R. SIEGMUND.
GOVERNOR.
APPLICATION FILED JAN. 22, 1906.

899,569. **Patented Sept. 29, 1908.**

2 SHEETS—SHEET 1.

Fig.1.

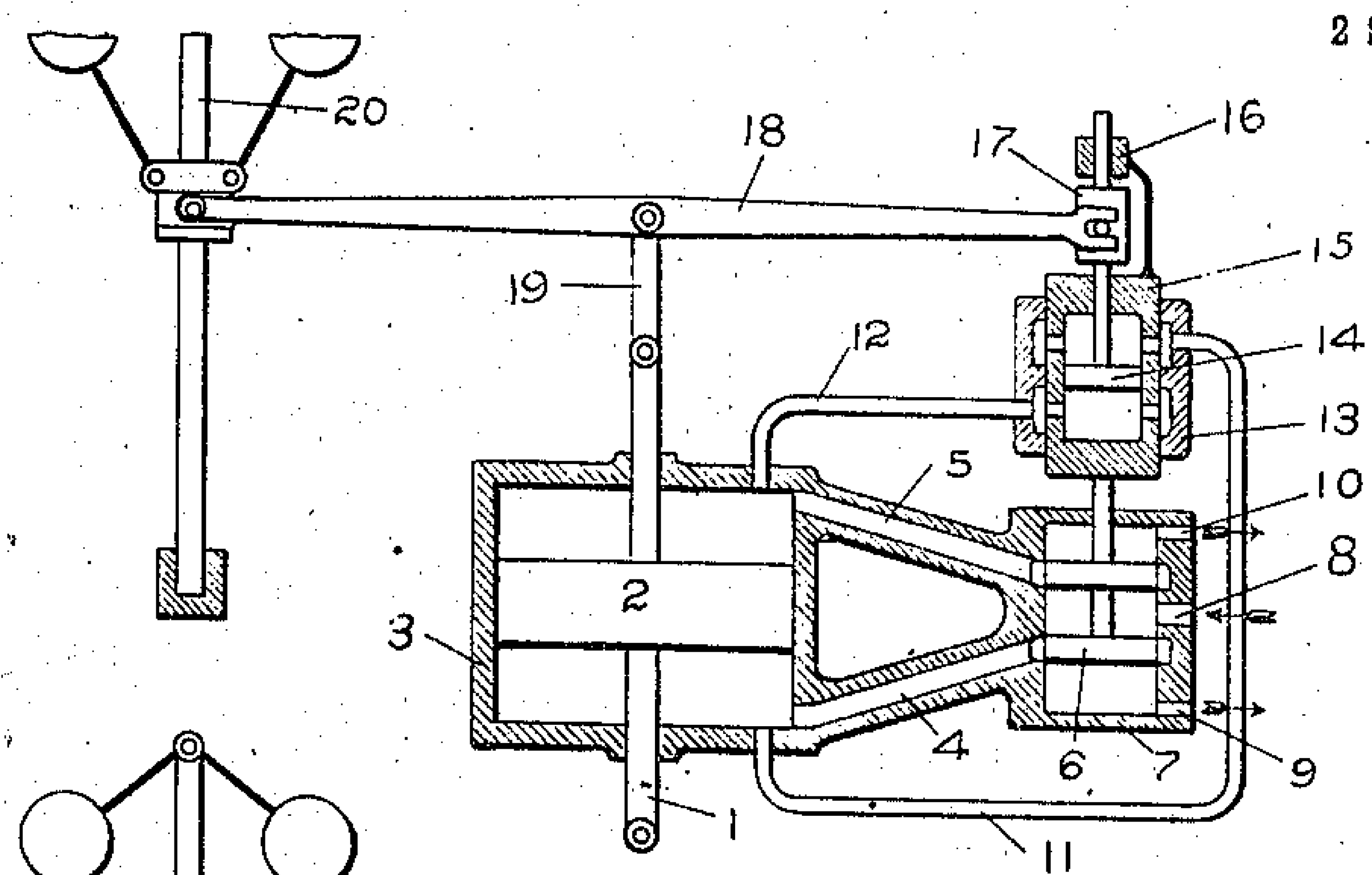


Fig.2.

