

May 9, 1961

J. ZUBATY

2,983,153

FLUID PUMP CONTROL MECHANISM

Original Filed Jan. 10, 1957

2 Sheets-Sheet 1

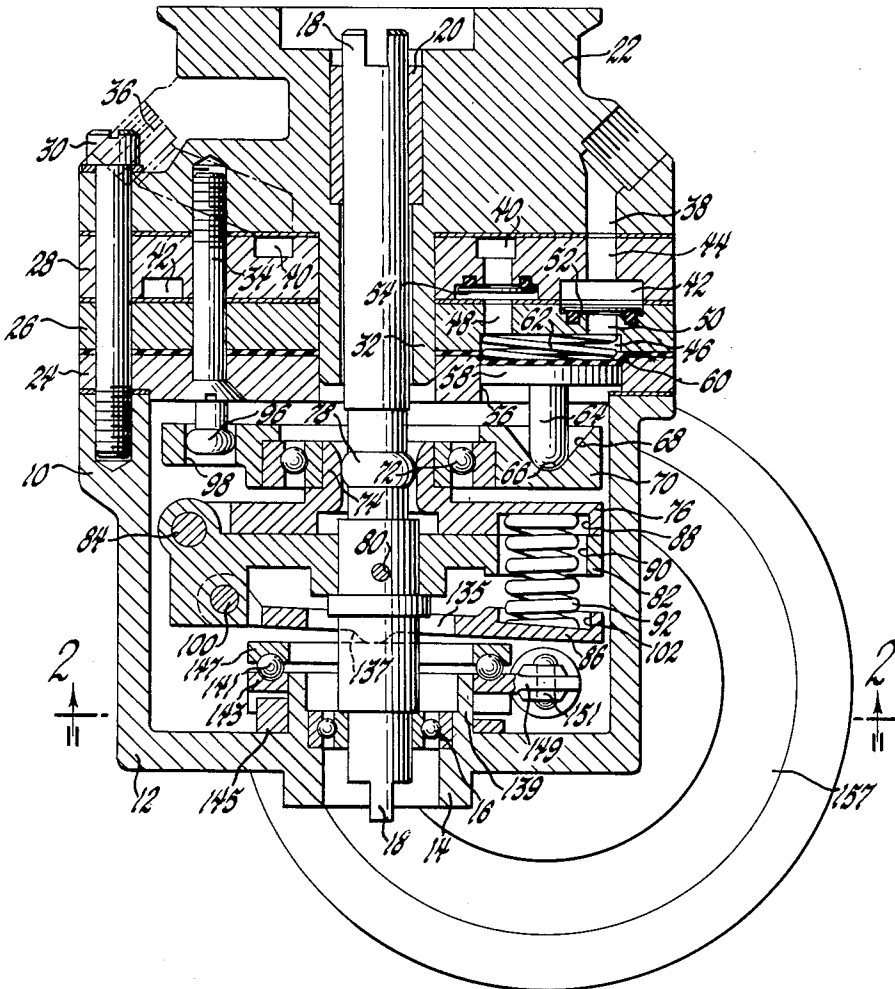


Fig. 1

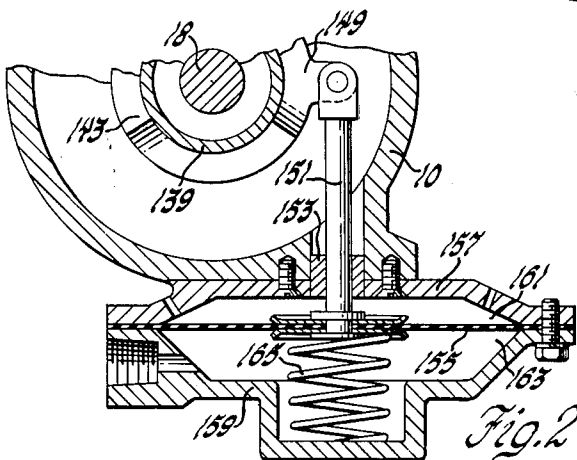


Fig. 2

INVENTOR.
Joseph Zubaty
BY
D. D. McGraw
ATTORNEY

May 9, 1961

J. ZUBATY

2,983,153

FLUID PUMP CONTROL MECHANISM

Original Filed Jan. 10, 1957

2 Sheets-Sheet 2

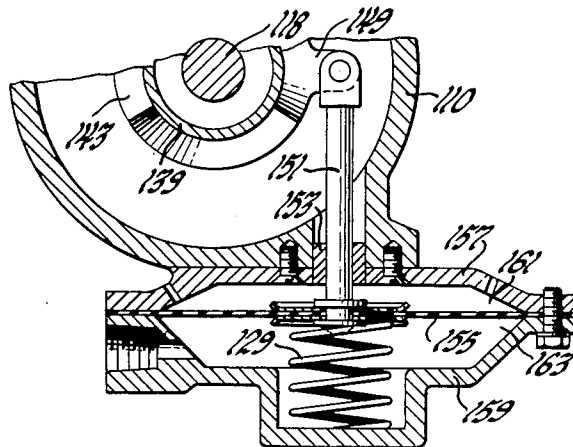


Fig. 3

INVENTOR.

BY *Joseph Zubaty*

D. D. McEraw
ATTORNEY

1

2,983,153

FLUID PUMP CONTROL MECHANISM

Joseph Zubaty, Flint, Mich., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Original application Jan. 10, 1957, Ser. No. 633,456. Divided and this application June 4, 1959, Ser. No. 818,114

3 Claims. (Cl. 74—60)

The invention relates to fluid pump control mechanisms and more particularly to control mechanisms for pumps of the wobble plate type. A pump with which the invention may be used is disclosed as having a plurality of plungers which are reciprocated by the action of a wobble plate and act upon either a common diaphragm or directly to produce a desired pressure in the fluid. The control mechanism embodying the invention adjusts the pump stroke to provide for minute pump adjustment. This is a division of my United States application Serial No. 633,456, entitled "Variable Pressure Fluid Pump," filed January 10, 1957.

Pumps of the type with which the invention is concerned are adapted for use in systems requiring a relatively constant source of fluid under a predetermined pressure. They can be accurately adjusted by adjusting the tilt angle of the wobble plate. In order to be used in high pressure sensitive systems such as automotive fuel injection systems however, pumps previously known have not obtained the high degree of accuracy of pressure control necessary. Such pumps must have a long life and be relatively free from mechanical failures