

Nov. 8, 1927.

A. F. MEYER

1,648,419

GOVERNOR

Filed March 6, 1925

3 Sheets-Sheet 1

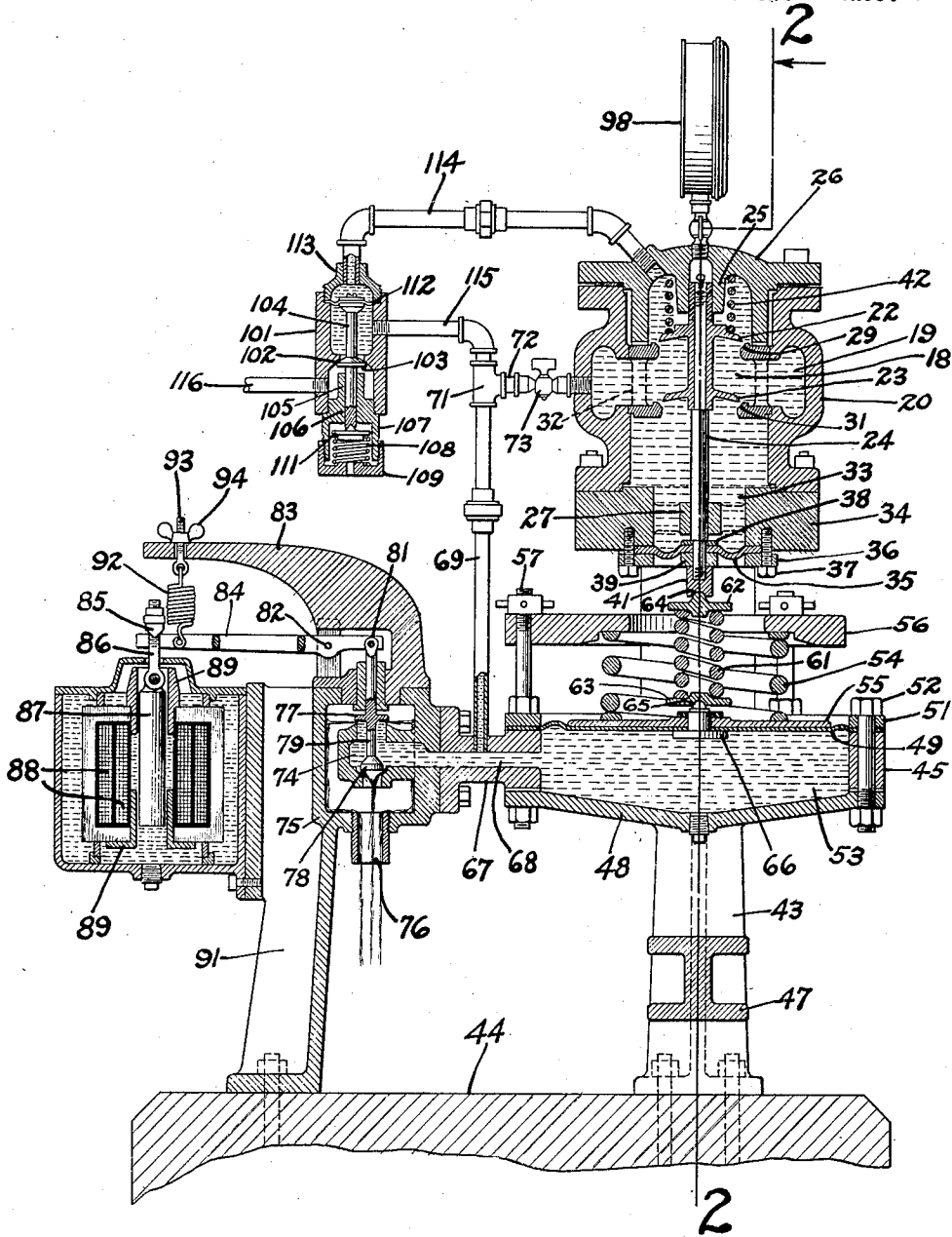


FIG. 1

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3 Sheets-Sheet 2