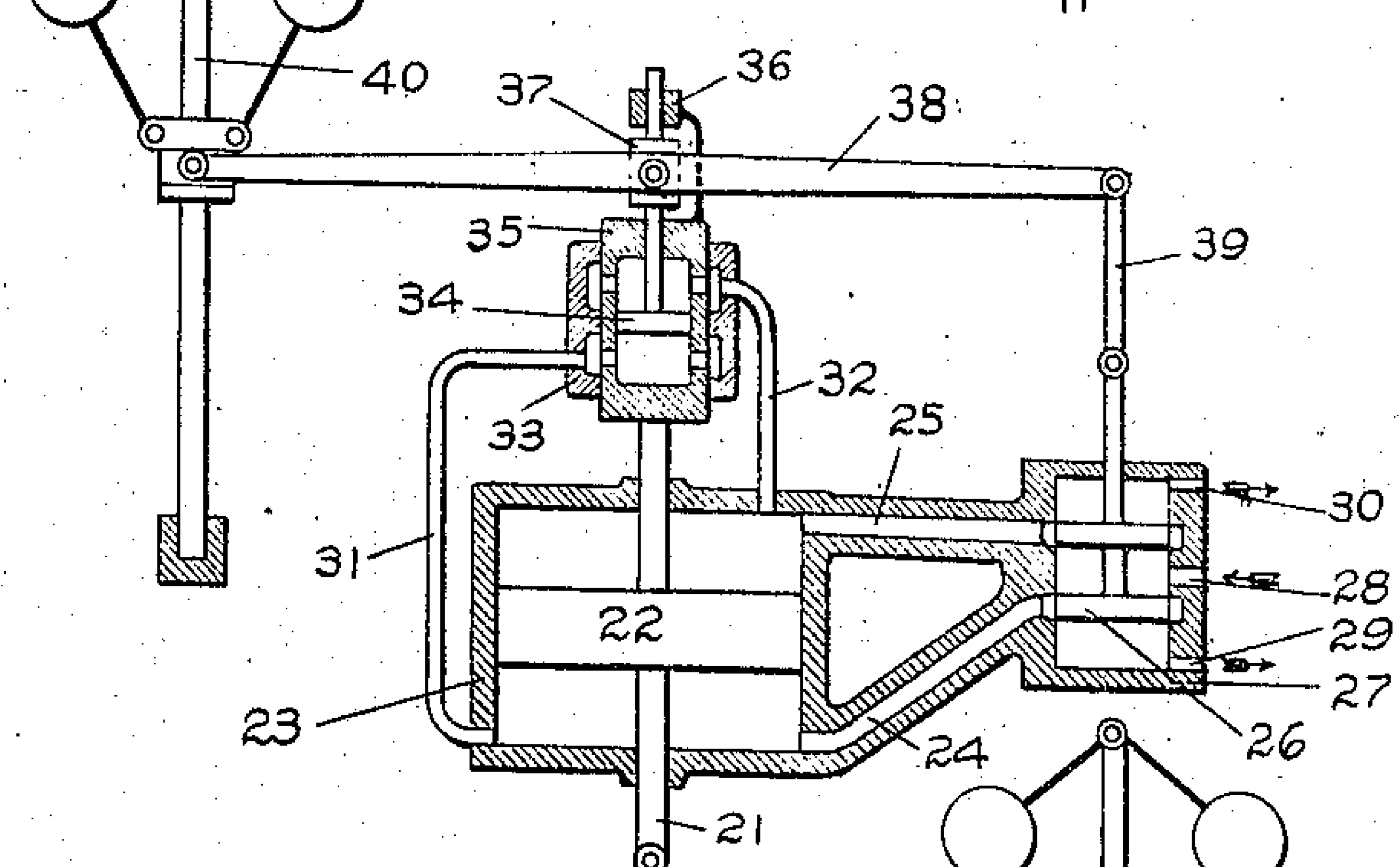


Fig.3.

