

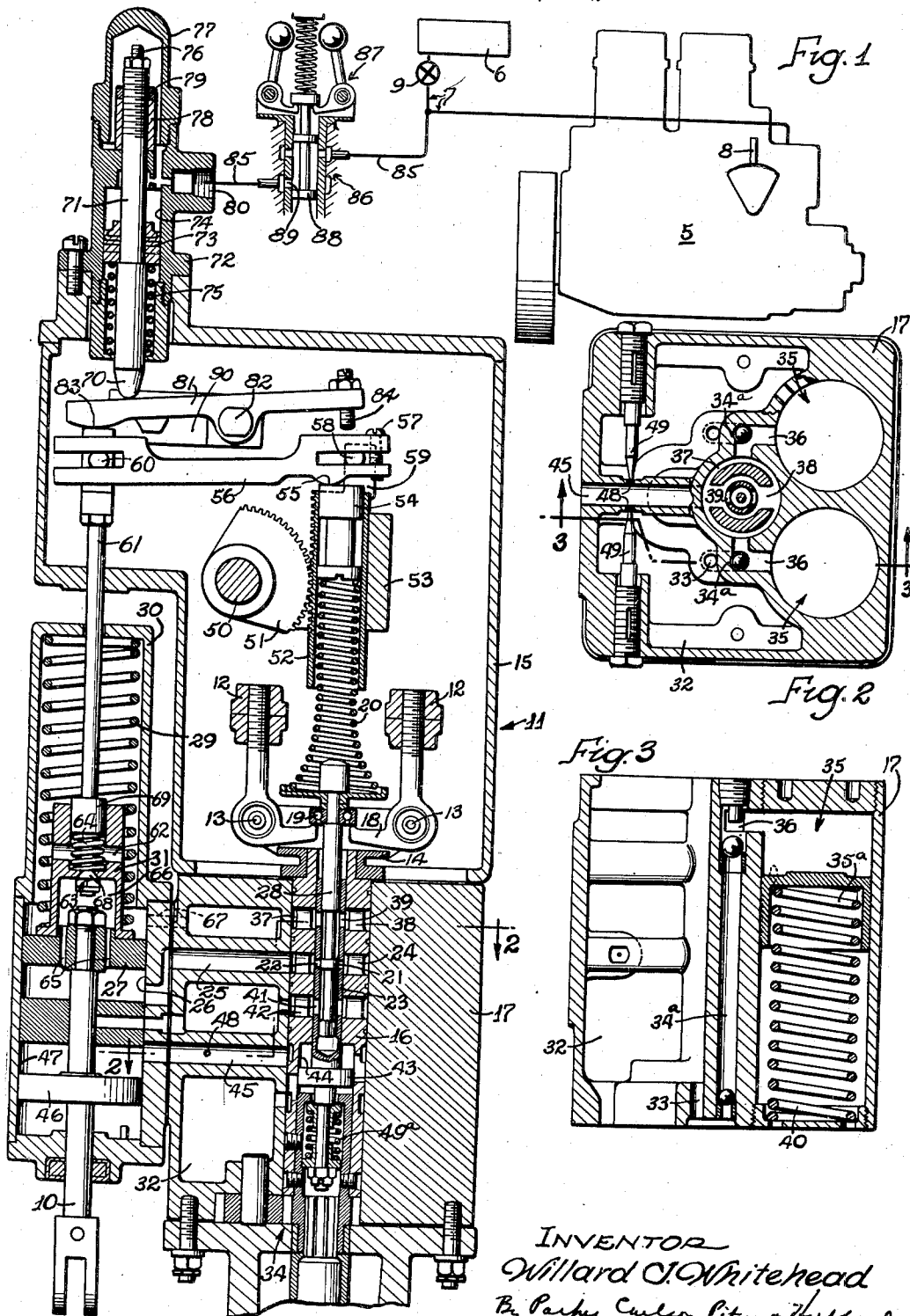
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GOVERNOR CONTROL

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GOVERNOR CONTROL

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This invention relates to the control of prime movers by speed responsive governors and has more particular reference to governors of the hydraulic type.