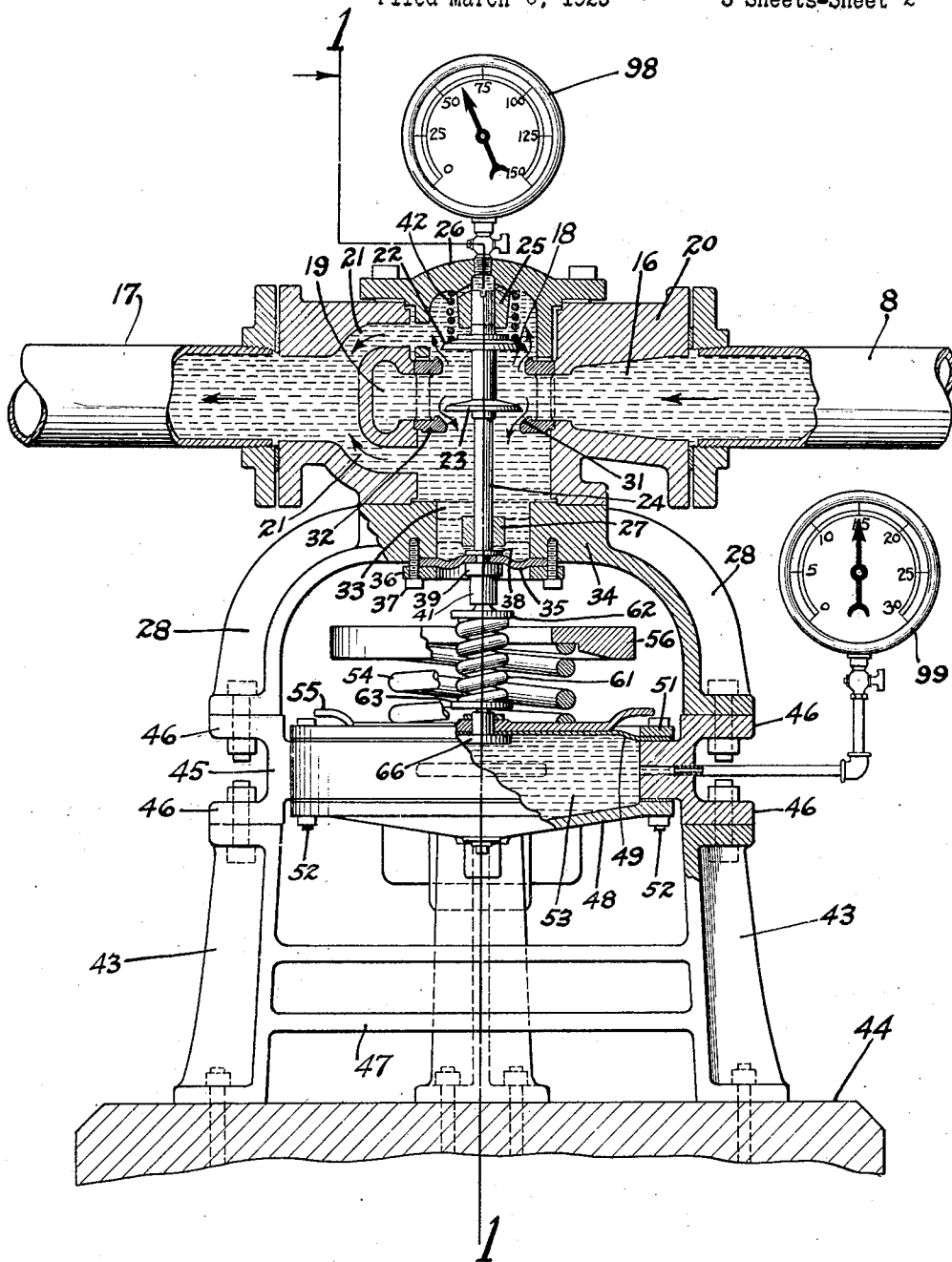


FIG. 2

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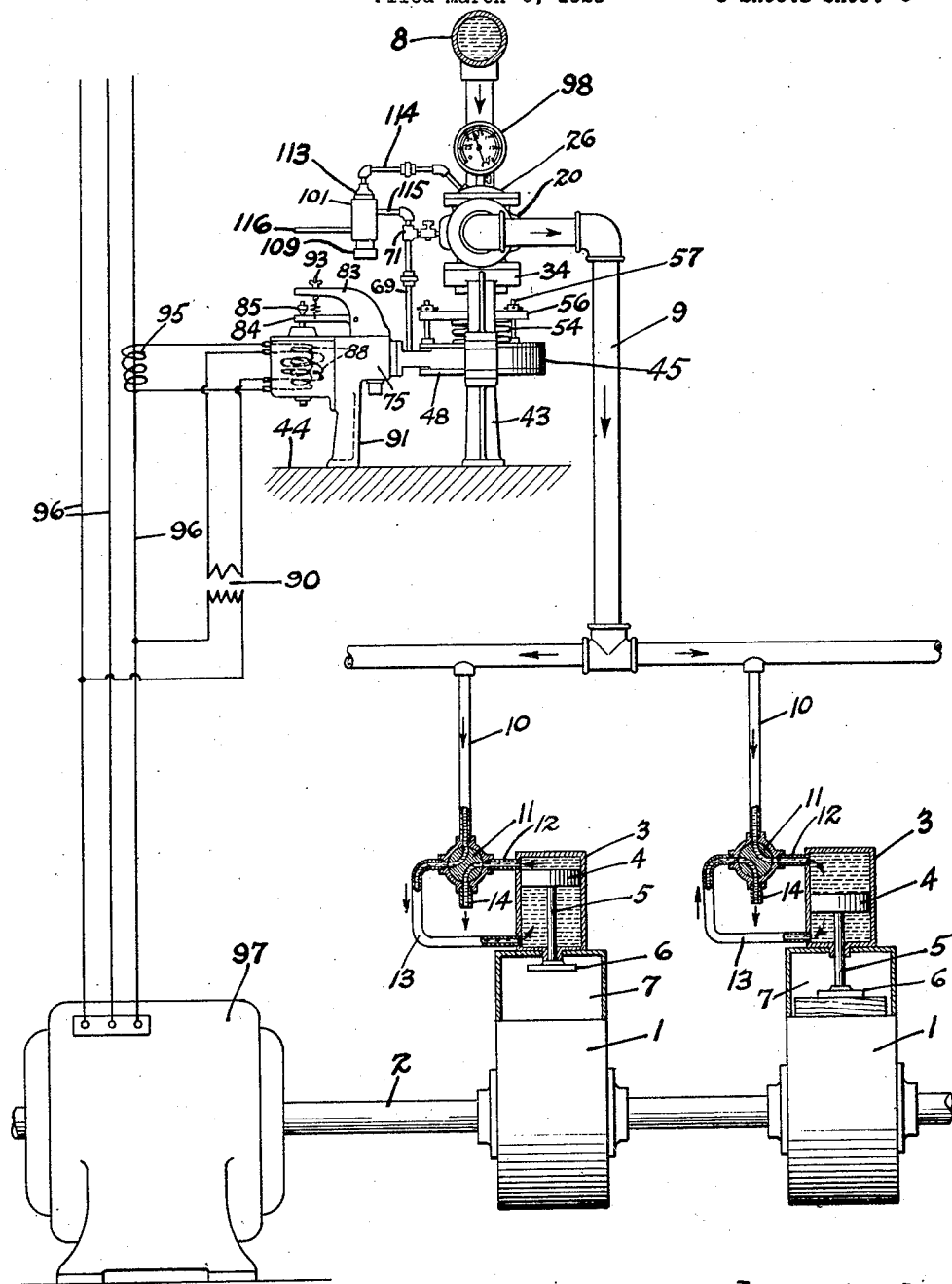
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE.