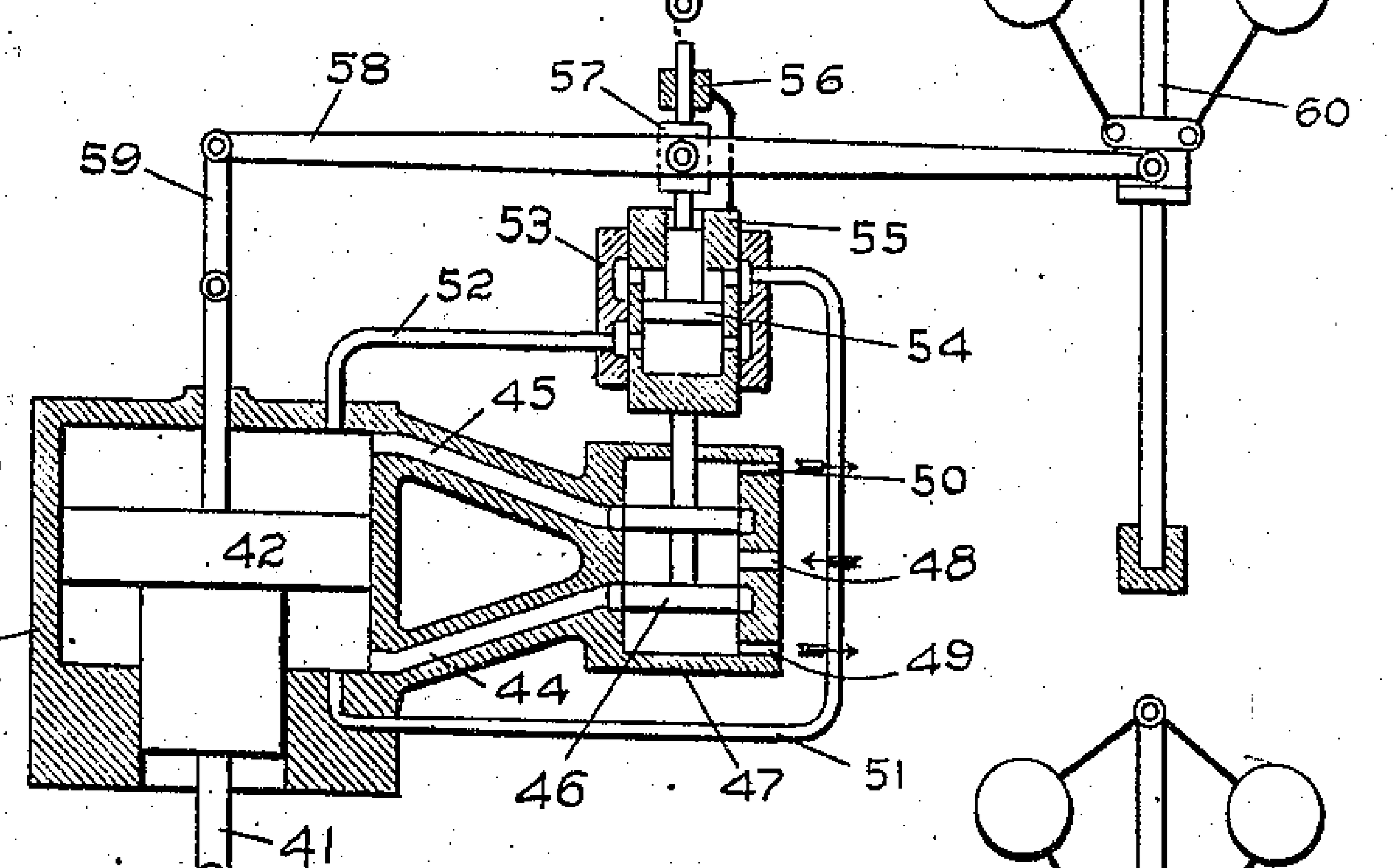
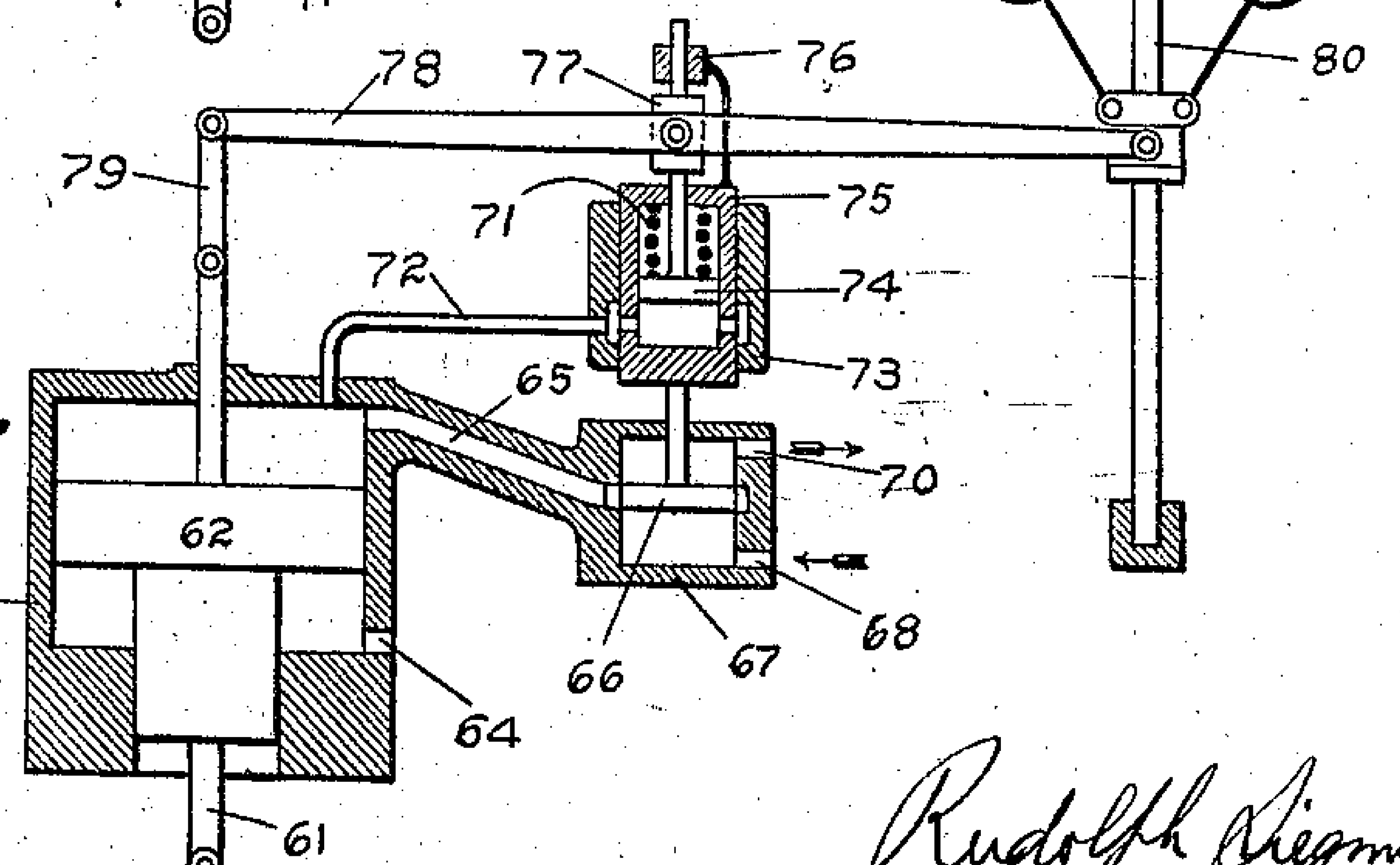


Fig. 4.



WITNESSES:
Phil Gutmann
Geo E Kirk

Rudolph Siegmund INVENTOR

BY

G. J. DeWein ATTORNEY.

R. SIEGMUND.
GOVERNOR.
APPLICATION FILED JAN. 22, 1906.

899,569.

Patented Sept. 29, 1908.
2 SHEETS—SHEET 2.

