is open.

Governor and Fan Shaft Gear Interface

There are a number of applications where a combination of shims and gaskets serve as an adjustment between two operating gears. Surely this is true of gaskets and shims at two points: (1) where the fan shaft interfaces with the governor, and (2) the L.H. governor bearing housing (can be a hydraulic lift unit). These motley groupings of shims and old gaskets are, in essence, the adjustment spacers for heeling of the fan drive gear and bevel pinion, and for backlash! **Heeling** is to position the gear and pinion (See Figure 310) so that heels are in line. **Backlash** is the spacing or play between gear teeth.

Spiral-Bevel Gears -- The most challenging issue with the governor deals with its relationship with the cooling fan via the fan shaft assembly. Driving the fan is the heaviest load placed on the governor's drive gear and bearings. This load is increased for tractors with generator/electrical systems. Spatial restrictions drove engineers to use spiral-bevel gears to perform the governor and fan shaft interface. Spiral-bevel gears offer more teeth in contact than straight bevel gears. Size for size, they can carry more load and are quieter than straight bevels, but are much more sensitive to misalignment. Their shafts

MUST be at right angles to each other, and in the same plane! Governor mounting will involve either guide pins or special shoulder bolts to ensure alignment is established – pay close attention here.

Single Unit Concept -- The service manual and all available reference materials instruct repair personnel to treat the governor and fan assembly as a unit when: (1) removing it from the tractor, (2) making HEEL and MESH (or backlash) adjustments which are done off-tractor, and (3) during reinstallation.

The Overall Approach -- By this point you are thinking, "No way am I removing and reinstalling both governor and fan shaft as a single unit!" You should, but many will not. The alternative is to perform the function set with equivalent precision so as to achieve the "single assembly" result.

At essence is to establish and record the relationship of the governor and fan shaft interface as found. Whether you remove the magneto and measure **backlash** before disassembly, or reconstruct the governor and fan shaft on the bench to make measurements afterwards is your choice. **Journal** the reading.

As part of disassembly, be meticulous in protecting the shim and gasket sets between the governor and fan shaft, and also the set between governor housing and L.H. governor bearing housing. The most ideal bit of data to have here is to meticulously measure each "set" with a micrometer resolute to 1/1000 inch, and record the result in your journal. One other action I recommend is that once the assemblies are separated and removed from the tractor, re-mate them on the bench using the old "sets" to measure & inspect **backlash** and observe **heel**, recording both results in your **Journal**. A digital camera comes in handy for this type of data to complement your written notes.

At minimum, you should bag and tag, and maintain the "set" as found. At some point between removal, measuring, bagging & tagging, and beginning re-integration and final assembly, you will renew each of the "sets" with fresh gaskets to go with salvaged and cleaned shims. Interleave gaskets and shims.

Later, When Putting It All Back Together -- Integrate the governor and fan shaft on the bench using the renewed "sets" adjusting as needed to bring the fan drive gear and fan drive bevel pinion first into heel, and then setting backlash. Look back into your Journal here for a starting point. Once adjusted, your new "sets" now bagged and tagged to preserve vital adjustments of gear heel and backlash. This is it! Use them during final assembly with the level of confidence you place in the on-bench adjustment operations.

Replication -- It is VITAL that existing governor gear/fan shaft gear backlash amount be measured, and the nature of heel-to-heel registry between these two gears be observed prior to disassembly because this very condition is to be sought as a starting point during final assembly. The significance here is these two gears are reinstalled in pretty much the same relationship as they have had for the prior 60+ years. To end up meshing them too closely at the worn state they are in would set them up for a new wear pattern and could hasten their demise. This discussion assumes the existing gears will be reused. You may even choose to take some pictures. **Journal it!**

If you've already separated the fan shaft and L.H. governor bearing housing from the governor case before this reading and do not have the bagged and tagged "sets" nor any record in your journal of heel and backlash, then proceed with renewal activity on the units followed by the "Governor and Fan Shaft Integration" process plan to make the needed adjustments in **heel** and **backlash**.