while providing the high degree of accuracy required. The control mechanism herein disclosed which embodies the invention is adapted to a long trouble-free life and will provide very accurate control by pressure controlled devices which are subject to the varying conditions in the associated equipment. The pumps may be used as fuel pumps for automotive engines and are also adapted to other uses requiring the features set out.

In the drawings:

Figure 1 shows a pump in cross-section and having a pump pressure adjusting control which embodies the invention.

Figure 2 is a view taken in the direction of arrows 2—2 of Figure 1.

The pump shown in Figure 1 includes a housing 10 having integrally formed therewith an end plate 12 in which a hub 14 is centrally located. Bearing 16 is mounted within hub 14 and receives drive shaft 18 therein. Drive shaft 18 extends through the housing and into a bearing 20 which is secured in pump end cover 22. Intermediate housing 10 and cover 22 are a plurality of plates extending transversely of the pump housing. These plates include plunger guide plate 24, outlet valve and pressure chamber plate 26 and inlet valve and manifold chamber plate 28. A plurality of bolts 30 may be used to secure cover 22 and plates 24, 26 and 28 to the housing 10. In order to properly assemble the plates in relation to the remainder of the pump, cover 22 may be provided with an inwardly extending hub 32 on which the plates 24, 26 and 28 are piloted. A key or other suitable means may be used to permit assembly of the plates only when they are in proper alignment relative to each other and to the cover 22. Bolts 34 may be provided to fasten the plates to the cover in order to permit removal and assembly of the plate and cover group as a unit. The housing, plates and cover are preferably sep-

2

arated and sealed by gaskets positioned between adjacent elements.