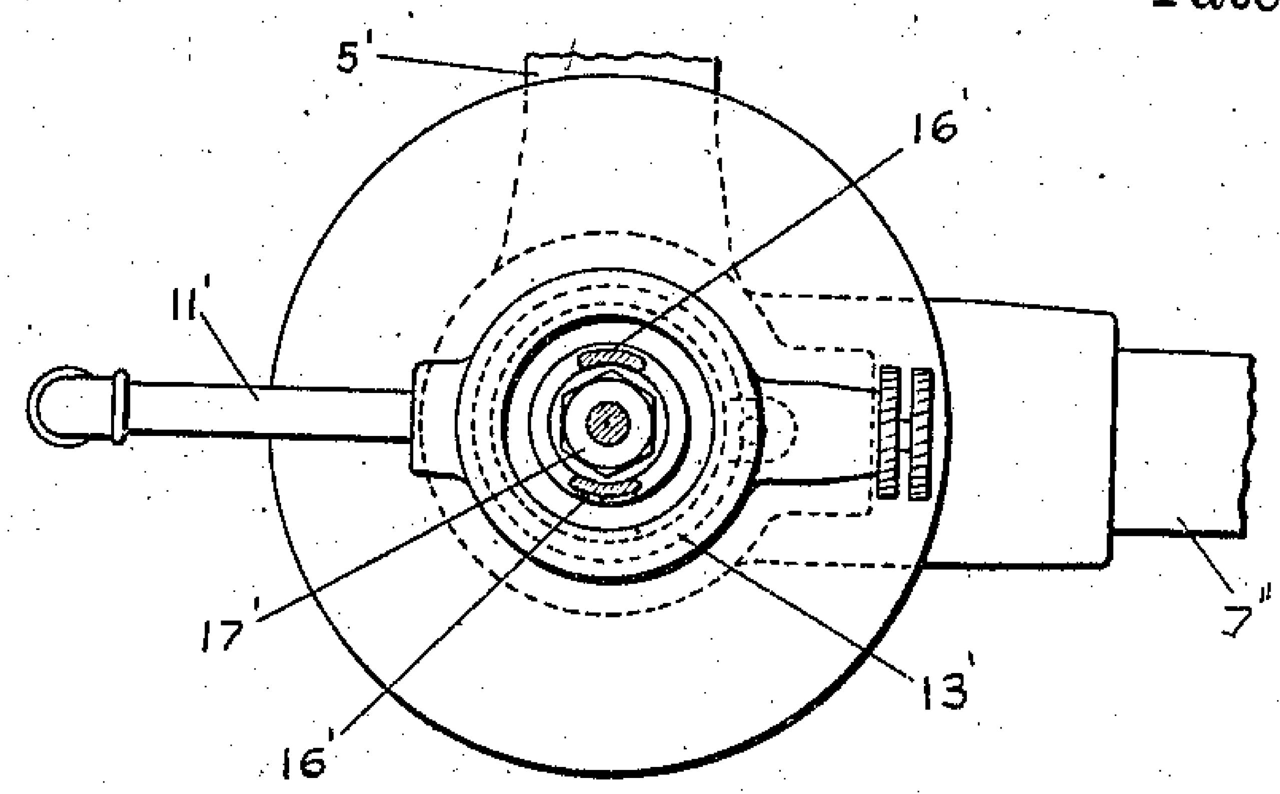


Fig. 6.

Fig. 5.

