June 5, 1934. R. J. BROEGE 1,961,842

CONTROL MECHANISM

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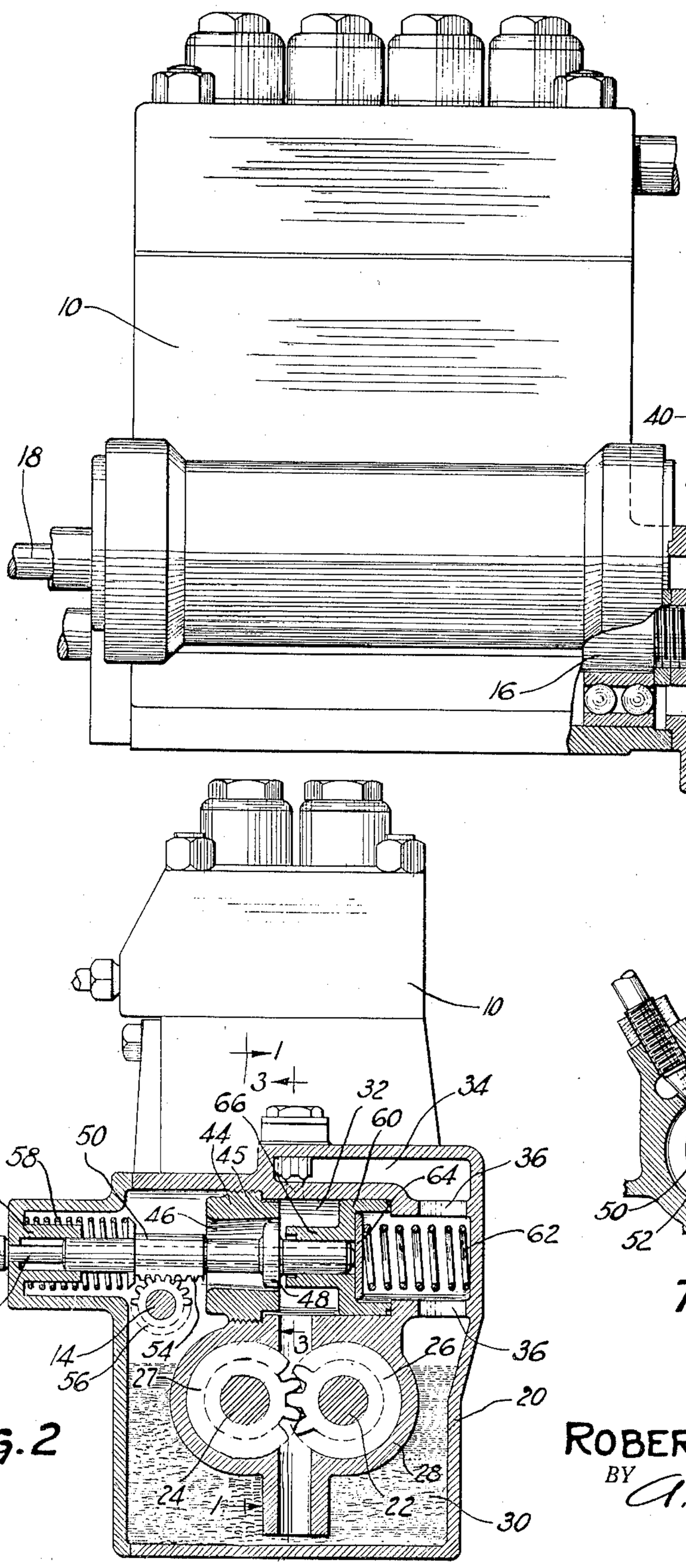

FIG. 1

FIG. 2

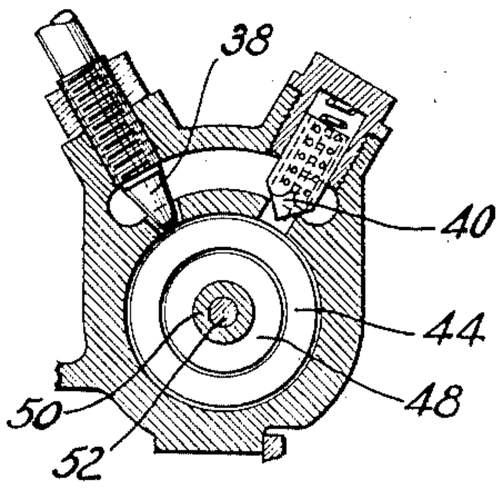

FIG. 3

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CONTROL MECHANISM

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4 Claims. (Cl. 264—14)

This invention relates to governors and more particularly to a hydraulic speed governor for controlling the speed of a machine such as a prime mover of the internal combustion engine type.