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GOVERNOR.

Application filed March 6, 1925. Serial No. 13,433.

This invention relates to a new and improved regulator for the control of fluid flow and pressure. It is particularly adapted for use as a means for the automatic maintenance of any desired load on a driven member working under a friction load produced by fluid pressure. This regulator is capable of a wide variety of uses in which a sensitive and responsive automatic control of fluid pressure and flow is desired. In the selected embodiment of the invention herein disclosed, this novel regulator is shown as adapted for use in the wood-pulp making art. It is particularly adapted for use in connection with the well-known electric motor-driven grindstones used for the production of wood-pulp.

This novel regulator is entirely automatic in action. It always increases the fluid pressure and flow with the least reduction in friction load and decreases the pressure with the least increase in friction load.

An object of the invention, therefore, is to provide an improved device for controlling fluid pressure.

A more specific object is to produce a means for the automatic maintenance of a desired load on a driven member working under a friction load produced by fluid pressure.

Other objects of the invention will more fully appear from the following description and the accompanying drawings and will be pointed out in the annexed claims.

In the accompanying drawings there has been disclosed a structure designed to carry out the objects of the invention, but it is to be understood that the invention is not to be confined to the exact features shown as various changes may be made within the scope of the claims which follow.

In the drawings:

Figure 1 is a vertical sectional view through the valve structure with the valve in the running position;

Figure 2 is a vertical sectional view on the line 2-2 of Figure 1; and

Figure 3 is a diagrammatic view of an operative assembly of the novel governor with motor-driven pulp grinders.

In the preferred embodiment of this invention this means for the automatic maintenance of a desired load is shown in connection with a driven member such as a grindstone. A plurality of these grindstones are usually mounted upon and rotated

by a driven shaft. An instrumentality is provided to press wood placed in pockets against the face of the grindstones, and usually consists of a piston having a head movable in a cylinder. The opposite end of the piston is provided with a foot by means of which the wood is pressed against the grindstone face. It is to be understood that, not only may a plurality of these grindstones be mounted upon a shaft, but each grindstone may be provided with more than one of these cylinder and piston devices for pressing the wood in the several pockets against the grindstone. The grindstone is thus operated under friction load induced by sticks of wood thus forcibly held against its peripheral surface.

It is customary in this art to drive these grinders by means of hydraulic turbines or electric motors. As here shown the device is adapted to grinders driven by an electric motor. It is highly desirable to keep the friction load on the grindstones and therefore the current consumption and voltage of the electric motor constant.