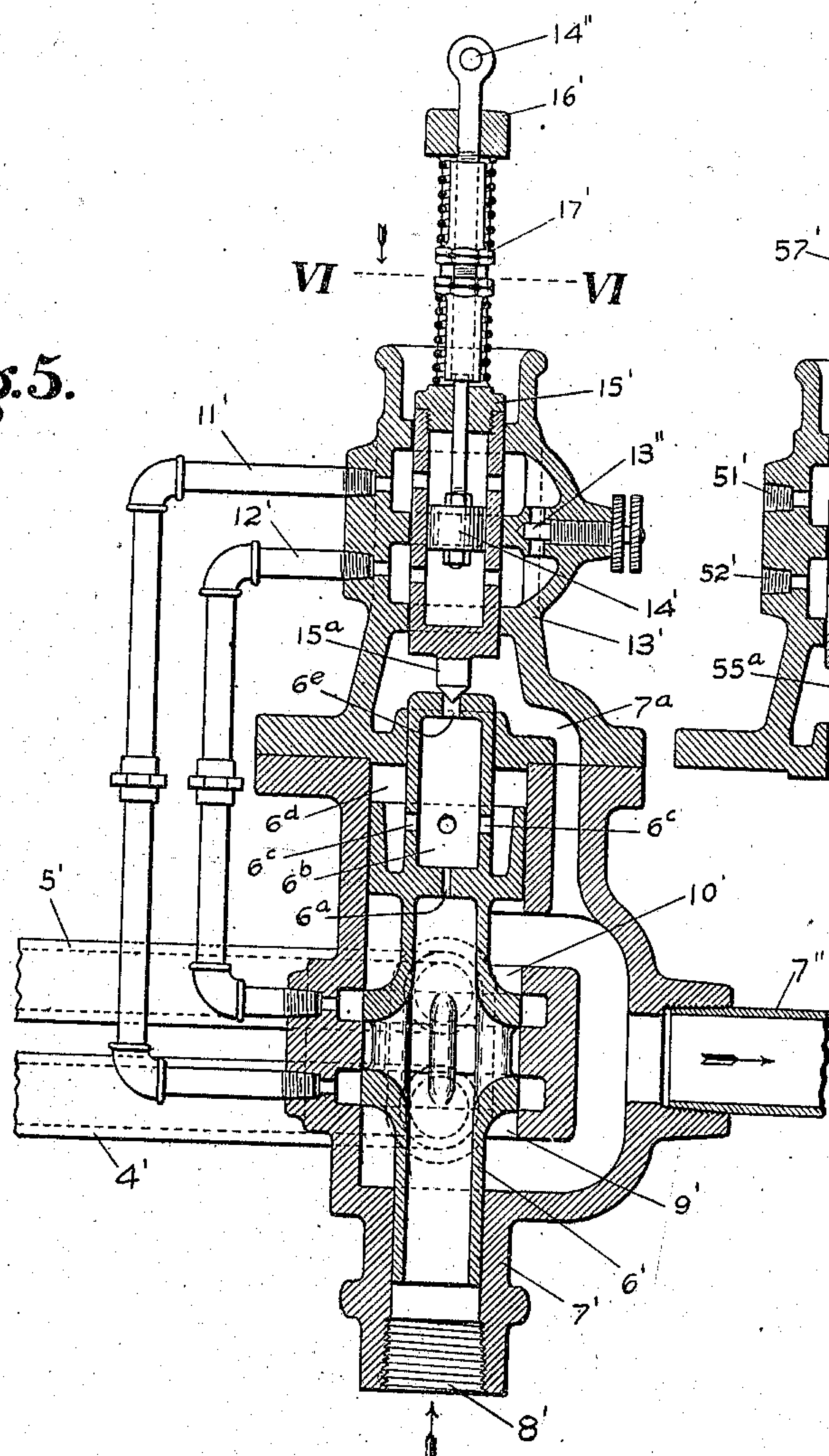
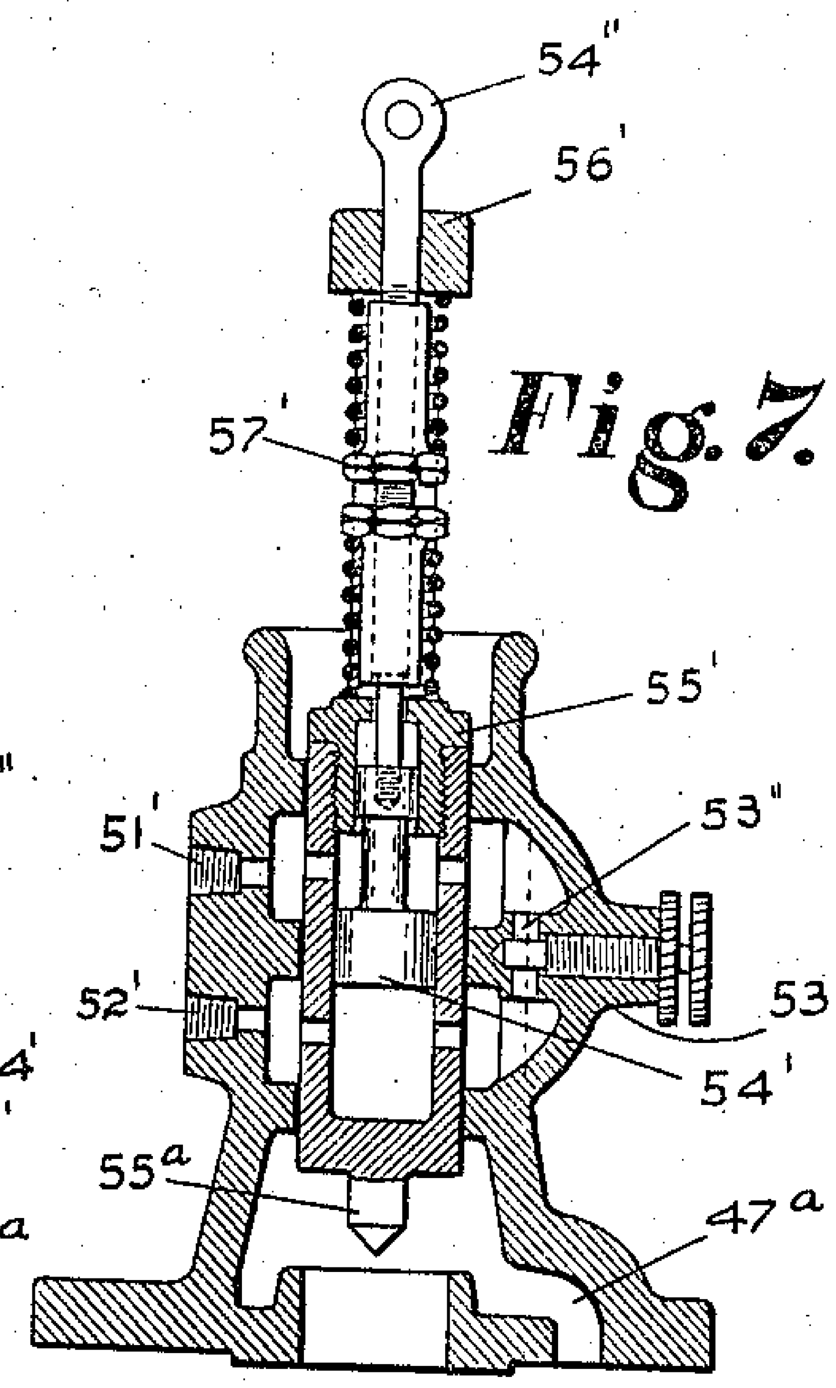


Fig. 7.