Methods -- There are two methods of expressing backlash between the fan drive gear and its pinion. One is for the laboratory and is an engineering standard which calls for a micro-measurement. A dial

indicator is used to measure actual free space between gear teeth. The result is expressed as a number in the range of from 0.004 to 0.007 inches (FSB 113-S, 9-15-40) of backlash. The more commonly used method observes the amount of free travel at the fan blade tip (from one extreme to the other) while holding the governor magneto flange stationary.

Criteria, Common Method -- To measure backlash as outlined in the service manual, the governor shaft must be held fast and the fan clutch must not slip. Remove the magneto and secure the magneto flange. Observe backlash in terms of inches of free rotation at fan blade tip. Per FSB 113-S, you should observe from 1/4 to 3/8 inch of free travel. This is a "new gears - no wear" measurement. Should you expect a 60-year-old tractor to meet factory specifications? In general, the answer is "not really"! Up to three times this amount is reasonable for old gears. Your objective and budget will guide you here.

Must-Meet Criteria -- There should be enough backlash between the gears so there is no binding or noise in operation. Bottom line: You should have some backlash and fan shaft rotation must be free. The final outcome will generally be determined during engine run up noise testing.

Backlash versus Wear: Gear wear and backlash are not interchangeable. One cannot overcome the effects of tooth width loss of the pinion and drive gear by moving them closer together. Realize that wear narrows the tooth but does not necessarily shorten it. Thus, to move gear and pinion closer to reduce measured (or perceived) backlash, is effective only to a point. That point is defined as the condition where the tip of the gear tooth cannot clear the valley of the pinion -- the point beyond which gear teeth are cracked and even chipped away as a result of this interference. Examine pinion and gear teeth. If the flat top has worn to a point, you know the part is worn out! Even if it has some flatness across the breadth of the tooth, if that flatness has been reduced to half of its original value of 3/16 of an inch, be advised that getting continued use from these valuable little jewels will depend on setting "backlash" close to where it was; optimum 3/4 inch minimum, or to a point never less than 1/2 inch as measured at the fan blade tip. As much as 1-1/8 inch may be appropriate -- often determined during run up.

Fan Shaft Service and Overhaul – At a minimum, the fan shaft subassembly should be disassembled, cleaned, and its bearings checked for continued worthiness. Pack the front bearing with high-melting point grease and renew oil seals and packing. Once the fan and governor unit has been removed and the two have been separated for overhaul work, remove the fan as a first step in disassembly of the fan shaft. The fan may not have been removed for over 6 decades, and not every owner will have access to "a bar or press" as outlined in the service manual or service guide. If you have the tooling, it will work!

However, an alternative and widely accepted method of removing the fan blades is as follows: with the fan shaft in vertical position (fan up), jam fan shaft assembly down onto a wooden block, forcing the fan down into the front bearing. [No! The fan blades won't fall off!]. Remove the two split cone locks and the fan. Be careful not to stress the rubber bushing in the fan hub (standard for tractors without electric start up to H-50500). See PC304 Parts Catalog for order of parts during reassembly.

Governor and Fan Shaft -- Integration (Off Tractor)

A Process Plan -- Reference FSB 113-S, 9-15-40

1. Clean oil passageway, ensuring it is open.
2. Install gear assembly into governor case. Install L.H. governor bearing housing along with the pre-established gasket and shim set (if available), no gasket sealers at this time. Tighten cap screws.

WARNING!

If estimating thickness of the gasket and shim set, go thicker rather than thin. As you draw the cap screws tight, keep a close watch on gear mesh to ensure you do not draw these old gears into an interference fit that may result in damage to gears, to castings or to both. A screw is a powerful tool, so there is no reason to "gorilla-wrench" these cap screws!

3. Install fan shaft subassembly onto governor subassembly using the pre-established gasket and shim set (if available), no gasket sealers at this time. Tighten cap screws.
4. Check position of the governor arm fork. It should not bind. It should not rest on either top or bottom of the governor sleeve. It must be centered around the governor sleeve.
5. Position the governor-fan shaft assembly so that its open side is up and the operating parts are in plain view.
6. **HEEL** the fan drive gear and bevel pinion (line up the two gear heels), by adding to or deducting from the gaskets at the interface between the FAN SHAFT and GOVERNOR CASE. Secure the interface.