It is also common in this art to employ a fluid under pressure not only for the purpose of forcibly pressing the wood in the pockets against the grinder by means of the piston, but also to use this fluid pressure to raise the piston head away from the grindstone in order that the pockets may be refilled. It should be noted that the maintenance of the uniform electrical load on these motors is effected by the maintenance of a uniform friction load on the grindstones. For example, when one pocket is pulled off for refilling it is obvious that the motor load would be lessened hence the pressure must be increased upon the other pistons. A complication arises in that the amount of fluid, such as water, consumed in forcing the pistons in their normal working movement to maintain objects engaged with the grinder, is small; while the amount of water consumed upon abnormal movement of each piston from or to its object-maintaining position is relatively large. These two factors make load control difficult. The invention includes an apparatus or mechanism which controls the fluid flow and pressure supplied to the pistons. In the selected embodiment here disclosed, there are preferably employed two co-operable mechanisms. One of the mechanisms is actuated by changes in the electricity flowing to the electric motor, that is, in

the amperage or voltage or both; and the other is actuated by changes in the pressure and flow of water to the cylinders and pistons. Only the latter mechanism is directly actuated by the abnormal movement of the piston. The former is indirectly actuated inasmuch as such abnormal movement causes instantaneous load changes. In order to prevent large load changes it is highly desirable that increased flow resulting from abnormal movement shall not cause a pressure drop in the cylinders which are pressing wood against the grindstone. In other words, variations in pressure resulting from variations in water flow through the supply pass should be prevented so far as possible. This novel structure effects such result through the co-operation of the two mechanisms.

The selected embodiment of this invention in combination with such motor-driven grinder is diagrammatically shown in Figure 3. Each grindstone 1 is fast upon the motor-driven shaft 2. A cylinder 3 is suitably mounted adjacent the peripheral surface of the grindstone and bears therein a piston-head 4 mounted upon the rod 5, the opposite end of which carries a foot 6 operating in the pocket 7 to press objects, such as blocks of wood, against the surface of the grindstone whereby the wood is ground into pulp. Several such grindstones may be mounted fast upon the same shaft and, while several such cylinders and connections may be operatively associated with each grindstone, it is only necessary for the purpose of disclosure of this invention to show a single cylinder with each grindstone.

A pass is provided which is adapted to supply a fluid, such as water, under pressure from a suitable source, to the wood-pressing cylinders. Herein such pass is shown as comprising a supply pipe 8 connected to a suitable source of supply of water under pressure and having the valve mechanism interposed in the supply pass between the pipe 8 and the pipe 9, which forms a continuation of the pass. This pipe 9 supplies the water under pressure in accordance with usual practice to each of the different pocket cylinders. As shown in Figure 3, passages 10 are shown as leading from the pipe 9. Each passage is provided with a two-way valve 11, diagrammatically represented, which is manually operable either to divert the water under pressure to one side of the piston-head while permitting escape of any water on the other side of the head, or vice versa. In the position shown on the right in Figure 3, the right valve 11 is turned to permit water under pressure through the passage 10 and port 12 to the upper face of the piston-head 4 by which means that piston head is gradually downwardly forced to maintain the wood in engagement with the

grindstone. This movement is termed, for sake of brevity, the normal movement. As the piston-head 4 is downwardly forced by means of pressure admitted to the upper portion of the cylinder through the port 12, any water in the lower portion of the cylinder may escape through the port 13 by way of the two-way valve 11 to the exhaust 14. The so-called abnormal movement of this wood-feeding instrumentality occurs when the valve 11 is manually turned half way as shown in the left in Figure 3. In the position of this left valve 11, direct connection is had between the port 12 of the cylinder and the exhaust 14 to permit the escape of water from the upper portion of the cylinder and to direct the water under pressure from the passage 10 to the port 13 whereby the piston-head 4 is upwardly forced to permit refilling of the pocket with wood. This abnormal movement, being substantially unopposed is relatively rapid and demands a relatively increased amount of water.

Similar abnormal movement, although of lesser magnitude occurs when the pocket has been refilled and the two-way valve 11 is then turned to the position shown on the right in Figure 3, so as to move the piston-head 4 downward until the foot 6 again engages the blocks of wood.

This selected embodiment of the novel governor is adapted automatically to maintain a uniform friction load produced by fluid pressure upon a member driven by an electric motor and includes mechanism operable by changes in fluid flow and pressure to reduce such pressure changes and a means electrically operable by the electricity supplied the prime mover to control the load.

The former mechanism includes a valve interposed in the fluid pass leading from the source of supply of fluid under pressure to the frictional load devices. This valve is partly controlled by a partition or diaphragm whose position is dependent upon the pressure in the pass; that is, when the pressure drops, the valve is more widely opened and vice versa.

The latter means consists generally in electrical means operable in response either to current consumption or voltage drop, or both, of the member-driving motor and is adapted also to control the position of the same valve.

In the governor here disclosed, the water under pressure is received from the pipe 8 through the port 16 and finds outlet through the section 17 of the pass. The valve structure includes a pressure chamber 18 provided by the casting 20. This casting is formed with a substantial annular waterway 19 communicating with the port 16 and inwardly opening into the pressure chamber. A double valve structure is provided to con-

trol the flow of water from the port 16 and the water-way 19 into the passages 21 in the main casting which lead to the section 17. As this governor is usually erected in an upright position, as shown, the valve 22 may be termed the upper, and the valve 23 the lower. These two valves are fixed to the same stem 24 and terminally borne by the recessed boss 25 of the cap 26 at one end, and by the spider bearing 27 of the supporting arches 28. The stem is thus mounted for reciprocatory movement in axial directions. An upper valve seat 29 and a lower valve seat 31 are provided by the cage 32 fitted within the annular portions of the casting and the lower valve seat has a shoulder and recess mounting upon the lower portion of the casting.