WITNESSES:
Phil Gutsein
Geo E Kirk

Rudolph Siegmund INVENTOR
BY
G. J. DeWein ATTORNEY.

UNITED STATES PATENT OFFICE.

RUDOLPH SIEGMUND, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO ALLIS-CHALMERS COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF NEW JERSEY.

GOVERNOR.

No. 899,569. Specification of Letters Patent. Patented Sept. 29, 1908.

Application filed January 22, 1906. Serial No. 297,200.

To all whom it may concern:

Be it known that I, RUDOLPH SIEGMUND, formerly a subject of the Emperor of Austria-Hungary, but having declared my intention to become a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Governors, of which the following is a specification.

This invention relates to regulation, and more particularly to fluid control mechanism therefor.

This invention has utility when embodied in a speed control device, as the connections are such that minor fluctuations are not transmitted, while the larger fluctuations are taken care of accurately and steadily without out loss of motion, sudden or excessive movement.

Referring to the drawings: Figure 1 is a section through a structure showing an embodiment of the device in which the auxiliary valve moving mechanism is in tandem with the valve. Fig. 2 shows an embodiment of the invention in which the auxiliary valve moving device is in tandem with the driven member. Fig. 3 shows an embodiment of the device in which different pressure areas are used to actuate the driven member; the auxiliary valve moving device being in tandem with the valve. Fig. 4 shows an embodiment of the invention in which different pressure areas are used to actuate the driven member, and the auxiliary movement of the valve is effected by a device in tandem with the valve, but fluid actuated in one direction only. Fig. 5 is a section of an embodiment of the invention such as could be applied to the structure shown in Fig. 1. Fig. 6 is a section of Fig. 5 on the line VI—VI looking in the direction of the arrow. Fig. 7 is a detail of an embodiment of the device applicable to the structure shown in Fig. 3.

Referring to Fig. 1: The driven member 1 may be connected in the structure shown with means which would affect the speed of the machine to be controlled. The driven member 1 has a piston 2 in the chamber 3. Communicating with the chamber 3 at one side of the piston 2 is the passage 4. Communicating with the chamber 3 from the opposite side of the piston 2 is the passage 5. The flow of fluid through these passages 4 and 5 is controlled by the valve 6 in the chamber 7. The fluid under pressure enters the chamber 7 at opening 8. Fluid passing from chamber 3 through passage 4 is exhausted from chamber 7 through passage 9; while fluid from chamber 3 passing through passage 5 is exhausted from chamber 7 through passage 10. Leading from the same side of the piston 2 as the passage 4 is the duct 11. Leading from the same side of the chamber 3 as the passage 5 is the duct 12. These ducts 11 and 12 lead to the guide 13 and communicate with piston 14 in shell 15. This shell 15 has connection with the double-acting valve 6 in tandem therewith. The shell 15 has an upward extension 16 through which the stem of the piston 14 operates. A block 17 is mounted on the stem of the piston 14 between the shell 15 and the upward extension thereof, 16. This block 17 is of such proportion that it may have some movement with the stem of the piston 14 before the block is stopped by engagement with shell 15 or its extension 16. Engaging the block 17 is the floating lever 18 connected by link 19 with the driven member 1. A speed governor device 20 is also connected to the floating lever 18.

The operation of the device shown in Fig. 1 is as follows: As the speed increases beyond the limit set, the balls of the governor will fly outward and tend to lift that end of the floating lever 18, which lever, on link 19 as a fulcrum, will move the block 17. This movement of the block 17 will not cause relative movement between the shell 15 and the piston 14 therein, because on each side of the piston there is an incompressible fluid. Accordingly, the movement of the block 17 is transmitted by the fluid to the shell 15, and thus to the valve 6. The downward movement causes the valve 6 to open passage 4 and permit fluid under pressure entering at 8 to be transmitted to the lower side of the piston 2. This pressure is also effective through the duct 11 to the upper side of the piston 14. As the valve 6 opens the passage 4 to pressure, this same valve also opens passage 5 to exhaust through passage 10. This movement of the valve 6 therefore exposes the upper side of the piston 14 to pressure, and the lower side of the piston 14 through duct 12 and passage 5 to exhaust. Inasmuch as the floating lever 18 is firmly held by link 19 and governor 20, the pressure above the piston 14 will cause relative movement between the piston 14 and the shell 15, and the shell 15 will automatically move upward and close the valve 6. This operation due to the compensating device takes place in a very short period of time, and as fluid connections solely are used, there is no opportunity for lost motion and this secondary or reversal operation is accurate and certain.

The movement of the valve as described, is all that occurs when but slight movement of the governor takes place, that is, the governor may be very sensitive, the "hunting" may occur and still not transmit the undesirable slight variations to the driven member. These slight movements do not actuate the driven member owing to the very small movement of the valve 6 permitting such a small quantity of fluid to pass, and the brief time which the valve is open. However, should the governor fluctuate more decidedly, the larger movement of block 17 and shell 15 therewith would, of course, open the valve 6 to a greater extent and the driven member be operated. Considering this operation as taken place and that the machine has had its speed reduced below normal, then the balls of the governor will move inward. This will cause the floating lever to move the block 17 upward, and, as on each side of the piston 14 is an incompressible fluid, the shell will be lifted and with it the valve 6. This will result in fluid pressure entering the valve at 8, being transmitted through passage 5 and duct 12 to the lower side of the piston 14, which piston 14 is below its medial or normal position. Simultaneously the upper side of the piston 14 is connected with the exhaust through duct 11, passage 4 and opening 9. If the movement of the governor be of some consequence, the valve 6 would be opened sufficiently to cause proper amount of movement of the driven member 1. However, if the movement of the governor were slight, the driven member 1 would not be actuated; in which instance, nevertheless, the piston 4 would have movement relative to the shell 15 and in this instance would move the shell to close the valve 6, the resulting position of the piston being medial, as at starting and as shown in Fig. 1.