An object of the invention is to provide a governor which is quickly responsive to any changes in the speed of the governed machine.

A further object of the invention is to provide a governor which will maintain a predetermined speed within very narrow limits under all conditions.

A further object of the invention is to provide a governor wherein a relatively great amount of energy is available for controlling the speed of the machine.

Where a governor of the centrifugal or flyball type is used, and a relatively great amount of energy is required for speed control, the weights or flyballs required to produce sufficient energy are excessively large, and in order to prevent hunting require a heavy spring opposing their force. The heavy spring in turn increases the limits within which the speed can be held, so that a choice must be made between a hunting governor with narrow limits and one which does not hunt but has wider control limits. An important factor causing hunting is friction, and since friction increases with the size of the parts the problem becomes acute in larger governors.

Further objects and advantages of the invention will be apparent from the following description, taken in connection with the appended drawing, in which:

Figure 1 is a side elevation of a Diesel engine fuel pump provided with a governor embodying this invention, the governor being shown in section corresponding to a section taken substantially on the line 1—1 of Figure 2;

Figure 2 is a sectional view of the governor taken on the line 2—2 of Figure 1; and

Figure 3 is a detailed sectional view taken on the line 3—3 of Figure 2.

Although the invention is illustrated as applied to the fuel pump of a Diesel engine, it will be understood that it may be applied to a wide variety of uses other than that shown. The fuel pump is designated generally by the numeral 10, the output of the pump being controlled by known valve mechanism actuated by the rotation of a throttle shaft 14. The Diesel engine (not shown) drives a camshaft 16 of the fuel pump 10, which, in any known manner, drives the shaft 18 of the pump.

The governor comprises a casing 20 secured to the casing of the fuel pump, and shut off from communication with the fuel pump casing by a seal 23. An extension 22 of shaft 16 is journalled in the governor casing. An idle shaft 24 is also mounted in the casing parallel to extension 22, and gears 26 and 27 are mounted respectively on the extension and shaft 24 to constitute a gear pump operating in a pump casing 28.

The lower portion of casing 20 constitutes a reservoir or sump adapted to contain any suitable liquid 30 such as glycerine or lubricating oil to be pumped by the gear pump. A pressure chamber 32 is provided to receive the output of the pump, which may flow through an aperture 45 and passage 46 back to the liquid reservoir. A metering valve 38, designed to be manually controlled, and a spring pressed relief valve 40, control the flow of liquid between chamber 32 and a return passage 34 which constitutes the uppermost portion of the chamber 20, and thus regulate the flow of liquid from chamber 32 through the aperture 45. A cylinder 44 is adjustably mounted at one side of chamber 32 by having its periphery threaded to engage corresponding threads in the casing 20 and in the gear pump casing 28. The cylinder is provided with a tapered bore 46 which cooperates with a piston 48 secured to a sleeve 50 which is slidably mounted in an extension 66 and bearing 67. A starting rod 52 extends transversely of the governor and is slidable in sleeve 50. Sleeve 50 is provided with a rack 54 engaging a pinion 56 secured to the throttle shaft 14, so that movement of the piston 48 rotates shaft 14 and thereby controls the amount of fuel delivered to the engine. Sleeve 50 and piston 48 are urged to the right in Figure 2 by a spring 58, and are shown in their extreme right hand position in Figure 2.

Piston 48 is of smaller diameter than the smallest diameter of bore 46, so that in any position of the piston a certain amount of liquid may pass between them from the pressure chamber 32 back to the sump, but as the piston is forced toward the left in Figure 2 the rate of flow of liquid past the piston tends to become less due to the taper of the bore 46. This tends to make the governor more sensitive. The edge of the piston away from the liquid pressure side, and the corresponding end of cylinder 44 are rounded off, the curvature of the two parts being such that the liquid escaping between the piston and cylinder flows smoothly with a minimum of agitation and churning.