The lower portion of the pressure chamber has a continuation formed by the central recess 33 in the annular head 34 integrally provided by the opposed arches 28. The bottom of this chamber continuation is closed by a movable partition such as the diaphragm 35 of suitably flexible material such as a rubber composition. The diaphragm is held in water-tight position by the ring 36 and the screws 37. The lower portion of the valve stem is reduced in diameter and provides a downwardly presented shoulder. This reduced stem portion extends through the diaphragm and receives a washer 38 between the diaphragm and shoulder and another washer 39 between the other face of the diaphragm and the terminal cap nut 41 received in threaded engagement upon the stem. When the nut 41 is turned down, the parts are so assembled that movement of the diaphragm is communicated directly to the stem.

Means are provided which tend to force the valve to seated position and to that end, the compression spring 42 encircles the boss 25 and tends to force downwardly the upper and lower valves 22 and 23. This downward force is aided by the grinding pressure communicated to the chamber recess 33 and therefore to the auxiliary diaphragm 35 so that the grinding pressure upon this diaphragm tends also to seat the valves. Such downward valve-seating force is opposed by another force such as water-pressure in the main pressure chamber 53 exerted through the compression spring 61 as will be hereafter described.

This water-pressure in the pressure chamber 53 is controlled by the electricity supplied to the electric motor which drives the member or grindstone. This electric motor is preferably of the constant-speed type and its power consumption is dependent upon the friction load upon the grinders.

The two legs 43 rest upon the floor 44 and carry the relatively thick ring 45 which has oppositely extending lugs 46 arranged in

spaced pairs. The lower lugs of each pair are securely bolted to the legs 43 while the upper lugs of each pair are similarly secured to the supporting arches 28. Preferably these legs are joined by a reinforcing bar 47. The lower opening of this ring is closed by a metallic plate 48 bolted to the under face of the ring and having an interposed gasket to effect a water-tight closure. The main diaphragm 49 similar to the auxiliary diaphragm 35 closes the upper opening of the ring and is held thereto by means of the annulus 51 and the bolts 52. The main pressure chamber 53 is thus provided. A compression spring 54 is mounted to exert a force tending to push the diaphragm downwardly. This spring is held between the diaphragm cap 55 and an overhead plate 56 adjustably mounted upon the three posts 57 upwardly extending through the plate 56 and downwardly held by the adjusting nuts received in threaded engagement upon the upper ends of these posts 57.

The above-mentioned compression spring 61 is mounted between the caps 62 and 63 and tends to thrust them apart. The upper spring cap 62 has an integral upwardly extending ball 64 which is seated within a socket provided in the end of the nut 41 while the lower spring cap 63 has its under face provided with a socket for the reception of the ball 65 formed upon the upper end of the headed screw 66 whose shank extends through the diaphragm 49 and its cap 55. While a solid post may be used to communicate the pressure in this main chamber to the valve stem 24, it is preferred to use this spring 61 and, obviously, this spring 61 is of relatively greater strength and stiffness than the spring 42 and is graphically so indicated in the drawings by means of relatively greater size of wire.

The main chamber 53 is filled with water under pressure during the operation of the governor and this chamber has communication with the annular water-way 19 or any other source of relatively constant water pressure. The ring 45 is formed with an integral neck 67 through which extends the port 68. The neck 67 is intermediately tapped and a pipe 69 is inserted therein for communication with the transverse port 68. This pipe 69 upwardly extends to a T 71 which has connection with the pipe 72 communicating with the water-way 19. A gate-valve or petcock 73 or an electricity-actuated pilot valve structure such as that shown on the left of Figure 1 as hereafter described, controls flow through the pipe 72. During the normal operation of the governor a small flow of water continues through the water-way 19, pipe 72, T 71, pipe 69, transverse port 68, to a gate-valve or petcock or to the electricity-actuated pilot valve structure shown in Figure 1. Such a structure