Referring to Fig. 2: The driven member 21 has the piston 22 in the chamber 23. Communicating with one end of the chamber 23 is the passage 24. Communicating with the opposite end of the chamber 23 is the passage 25. The flow of fluid through these passages is controlled by the valve 26 in the chamber 27. Between the seat portions of the double-acting valve 26 there is an opening at 28 in the chamber 27 through which fluid under pressure may enter. Near one end of the chamber 27 is the exhaust opening 29. Near the opposite end of the chamber 27 is the exhaust opening 30. Communicating with the same end of the chamber 23 as the passage 24, is the duct 31. Communicating with the same end of the chamber 23 as the passage 25, is the duct 32. Ducts 31 and 32 lead to annular passages in the guide 33 and communicate with the piston 34 mounted in the shell 35, movable in the guide 33. It is to be noted in this construction wherein the auxiliary valve moving device is in tandem with the driven member, the duct connections are oppositely arranged to that shown in Fig. 1, wherein the auxiliary valve moving device is in tandem with the valve. The shell 35 has an upward extension 36, and between this extension 36 and the shell proper is mounted the block 37 on the stem of the piston 34. Engaging the block 37 is the floating lever 38, which at one end is connected by the link 39 with the valve 26. At its opposite end the lever 38 is connected to a fly ball governor.

Operation of the device shown in Fig. 2.—Should the speed rise above normal, the fly balls would fly outward, lifting the end of the floating lever 38 engaged therewith. This would cause the lever to move about the block 37 as a fulcrum and force the valve 26 downward, thereby admitting pressure through opening 28, passage 24 to lower side of piston 22, through duct 31 to lower side of piston 34. Likewise this movement of the valve 26 connects the upper side of the piston 34 by means of the duct 32, upper side of the chamber 23, passage 25 with the exhaust opening 30. Accordingly the piston 34 will have movement relative to its shell 35 and will move the floating lever 38 about the end of the lever connected with the governor as a fulcrum, lifting the valve 26 to close the passages 24 and 25. Should the movement of the fly balls have been considerable, enough fluid would have been permitted to pass to actuate the driven member 21. In the event of the speed falling, the fly balls would move inward and actuate the floating lever 38 about the block 37 as a fulcrum to lift the valve 26. Considering this second operation to take place after the one already described due to excessive speed, the piston 34 would be above medial position in the shell 35. The upward movement of the valve 26 will permit fluid under pressure entering at opening 28, to pass through passage 25 into the upper end of chamber 23, through duct 32 to the upper side of the piston 34. Simultaneously the lower side of the piston 34 is connected through duct 31, lower side of chamber 23 and passage 24, with the exhaust opening 29. This permits movement of the piston 34 downward in relation to the shell 35 and moves the floating lever 38 about its connection with the governor 40 as a fulcrum, to move the valve 26 to closed position.

Referring to Fig. 3: The driven member

41 has the piston 42 exposing the opposite sides thereof in the chamber 43 to different areas of pressure. Such a construction is desirable to overcome conditions presented by the part to be actuated which may be designed to require more power to actuate it in one direction than in the other. In this instance, the device is shown requiring more power above the piston 42. Communicating with the lower end of the chamber 43 is the passage 44. Communicating with the upper end of the chamber 43 is the passage 45. The flow of fluid through these passages 44 and 45 is controlled by the double-acting valve 46 in chamber 47. Between the seats of the valve 46 is the opening 48 in the chamber 47, permitting the entrance of fluid under pressure. Near one end of the chamber 47 is the outlet opening 49 Near the opposite end of the chamber 47 is the outlet 50. Communicating with the same end of the chamber 43 as the passage 44, is the duct 51. Communicating with the opposite end of the chamber 43 is the duct 52. These ducts 51 and 52 communicate with annular passages in the guide 53 and therethrough conduct fluid under pressure to the differential piston 54 in the shell 55 mounted in the guide 53. The shell 55 has an upward extension 56 serving as a guide to the stem of the piston 54. Mounted on the stem of the piston 54, between the shell 55 and the extension 56, is the block 57. Pivoted on the block 57 is the floating lever 58, connected at one end by a link 59 with the driven member 41. The opposite end of the lever 58 is connected with the governor 60.

The operation of the device shown in Fig. 3 is similar to that described as for Fig. 1, except that the floating lever 58 has its movement about the link 59 as a fulcrum.

Referring to Fig. 4: The driven member 61 has a differential piston 62, similar to that shown in Fig. 3. This piston is in the chamber 63. Communicating with one end of the chamber 63 is the passage 65, control of fluid through which passage is effected by the single-acting valve 66 in the chamber 67, which has the inlet opening 68 and the outlet opening 70. A duct 72 leads from the same end of the chamber 63 as the passage 65. This duct transmits fluid pressure through a passage in the guide 73 to piston 74 in the shell 75. The opposite side of the piston 74 than that exposed to fluid pressure has the spring 71 operating between the shell 75 and the piston 74. The shell 75 has an extension 76 serving as a guide for the stem of the piston 74 and also to limit the upward movement thereof through the block 77 mounted on the stem of the piston 74. Pivoted on the block 77 is the floating lever 78 having connected at one end thereof the link 79 attached to the driven member 61. Engaging the opposite end of the lever 78 is the governor 80.