A movable safety piston 60 is reciprocably mounted in chamber 32 and is normally forced by the liquid pressure to the right in Figure 2

against the action of a compression spring 62 acting on a plate 64 seated in a recess in the safety piston. Piston 60 has an extension 66 designed to contact with piston 48, the extension being formed with an axial bore which receives sleeve 50 and rod 52 in sliding relation. Vents 36 are provided in the casing behind piston 60 to prevent hydraulic pressure building up behind the piston during its operation.

The operation of the device is as follows. The speed of rotation of extension 22, and hence the rate of output of the gear pump, is directly proportional to the engine speed. At any given engine speed, piston 48 will assume an intermediate position representing a balance between the force of spring 58 and the liquid pressure on piston 48. A large excess of liquid above the amount required to control the piston is pumped at all times, and this excess is by-passed through valve 38, which is manually adjusted in accordance with the speed desired. If the load on the engine decreases, the engine speed increases, and a greater volume of liquid is pumped into chamber 32. The excess liquid creates a higher pressure in chamber 32 and moves piston 48 to the left in Figure 2. The higher pressure also tends to force the liquid more rapidly through aperture 45 and valve 38, but this tendency is counteracted by the fact that aperture 45 becomes smaller as the piston 48 moves to the left. The result is that a sudden surge of pressure in chamber 32 is not dissipated through aperture 45 and valve 38, but remains effective until piston 48 moves a sufficient distance to the left to develop an equal and opposite force in spring 58. In so doing, it rotates shaft 14 and reduces the fuel supply to the engine to bring the speed back to normal. Conversely, as the load on the engine increases, the speed decreases until the pressure in chamber 32 is insufficient to balance the force of spring 58, and the piston moves to the right in Figure 2 to increase the quantity of fuel supplied to the engine. Here, as in the case of movement to the left, the tapered bore 46 causes the piston to adjust itself to the new position more rapidly.

Safety piston 60 is held by liquid pressure at its extreme right hand position during operation of the pump, but should the liquid pressure fall to a point where it could not actuate the governor, the spring 62 is capable of overcoming such relatively low pressure and will force the piston 60 into contact with the piston 48, moving it toward the fuel shut off position. Thus the engine will be shut down if the liquid pressure in the governor fails due to leakage or other causes.

The pressure relief valve 40 provides for by-passing an additional amount of liquid in cases where, by reason of temperature or other causes, the viscosity may become so high that the normal excess can not be by-passed by valve 38.

When the engine is stopped, safety piston 60 moves to the left to shut off the fuel, and for this reason the starting rod 52 is provided. When the engine is being cranked preparatory to starting, rod 52 is pushed in by means of a button 68, compressing spring 62. Spring 58 is sufficiently strong to overcome the slight pressure on piston 48 developed by cranking, so that the supply of fuel to the engine will be adequate for starting.

Although the invention has been described with particular reference to a specific embodiment thereof, it will be understood that it may be embodied in other forms within the scope of the appended claims.

I claim:

1. In a governor, a chamber, means for supplying liquid to the chamber at a pressure varying with the speed to be governed, a cylinder having a bore tapering outwardly from the chamber, a piston in the cylinder subject to the pressure in the chamber and controlling by its position the speed to be governed, and means operative upon drop of pressure in the chamber below a predetermined point acting upon the piston to reduce the governed speed to zero.

2. In a governor, a chamber, means for supplying fluid to the chamber at a pressure varying with the speed of the machine to be governed, an outwardly tapered cylinder communicating with the chamber, a piston in the cylinder controlling the speed of the machine, and a movable member operative to move the piston to stop the machine but normally held in inoperative position by the fluid in the chamber.

3. In a governor, a chamber, means for supplying fluid to the chamber at a pressure varying with the speed of the machine to be governed, an outwardly tapered cylinder communicating with the chamber, a piston loosely mounted in the cylinder and controlling the speed of the machine, and a yielding safety member operative to move the piston to stop the machine but normally held in inoperative position by the fluid pressure in the chamber.

4. In a speed governor, a pressure chamber, means supplying pressure fluid to the chamber at a rate varying with the speed to be governed, a cylinder having a bore tapering outwardly from the chamber, a yielding piston loosely mounted in the cylinder to provide an aperture for the by-passing of fluid between the piston and cylinder, the area of said aperture varying with the position of the piston, speed varying means controlled by the position of the piston, and means acting upon the piston and operative upon drop of pressure in the chamber below a predetermined point to reduce the governed speed to zero.

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