includes the valve chamber 74 formed in the casting 75 bolted to the main valve structure. Flow from this valve chamber 74 to the discharge pipe 76 is controlled by the electricity-actuated pilot valves 77 and 78. If a manually controlled valve be used where the petcock 73 is shown, then an electricity-actuated pilot valve must be used at the outlet or discharge port 68 as shown in Figure 1. If an electricity-actuated pilot valve is used in place of the manually controlled petcock 73, then either a manually controlled valve or an electricity-actuated valve may be used at the outlet port 68. The walls of the valve chamber 74 are preferably formed integrally with the casting 75 and provide an upper and lower valve seat for the upper and lower valves 77 and 78, the upper valve may have a slightly larger area. If so constructed this unbalance functions to cause these pilot valves fixed to the stem 79 to tend to unseat under pressure of the water. Such upward force exerted upon the valve stem 79 is communicated by the stem, through its pin engagement, to the short arm 81 of the lever pivoted upon the pin 82 carried by the bracket 83. The long arm 84 of this pivoted lever is engaged by a substantially knife-edge 85 adjustably carried upon the threaded link 86 pivotally connected to a plunger 87 slidably borne within electro-magnets 88 by means of the sleeves 89. These electro-magnets are preferably supported within a cooling oil-chamber bolted to the leg 91 which forms with the two legs 43, a three point support for the governor. The weight of the plunger 87 and the pull exerted by the electro-magnets, due either to the current flowing to the motor or to both the current and the voltage drop across the motor-leads, tends to move the valves from their seats. Working against such forces is the tension spring 92 adjustably suspended by the threaded pin 93 and its wing-nut 94 from the bracket 83.

During the running of this governor, water is led from the water-way 19 through an electricity-actuated pilot valve or the petcock 73 through the pipe 69 and the valve chamber 74 past the unseated pilot valves 77—78. The outflow from this valve chamber is controlled by the valves which are actuated through the medium of the electro-magnets 88 energizable either by the current flowing to the electric motor which drives the grinder shaft or by the current and the voltage drop. The opening of the main valves 22 and 23 and therefore the fluid flow and pressure are dependent, first, upon the pressure upon the diaphragm 35, and, second, upon the amount of water momentarily contained in the pressure chamber 53 of the governor. A current transformer 95 is connected into one or more phases of the current carrying wires 96 leading to the electric

motor 97 directly connected to the grinder shaft 2. By means of this transformer a small and relatively constant percentage of the electric current flowing to the motor is conveyed from the secondary side of the transformer to one of the electro-magnetic coils 88. There is also preferably employed a voltage transformer 90 shunted across two of the leads to the motor and having its secondary side connected to the other of the two electro-magnetic coils 88 as merely diagrammatically indicated in Figure 3. The plunger 87 thus exerts a pull on the lever arm 84 tending to open the pilot valve 77—78 in proportion to the current flowing to the motor 97, or to the current and the voltage drop across the motor leads. For example, the greater the load on the motor, the greater will be the current flowing, and, hence, the greater the pull exerted by a coil 88 to open the valves 77—78.

The pounds pressure exerted by the water, in the valve chamber, against the unbalanced area of the pilot valve, if any, aided by the pull of the magnet, and the weight of the plunger 87 always just balances the pull exerted by the spring.

An increase in pull of the electro-magnet accompanying an increase in load on the motor 97, and therefore increased flow of electric current to it, causes the pilot valve to open thus allowing the pressure in the chamber 53 to drop. Such a drop in this pressure which opposes the main spring 54 results in a downward movement of the diaphragm 49, effecting a closing of the main valves 22—23 and therefore a reduction in fluid pressure, friction load upon the grindstones and load upon the motor, and therefore a reduction in pull of the magnet and a return to substantially normal load. When one of the pockets is pulled off for refilling or put on for movement of the foot 6, toward grinding position, such above mentioned abnormal movement causes an abnormal demand for fluid flow and hence there is first a drop in fluid pressure. Such a drop in fluid pressure in the main valve pass reduces the pressure on the diaphragm 35 which co-operates with the main spring 54. Therefore, the opposing water pressure immediately causes the main diaphragm 49 to move upward thus resulting in an opening of the main valves 22 and 23 to provide passage for the increased flow during the abnormal movement of the piston-head 4 that was the cause of the drop in pressure.

When the spring 61 is used in place of a solid post, it also serves to produce valve-movement simultaneously with pressure changes. Through such valve movement it tends to prevent pressure changes.

In the case of motor driven grinders, a drop in pressure also causes an instantaneous reduction in load. This results in re-

duced pull by the electro-magnet and hence a closing of the pilot valves 77 and 78 followed by an increase in the pressure in the chamber 53 with the resulting further opening of the main valves 22 and 23 to bring the load back to normal. It will thus appear that the main valve mechanism is actuated directly by fluid pressure and indirectly by change in electric motor load.

While not essential, it is preferred to employ a gauge 98 to indicate grinding pressures and another gauge 99 to indicate pressure in the main chamber 53. Each such gauge is afforded operative communication with its chamber as shown.

It will thus be seen that if, for any reason, the pilot valves 77 and 78 should become inoperative and remain seated, the relatively large area of the diaphragm 49 would be subjected to the full force of the supply pressure with the result that the valve stem 24 might be upwardly thrust so far as to cause the upper valve 22 to strike the boss 25 and partially disrupt the apparatus. The spring 61 is used as a cushion to counteract the effects of such a contingency. The prevention of such a contingency, however, is accomplished by means of a safety device shown in the upper left-hand corner of Figure 1, and the spring or safety device or both may be used, both being here shown.