Cover 22 may be provided with an inlet passage 36 and an outlet passage 38. Plate 28 may be provided with an annular manifold type inlet chamber 40 which is preferably formed as a groove in the upper side of the plate. When the plate 28 is assembled on the cover 22, the lower surface of the cover closes the groove and forms the chamber. Inlet passage 36 is aligned with the chamber 40. Plate 28 is also provided with an annular manifold type outlet chamber 42 which may be formed as a groove on the lower side of the plate. Chamber 42 is concentric with and larger in diameter than chamber 40. An outlet passage 44 connects chamber 42 with outlet passage 38.

Plate 26 is provided with a plurality of pressure chambers 46 and an inlet passage 48 and an outlet passage 50 for each of the pressure chambers. Each of the outlet passages 50 is provided with an outlet valve 52 which is mounted in a recess formed in the upper side of plate 26. Each of the inlet passages 48 is provided with an inlet valve 54 which is mounted in recesses provided in the lower side of plate 28. The inlet and outlet valves may be of the check valve type.

The plunger guide plate 24 may be bored to form cylinders 56 which are adapted to receive pump plunger pistons 58. Each of the cylinders 56 are in alignment with an inlet passage 48 and an outlet passage 50 and a pressure chamber 46. The diaphragm 60 is preferably made of a material which operates satisfactorily as a gasket between plate 24 and plate 26. Each portion of the diaphragm 60 which extends between the pressure chamber 46 and the cylinders 56 is adapted to be engaged on its lower side by pistons 58 and on its upper side by a diaphragm return spring 62. Diaphragm 60 is therefore reciprocated with a pumping action when pistons 58 are reciprocated within cylinders 56.

Each of the pistons 58 has a plunger arm 64 extending down from its lower surface and terminating in a rounded end 66. Individual sockets 68 are formed within an actuating ring 70 and are adapted to receive plunger ends 66. Ring 70 is preferably mounted on the outer race of a bearing 72 with the inner race of the bearing secured to a hub 74 extending around drive shaft 18 and integrally formed with an oscillating member 76. Drive shaft 18 has an enlarged spherical gland 78 formed at a position within hub 74. The gland 78 has a diameter which is greater than the diameter of shaft 18 at this point and is substantially equal to the internal diameter of hub 74. This construction will permit actuating ring 70 to be tilted about the axis of drive shaft 18 when oscillating member 76 is tilted about that shaft. An enlarged section of the drive shaft 18 is formed intermediate the point at which drive shaft 18 passes through hub 14 and the gland 78. A drive pin 80 extends through this section in a transverse direction. A driving member 82 is mounted on pin 80 and is driven by shaft 18 through that pin.

Oscillating member 76 is secured to driving member 82 at one side by slotted hinge 84. A spring receiving depression 88 is formed in the lower side of oscillating member 76 and a spring aperture 90 extends through driving member 82 and is in alignment with depression 88. A plunger control spring 92 extends through aperture 90 and into depression 88. A spring tension control arm 86 is pivoted to the lower side of driving member 82 by hinge 100 and is provided with a spring receiving depression 102 in alignment with aperture 90. The end of plunger control spring 92 opposite the end received in recess 88 is received within depression 102. A pin 96 may be fastened to a non-rotating part of the pump and extend downwardly into a recess 98 formed within actuat-

ing ring 70. Pin 96 will then prevent the actuating ring from rotating.

Spring tension control arm 86 is provided with an enlarged aperture 135 through which drive shaft 18 extends. Arm 86 is also provided with a downwardly extending cam 137 on either side of aperture 135.

End plate 12 is provided with an inwardly extending hub 139 which may have an internal diameter approximately equal to the external diameter of the outer race of bearing 16. A thrust bearing 141 has its lower ring 143 piloted on the outer surface of hub 139 and may be rotated relative to that hub. A stationary cam 145 is concentric with hub 139 and positioned intermediate thrust bearing 141 and the inner surface of end plate 12. The upper surface of cam 145 is preferably formed as a three-pronged face cam. The lower surface of lower bearing ring 143 may also be provided with a three-pronged face cam which is complementary to the cam 145. The upper ring 147 of bearing 141 has its upper surface in engagement with tension control arm cams 137 at two points substantially in alignment with the central axis of the drive shaft 18.