One object is to provide a governor having novel means for limiting the governor action under certain operating conditions.

Another object is to provide a governor having a hydraulic servomotor and novel means for disabling the servomotor at selectively variable points in the movement thereof.

A further object is to provide a control of the above character adapted to limit the loading of the controlled prime mover during starting.

The invention also resides in the novel character of the means for rendering the limiting device operative and inoperative and for adjusting the servo position at which the device becomes operative.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawing, in which

Figure 1 is a schematic view of a prime mover and its governor control embodying the novel features of the present invention, the governor being shown in vertical central section.

Fig. 2 is a section taken along the line 2—2 of Fig. 1.

Fig. 3 is a section taken along the line 3—3 of Fig. 2.

In the drawing, the invention is embodied for purposes of illustration in a governor control for a Diesel type internal combustion engine 5 adapted to be started by the admission of compressed air from a source 6 to the engine through a conduit 7 and a distributing valve (not shown) of well known construction. Such admission may be controlled by manipulation of a handle 8 to open a valve 9 in the supply line.

The throttle controlling the fuel supply to the engine is connected to a rod 10 which is adjusted automatically by a governor 11 mounted on the engine and including a pair of flyballs 12 pivoted at 13 on a head 14 which is fast on the upper end of a hollow vertical shaft 16 and is housed in a casing 15. The shaft is journaled in a valve body 17 and driven by the engine through a connection extending to the lower end of the shaft. The inwardly projecting portions 18 of the flyball arms bear against the outer race of a ball bearing 19 whose inner race is urged downwardly by a compression spring 20, the force of which determines the engine speed maintained by the governor. The inner race is connected

to the stem 28 of a pilot valve plunger 21 which is slidable within a sleeve 23 that rotates with the drive sleeve 16.

The plunger 21 coacts with a port 22 opening laterally through the sleeve 23 and communicating continuously with a passage 25 that leads to a hydraulic servomotor comprising a cylinder 26 and a piston 27 slidable therein above the passage 25. The piston is on the throttle actuating rod 10 and is urged in the throttle-closing direction by a spring 29 acting in compression between the closed end of the servo cylinder cap 30 and a cap 31 on the piston.

Oil contained in a sump 32 defined by the valve body 17 is drawn through a passage 33 (Fig. 3) to the inlet of a gear pump 34 driven from the shaft 16. The pump discharges through a passage (not shown) into a passage 34^a (Fig. 3) leading to accumulators 35 loaded by springs 35^a and delivering oil at a predetermined pressure into the upper end of the sleeve 23. The flow is through passages 36, an annular recess 37 around the sleeve 16, and ports 38 and 39 in the sleeves 16 and 23.

As the speed decreases below a predetermined value, the plunger 21 is lowered below the port 22 and pressure fluid will be admitted to the cylinder 26 so as to raise the servo piston 27 and therefore increase the throttle opening. Conversely, in response to a speed decrease, the plunger 21 is raised thereby connecting the cylinder 26 to the sump 32 through the port 22 and sleeve ports 41 and 42. Fluid is thus permitted to drain from the cylinder 26 to the sump allowing the spring 29 to move the throttle rod downwardly and decrease the fuel supply.

The governor incorporates a stabilizing mechanism of well known construction. Herein, this includes receiving piston 43 slidable in a cylinder 44 in the drive sleeve 16 and connected to the lower end of the valve sleeve 23. The cylinder communicates through a passage 45 with a cylinder 47 having therein a transmitting piston 46 which is fast on the throttle rod 10. Through orifices 48, the passage 45 communicates with the sump 32 so that oil may flow into or out of the compensating passage depending on pressure conditions. The rate of such flow is controlled by the setting of needle valves 49, and the piston 43 is urged toward a centered position by spring 49^a compressible from either end.