WARNING: This gasket thickness is NEVER to be decreased in an attempt to quiet the gears!

7. **MESH** the fan drive gear with bevel pinion to establish a "working clearance" between the two by adding to or deducting from the gaskets at the interface between the L.H. GOVERNOR BEARING HOUSING and GOVERNOR CASE.

NEW GEAR CRITERIA: Parts should turn freely by hand. The range of **backlash** is from 1/4 to 3/8 inches at the fan blade tip.

ORIGINAL (now worn) GEAR CRITERIA: Parts should turn freely by hand. The range of **backlash** is from 1/2 to 1-1/8 inches at the fan blade tip.

NOTE: For maximum confidence these assemblies will perform as designed when mounted on the tractor. Double-check your work, be meticulous in your inspection, journal your work, and perhaps even take some detailed pictures.

8. **NOTE:** To install on the tractor, calling on a helpmate and installing the integration as a single unit is preferred. However, if you plan to separate the governor from the fan shaft (and if applicable) hydraulic lift unit once integration is completed, be sure to **bag and tag** each of the gasket and shim sets so that near-perfect replication is achievable during final assembly onto the tractor. **Observation:** When

installing the hydraulic lift unit separately, there is a better-than-even chance the L.H. governor bearing may not fully seat -- placing severe pressure on governor shaft components. Total integration on a bench where you have full vision of events, and "single-unit" installation is always the best way.



Figure 310. Governor and Fan Shaft Integration

Reinstallation -- Ensure flywheel is correctly positioned on the crankshaft by observing that the two "V" marks are in register (SM para 110). To Verify - Position the engine at TDC for the No. 1 cylinder (flywheel side). "L.H. IMPULSE" on flywheel aligns with mark on sliding shaft bearing cover (at 3:00 o'clock). Rotate governor shaft until the **slot** in the magneto coupling flange is parallel with the top of the crankcase (horizontal), and lower assembly to mesh the gears, FSB's 87-S (7-15-38) & 113-S (9-15-40).

Governor and Fan Shaft -- Final Assembly

A Process Plan -- Reference FSB's 87-S (7-15-38) & 113-S (9-15-40)

1. **Mount the governor and the fan shaft assemblies** timed to the engine. (a) Set flywheel with its L.H. IMPULSE indicator at the traditional 3:00 o'clock timing mark. (b) Situate governor assembly so that the magneto drive flange slot is parallel with the top of the crankcase. If separately mounted, install the fan assembly and secure to governor using pre-established thickness gasket and shim set.
2. **During engine run-up testing**, listen carefully for gear noise. If gears are noisy, two causes are to be considered: (a) Misalignment of fan shaft front bearing support, and (b) incorrect gasket thickness between L.H. governor bearing cover and governor case.

CORRECTIVE ACTION # A: The correct position of the fan bearing may be determined by starting the tractor and moving the front fan bearing slightly to the most quiet position (FSB 87-S).

ADDED TIP # A1: Try moving the front fan bearing support (H417R) slightly (up or down, and to the right or left). As noise is reduced, seek the most quiet position.

ADDED TIP # A2: Then loosen the three cap screws holding the rear fan bearing housing, and if more quiet operation results, add another gasket under rear fan bearing and tighten cap screws (FSB 87-S).

CORRECTIVE ACTION # B: One thin gasket can be added to or deducted from the L.H. Governor Bearing Cover to quiet gears.

WARNING: The L.H. Governor bearing cover should NEVER be reinstalled without first removing magneto from tractor.

Governor Linkage Adjustment

Linkage Adjustment -- Free up and align all linkage to remove any binding. Adjust or renew any parts causing lost motion, and disconnect throttle rod at carburetor.

TIP: Be sure you look for binding that could be caused by the way the legs of the cotter pin are dressed!

With hand control in full speed position (engine not running), adjust the length of the carburetor throttle rod so that the rod is 1/2 hole short from entering hole in carburetor throttle shaft lever when carburetor butterfly is in wide-open position. Reconnect throttle rod at carburetor.