The lower ring 143 has a control lever 149 extending radially therefrom to which is attached an actuating rod 151. Rod 151 may extend generally perpendicular to and be spaced from drive shaft 118. Rod 151 passes through a guide bushing 153 in housing 10 and is connected at its opposite end to a vacuum sensitive diaphragm 155. Diaphragm 155 separates a space formed by cover plates 157 and 159 into a pair of chambers 161 and 163. Chamber 161 is subject to atmospheric pressure while chamber 163 is subject to intake manifold vacuum. A spring 165 is provided within the vacuum chamber 163 to urge actuating diaphragm 155 in a direction toward chamber 161.

When there is no vacuum impressed upon diaphragm 155, actuating rod 151 has lower ring 143 positioned in a counterclockwise direction as viewed in Figure 2. Cam 145 and the cam formed on lower ring 143 permit thrust bearing 141 to be in a position on its axial movement line nearest control arm 86. As the vacuum in chamber 163 increases, actuating arm 151 is moved toward vacuum chamber 163, rotating lower ring 143 clockwise as seen in Figure 2. Thrust bearing 141 is permitted to move axially away from tension control arm 86 by means of the cam 145. Since the upper ring 147 of the thrust bearing is in engagement with the cams 137, tension control arm 86 is pivoted downwardly about hinge 100, decreasing the tension on spring 92. This decreased tension causes oscillating member 76 to tend to pivot about slotted hinge 84, resulting in a tilting action about spherical gland 78. Actuating ring 70 is then tilted to the same degree as oscillating member 76, decreasing the stroke of the plungers 64. When the vacuum in chamber 163 approaches atmospheric pressure due to increased

speed or torque requirements on the engine, spring 165 moves rod 151 to rotate cam 143 counterclockwise, increasing the stroke of the plungers. The actuating mechanism may be modified to use the increased vacuum force to increase the plunger stroke length if desired.

What is claimed is:

1. In a wobble plate pump control mechanism, an actuating ring for said pump, an oscillating member rotatably mounted adjacent said actuating ring, a drive member adapted to drive said oscillating member, said oscillating member being pivotable relative to said drive member, a spring for controlling the pivotal relationship between said drive member and said oscillating member, a tension control arm hingedly secured to said drive member and providing reaction for said spring, and means for pivoting said tension control arm relative to said driving member to adjust the force exerted by said spring on said oscillating member, said means including a thrust bearing having an upper race and a lower race, said lower race having a face cam formed thereon, a complementary face cam adapted to engage said lower race cam, and vacuum actuated means for rotating said lower race cam relative to said complementary cam whereby said thrust bearing is moved axially relative to said drive member to pivot said control arm relative to said driving member.

2. Mechanism for controlling a vacuum controlled variable pressure pump having a tiltable actuating ring and reciprocable pistons driven by said ring, said mechanism comprising pump and control housing means, a chamber formed in one end of said housing means and having a diaphragm extending therethrough, one side of said diaphragm being sensitive to a pressure differential vacuum induced by a source of pressure differential, first cam means operatively connected with the pump tiltable actuating ring and second cam means engaging said first cam means and being movable relative thereto, and an arm rigidly secured to said diaphragm and to said second cam means so that said actuating ring is tilted by movement of said diaphragm acting through said arm and said first and second cam means when said pressure differential is modified.

3. The mechanism of claim 2, said tiltable actuating ring having a tilt control for initially adjusting the tilt of said actuating ring, said tilt control including a spring having a predetermined spring force and spring length to introduce a tilt angle to said actuating ring.

References Cited in the file of this patent

UNITED STATES PATENTS

2,225,911 Ingoldby ----- Dec. 24, 1940
2,860,517 Cauble ----- Nov. 18, 1958

FOREIGN PATENTS

592,577 France ----- May 2, 1925