The speed setting of the governor is adjusted by turning a manually adjustable rock shaft 50 which may be held in adjusted position in any

well known way. The shaft is journaled in the casing 15 and carries a gear segment 51 which meshes with rack teeth on a tube 52 slidable in a cross-member 53. A plug 54 slidable in the tube bears at 55 against a lever 56 whose bifurcated end receives and is clamped by a screw 57 to a flattened pin 58 which is journaled in lugs 59 upstanding from the tube 52. The bifurcated other end of the lever receives a flattened pin 60 journaled in the upper end of a rod 61 which extends axially of the servo piston 27 and normally moves therewith. Through these connections, the stress in the spring 20, and therefore the speed maintained by the governor, may be varied as desired by rocking the shaft. For any given setting of the adjusting shaft 50, the position of the fulcrum pin 58 is fixed so that as the servo piston 27 moves in response to a speed change, the rod 61 moves the lever 56 about the fulcrum 58. The resulting movement of the plug 54 by the lever changes the stress of the spring 20 and produces permanent speed droop.

In accordance with the present invention, provision is made for limiting the movement of the throttle rod 10 in one direction when certain conditions exist, such for example as overloading of the engine during starting. To this end, the connection between the rod 61 and the servo piston 27 includes a valve 63 which is normally closed by a spring 64 and which when opened permits fluid from the servo cylinder 26 to be by-passed through passages 65 in the piston 27, a chamber 66 in the piston cap 31, the valve 63, ports 62, and a passage 67 leading to the sump 32. The valve comprises a conical member 68 on the lower end of the rod 61 which has an enlargement 69 slidable in the cap 31 in the direction of the servo motion. The spring 64 acts in compression against the enlargement to urge the valve member upwardly against a downwardly facing seat thereby normally maintaining the valve closed as it moves up and down with the servo piston. If the rod 61 is blocked during upward or throttle opening motion of the servo piston, the spring 64 is overcome and the valve is opened by power supplied by the servo. This permits fluid to be by-passed thereby preventing further movement of the piston.

In the present instance, such blocking of the valve rod is effected by a stop 70 which is mounted for movement into and out of active position longitudinally of the motion of the servo piston so that the servo position at which the stop becomes effective may be adjusted as desired. For this purpose, the stop comprises the lower end of a rod 71 slidable vertically in a fitting 72 on the governor cover. The rod carries a piston 73 which is slidable in a cylinder 74 in the fitting and is normally urged upwardly to inactive position by a compression spring 75, this motion being limited by engagement of an adjustable screw 76 on the rod with a cap 77 threaded into the upper end of the fitting 72. Downward motion of the rod to active position is limited by engagement of a collar 78 as shown with the upper end of the fitting 72, this point being adjustable by a nut 79 threading onto the upper end of the rod 71.

The stop 70 is thus adapted for power actuation by the application of pressure to the upper end of the cylinder 74 through an inlet 80. In response to such pressure application, the piston 73 and the stop 70 are forced downwardly against the action of the spring 75 to the active position shown in Fig. 1. In this position, the stop bears against one end of a lever 81 which is ful-

crumed intermediate its ends on a pivot 82 fixed to a bracket 90 on the governor casing. Now, as rod 61 is raised during opening of the throttle by the servomotor, the upper end of the rod will engage a rounded portion 83 of the lever 81 and thus become blocked. Then, as the servo piston and the seat of the valve 63 carried thereby continue to rise, the valve is opened thereby permitting oil from the servo cylinder 26 to escape through the passages 65 and the ports 62. When the pressure on the piston 73 is relieved, the stop 70 is retracted by the spring 75 whereupon the valve 63 is closed by its spring 64 and normal conditions are restored. The valve 63 will of course also close in response to a reverse motion of the servo piston 27.

The lever 81 coacting with the valve 63 is used to limit the degree of permissible throttle opening when the stop 70 is retracted and therefore is inactive. For such purpose, a screw 84 is threaded through the other end of the lever with its lower end adapted to contact the lever 56 at a predetermined point in the upward travel of the servo piston 27. The lever 81 is blocked by such engagement, the sleeve 52 being held stationary by the manually operable speed adjusting mechanism. Then, in the continued movement of the piston 27 the valve 63 is opened in the manner described above.