This safety device includes a suitably supported cylindrical casting 101 having an integral inwardly presented annular valve seat 102 for the valve 103 whose stem 104 projects above and below the valve. The lower portion of the valve stem is slidably borne for movement in axial directions by the centrally apertured boss 105 of the flanged cap 106. The annular flange 107 of this cap provides a housing for the compression spring 108 whose lower end is supported by the inner face of the cap-nut 109 received in adjustable threaded engagement with the flange 107. The upper end of the spring 108 carries the stem plate 111 by means of which the stem is upwardly thrust to hold the valve in yieldably seated position. The upper end portion of the hollow casting 101 is counter bored to provide an upwardly presented shoulder to form an annular seat for the circular diaphragm 112 fixedly secured to the valve stem 104 whose unseating movement the diaphragm may effect. This upper portion of the casting is closed by the cap 113 which is screwed thereto and forms a pressure chamber above the diaphragm similar to the one below the diaphragm. The pipe 114 provides fluid communication between this upper chamber and the fluid supply pass entering the main valve housing so that the grinding pressure is communicated rather than the pressure on the source-of-supply side of the main valves 22 and 23. The pipe 115 connects with the T 71 and

thus provides fluid communication with the main pressure chamber 53 through the pipe 69 and port 68, the valve being partly balanced so far as such pressure is concerned. A discharge pipe 116 opens from the casting 104 below the valve 103 to permit escape of fluid passing the valve 103.

The operation of this safety device or relief valve may be explained upon the assumption, for example, that the pilot valves 77 and 78 have failed to unseat during the running of the apparatus with the result that the overflow or fluid escape through the outlet 76 is stopped and pressure starts to build up in the main pressure chamber 53. This increased pressure upwardly thrusts the stem and the main valves 22 and 23 attached thereto and increases the grinding pressure and hence the pressure upon the upper side of the relief valve diaphragm 112 is increased above that for which the spring 108 is adjustably set to resist. Therefore, the valve 103 is unseated and fluid escapes past the valve and out the discharge pipe 116 with the result that the pressure in the main pressure chamber 53 is reduced.

Having thus described my invention what I claim as new and desire to secure by Letters-Patent, is:

1. An apparatus for the automatic maintenance of a substantially uniform friction load produced by fluid pressure upon a member driven by an electric prime mover including a pass adapted to supply fluid under pressure, a valve movable to control the pressure under which said fluid is supplied, elastic means straining to move the valve in one direction, an electrically operable device actuatable in response to changes in said friction load, and fluid means co-operable with said device straining proportionally to said friction load to move the valve in the opposite direction to provide a valve opening proportional to said friction load whereby said friction load is automatically maintained.

2. An apparatus for the automatic maintenance of a uniform friction load produced by fluid pressure upon a member driven by an electric prime mover including a pass adapted to supply fluid under pressure, a valve movable to control the pressure under which said fluid is supplied, elastic means straining to move the valve in one direction, an electrically operable device actuatable in response to changes in said friction load, fluid means co-operable with said device straining to move the valve in the opposite direction to provide a valve opening proportional to said friction load whereby said friction load is automatically maintained, and means for adjusting the elastic means whereby its straining effort may be adjustably altered.

3. An apparatus for the automatic maintenance of a substantially uniform friction

load produced by fluid pressure upon a member driven by an electric prime mover including a pass adapted to supply fluid under pressure, a valve movable to control the pressure under which said fluid is supplied, elastic means straining to move the valve in one direction, fluid means straining to move the valve in an opposite direction, and an electrically operated device actuatable in response to changes in said friction load to vary the straining effort of said fluid means whereby the uniform friction load is automatically maintained.

4. An apparatus for the automatic maintenance of a substantially uniform friction load produced by fluid pressure upon a member driven by an electric prime mover including a pass adapted to supply fluid under pressure, a valve movable to control the pressure under which said fluid is supplied, elastic means straining to move the valve in one direction, fluid means straining to move the valve in an opposite direction, and an electrically operated device actuatable in response to changes in said friction load to vary the straining effort of said fluid means, whereby the uniform friction load is automatically maintained, and complementary means actuatable by fluid flow through said pass to control the pressure therein.

5. An apparatus for the automatic maintenance of a substantially uniform friction load produced by fluid pressure upon means driven by an electric prime mover including a valve to control said fluid pressure, an electrically operable instrumentality, connections therefor to operate the same in accordance with the current consumed by the prime mover, means operable by said instrumentality to maintain a valve opening proportional to the current consumed by the prime mover, and complementary means actuatable by the flow of said fluid to control the pressure thereof.

6. An apparatus for the automatic maintenance of a substantially uniform friction load produced by fluid pressure upon means driven by an electric prime mover including a valve to control said fluid pressure, an electrically operable instrumentality, connections therefor to operate the same in accordance with the current consumed by the prime mover, means operable by said instrumentality to maintain a valve opening inversely proportional to the current consumed by the prime mover, and complementary means actuatable by the flow of said fluid to control the pressure thereof.