A governor equipped with a limit control of the character described may, for example, be used to advantage in limiting the degree of throttle opening during starting of the Diesel engine 5 so as to prevent the delivery of more fuel than the engine will burn with the amount of air available at low speed. This may be accomplished by connecting the inlet 80 of the stop actuator to a branch line 85 joined to the air supply line 7 so that when starting air is admitted to the engine by opening the valve 9, the stop 70 is moved to active position automatically. Preferably, the connection is through a valve 86 by which the governor limit control may be disabled before the application of starting air to the engine is discontinued. Herein, this latter valve is actuated automatically by an unstable ball head 87 driven by the engine and conditioned when the engine is operating below a predetermined speed to maintain the valve 86 open. However, when the engine attains a speed predetermined by the ball head setting, the valve plunger 88 is raised above the port 89 so as to interrupt the air supply to the limit device and release the pressure within the cylinder 74.

As a result of this arrangement, the limit stop 70 is retracted and therefore is ineffectual during normal operation. During starting, when the valve 9 is opened to admit air to the engine 5 for starting, air is also admitted through the valve 86 to the cylinder 74 and the stop 70 is forced downwardly into active position. Then, if the engine is running at a speed under that for which the governor is adjusted, so that the governor attempts to admit more fuel than can properly be burned at the low speed, the valve 63 is opened and the admission of more fuel is prevented. As soon as the engine attains a predetermined speed, the valve 86 is closed automatically and the limit control is again rendered active.

I claim as my invention:

1. The combination with a prime mover and means for temporarily supplying fluid under pressure for starting the prime mover of, a member controlling the speed of said prime mover after

starting thereof by said pressure fluid, a hydraulic servomotor for actuating said member, means including a fluid control valve responsive to the speed of said prime mover and controlling the flow of pressure fluid to and from said servomotor to correct for normal speed changes of said prime mover, a normally closed valve adapted when open to by-pass fluid from said servomotor whereby to interrupt the motion of said member independently of said control valve, a device normally maintained inactive and adapted when in active position to cause opening of said valve as said member reaches a predetermined position, and means automatically responsive to the temporary application of pressure fluid to said prime mover during starting of the latter to move said device to said active position.

2. A governor mechanism comprising, in combination, a cylinder, a piston therein carrying a normally closed valve controlled by-passage, a member movable with said piston and by-passage and operable when blocked to open the by-passage, separate speed responsive means controlling the admission of pressure fluid to said cylinder, a device movable into and out of blocking position with respect to said member, power actuated means for moving said device into blocking position, and stop means selectively adjustable to vary the extent of motion of said device by said power actuated means.

3. A governor comprising, in combination, a cylinder, a piston therein, a normally closed valve controlled by-passage communicating with said cylinder, a member movable with said piston and operable when blocked to cause opening of said by-passage, speed responsive means including a second valve controlling the flow of pressure fluid

to and from said cylinder while said by-passage remains closed whereby to impart speed regulating movements to said piston, a device movable into and out of blocking position with respect to said member, a second cylinder, a piston therein connected to said device for actuating the same in response to pressure applied to the piston, and stop means selectively adjustable to vary the extent of motion of said device by said second piston.

4. The combination with a prime mover and means for temporarily supplying auxiliary power for starting the prime mover of, a member controlling the speed of said prime mover after starting thereof by said auxiliary power, a hydraulic servomotor for actuating said member, means including a fluid control valve responsive to the speed of said prime mover and controlling the flow of pressure fluid to and from said servomotor to correct for normal speed changes of said prime mover, a normally closed valve adapted when open to by-pass fluid from said servomotor whereby to interrupt the motion of said member independently of said control valve, a device normally maintained inactive and adapted when in active position to cause opening of said valve as said member reaches a predetermined position, and means directly associated with said auxiliary power supplying means and operable to move said device to active position simultaneously with the application of said auxiliary power to said prime mover, said last mentioned means acting during normal operation of the prime mover after starting thereof to hold said device in inactive position.

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