7. In an apparatus for the automatic maintenance of a substantially uniform friction load produced by fluid pressure upon means driven by an electric prime mover, including a valve operable to control the amount of said fluid pressure, an electrical control device variably movable in accord-

ance with current consumed by the prime mover, a lever operable by the control device and movable proportionately to the movement of the device, hydraulic means operable by the lever to move the valve proportionately to the movement of the device whereby the fluid pressure is varied proportionately to said current consumption, and complementary means actuatable by the flow of said fluid to control the pressure thereof.

8. In an apparatus for the automatic maintenance of a substantially uniform friction load produced by fluid pressure upon means driven by an electric prime mover, including a valve operable to control the amount of said fluid pressure, an electromagnet and an armature therefor adapted to be moved thereby proportionately to the current consumed by the prime mover, a lever movable by the armature proportionately to said armature-movement, means operable by the lever to move said valve proportionately to said lever-movement whereby the fluid pressure is varied proportionately to said current consumption, and complementary means actuatable by the flow of said fluid to control the pressure thereof.

9. In an apparatus for the automatic maintenance of a substantially uniform friction load produced by fluid pressure upon means driven by an electric prime mover, including a valve operable to control the amount of said fluid pressure, an electric device movable by and proportionately to the current consumed by the prime mover, means to impart movement to the valve proportionately to the movement of the device whereby the fluid pressure is varied proportionately to said current consumption, and complementary means actuatable by the flow of said fluid to control the pressure thereof.

10. In an apparatus for the automatic maintenance of a substantially uniform friction load produced by fluid pressure upon means driven by an electric prime mover, including a valve operable to control the amount of said pressure, an electromagnet and armature therefor adapted to be moved thereby proportionately to the current consumed by the prime mover, means movable by the armature to move said valve proportionately to armature movement, and complementary means actuatable by the flow of said fluid to control the pressure thereof.

11. In an apparatus for the automatic maintenance of a substantially uniform friction load produced by fluid pressure upon means driven by an electric prime mover, including a valve operable to control the amount of said pressure, an electromagnet and armature therefor adapted to be moved thereby directly proportionately to the current consumed by the prime mover, means movable by the armature to maintain a

valve opening inversely proportional to said current consumption, and complementary means actuable by the flow of said fluid to control the pressure thereof.

5 12. An apparatus for the automatic maintenance of a substantially uniform friction load produced by fluid pressure upon means driven by an electric prime mover including a pass adapted to supply fluid under
10 pressure, a valve movable to control the pressure under which said fluid is supplied, elastic means straining to move the valve in one direction, a pressure chamber, means
15 constantly to maintain fluid pressure therein, means associated with said pressure chamber to cause the chamber pressure to tend to move the valve in the other direction, and an electric device movable proportionately to the current consumed by the
20 prime mover to vary proportionately the chamber pressure whereby the valve opening is proportional to the current consumption.

25 13. An apparatus for the automatic maintenance of a substantially uniform friction load produced by fluid pressure upon means driven by an electric prime mover including a pass adapted to supply fluid under
30 pressure, a valve movable to control the pressure under which said fluid is supplied, elastic means straining to move the valve in one direction, a pressure chamber, means constantly to maintain fluid pressure therein, means associated with said pressure
35 chamber to cause the chamber pressure to tend to move the valve in the other direction, and an electric device movable proportionately to the current consumed by the prime mover to vary proportionately the
40 chamber pressure whereby the valve opening is inversely proportional to the current consumption.

45 14. An apparatus for the automatic maintenance of a substantially uniform friction load produced by fluid pressure upon means driven by an electric prime mover including a pass adapted to supply fluid under pressure, a valve movable to control the

pressure under which said fluid is supplied, elastic means straining to move the valve
50 in one direction, an electrically operable device actuable in response to changes in said friction load, fluid means co-operable with said device straining proportionately to said friction load to move the valve in the
55 opposite direction to provide a valve opening proportional to said friction load whereby said friction load is automatically maintained, and complementary means actuable by fluid flow through said pass to control
60 the pressure therein.

15. An apparatus for the automatic maintenance of a substantially uniform friction load produced by fluid pressure upon means driven by an electric prime mover including a pass adapted to supply fluid under
65 pressure, a valve movable to control the pressure under which said fluid is supplied, elastic means straining to move the valve in one direction, a pressure chamber, means constantly to maintain fluid pressure therein, means associated with said pressure
70 chamber to cause the chamber pressure to tend to move the valve in the other direction, an elastic device movable proportionately to the current consumed by the prime mover to vary proportionately the chamber
75 pressure whereby the valve opening is proportional to the current consumption, and complementary means actuable by fluid flow
80 through said pass to control the pressure therein.

16. An apparatus for the automatic maintenance of a substantially uniform load produced by fluid pressure upon means driven
85 by an electric prime mover including a valve to control said fluid pressure, means electrically operable by the current supplied the prime mover to maintain a valve opening inversely proportional to the current
90 consumed by the prime mover, and complementary means actuable by fluid flow, tending to prevent pressure changes.

In witness whereof, I have hereunto set my hand this 3rd day of March, 1925.

ADOLPH F. MEYER.