Operation of the device shown in Fig. 4.—Should the speed exceed normal, the governor 80 will move the floating lever about the link 79 as a fulcrum, lifting the block 77, and, through the resistance of the spring 71, move the shell 75 and the valve 66 to open position. This will permit fluid under pressure entering at 68 to pass through passage 65 and duct 72 to move the shell 75 in relation to the piston 74, thereby closing the valve 66 against the resistance of the spring 71. Should the movement of the governor have been excessive, sufficient fluid would have been permitted to enter the chamber 63 before the valve 66 had closed, so that the driven member 61 would have been proportionally moved. Assuming now that the speed falls below normal, the balls of the governor will move inward, the floating lever 78, moving about the link 79 as a fulcrum, will cause the block 77 to move downward, which movement will be transmitted through the incompressible fluid at the lower side of the piston 74 and cause the valve 66 to move downward. This will permit the fluid at the lower side of the piston 74 to flow through the duct 72 and passage 65 out through the exhaust opening 70, the spring 71 operating meanwhile to close the valve 66 as soon as the piston reaches the normal or medial position in the shell 75.

Referring to Fig. 5: The flow of fluid through passages 4′ and 5′ is controlled by the double-acting poised valve 6′ in the chamber 7′. Fluid under pressure is admitted to the chamber 7′ through the opening 8′. Outlet openings 9′ and 10′ from the valve 6′ communicate with the exhaust 7″. Communicating with the passage 4′ is the duct 11′. Communicating with the passage 5′ is the duct 12′. These ducts 11′ and 12′ communicate with annular passages in the guide 13′ and communicate fluid pressure to effect the operation of the piston 14′ in the shell 15′ movable in the guide 13′. The movement of the piston 14′ relative to the guide 13′ may be controlled to some extent by the passage 13″ manually controlled and operable as a cataract device. The piston 14′ has at the upper end of its stem an eye 14″, which may be connected to a floating lever. The shell 15′ has an upward extension 16′. Mounted between the upward extension 16′ and the shell 15′ is the adjustable yieldable device 17′ mounted on the stem of the valve 14′. This yieldable device limits the extreme movements of the shell relative to the piston and serves as an aid in bringing the elements into normal relation, that is with the piston 14′ in a medial position in the shell 15′. Of the pair of movable elements 14′ and 15′, the element 15′ has no positive mechanical connection with the other parts. In the structure herein shown there is no mechanical or rigid connection between the valve control element 15′ and the reciprocable device or valve proper 6′. The movements of the valve are controlled by a fluid coupling. The valve 6′ is pressure poised, the fluid under pressure gradually passing through the opening 6^a into chamber 6^b, from which chamber 6^b it may pass through openings 6^c into chamber 6^d. From the chamber 6^b is the opening 6^e into the passage 7^a leading to the exhaust 7″. The opening 6^e is controlled by the head 15^a of the shell 15′.

The operation of the device shown in Fig. 5 is as follows: Fluid under pressure entering at 8′ seeps through opening 6^a and opening 6^e. This fluid under pressure poises the valve upward toward the head 15^a, but the continual seeping of the liquid through the opening 6^a is taken care of by a like area, being an annular opening about the head 15^a in the opening 6^e. Assuming that the governor balls move to force the stem of the piston 14′ downward, a very slight movement might be taken up through the cataract opening 13″. More pronounced movement would cause the incompressible fluid in the shell 15′ to force the shell downward and the head 15^a to its seat in the opening 6^e. The fluid under pressure in the chamber 6^b would pass out to the chamber 6^d, and this area being somewhat larger than the opening 8′, would cause the valve 6′ to move downward from the head 15^a sufficiently to give an opening about the head 15^a equal in area to the opening 6^a. This movement downward of the valve 6′ would permit fluid under pressure to pass through duct 11′ to the upper side of piston 14′ and at the same time the fluid below the piston 14′ would be connected up through duct 12′ with opening 10′ to the exhaust 7″. Relative movement between the piston 14′ and the shell 15′ would then take place and the shell 15′ be moved upward against the resistance of the yieldable device 17′. This would increase the size of the annular opening about the head 15^a, relieve the pressure in the chamber 6^b, and permit the pressure at 8′ to force the valve 6′ up into such position that the opening about the head 15^a will be equal in area to the opening 6^a, thereby seating the valve 6′. Should the fluctuation of the governor be considerable, the movement of the valve 6′ would have been proportionally greater and sufficient fluid would have been permitted to pass through the duct 4′ to operate the driven member. Considering the operations described to have taken place, and the piston 14′ to be below medial position in the shell 15′, and that the governor operates in the reverse direction to lift the piston 14′,—this will cause the head 15^a to move away from the opening 6^e, relieving the pressure in the chamber 6^b. This would permit the pressure from 8′ to force the valve 6′ upward, thereby transmitting pressure through the duct 12′ to the lower side of the piston 14′. Simultaneously fluid on the opposite side of piston 14′ would be connected through duct 11′ with outlet opening 9′ to exhaust 7″. This unbalanced pressure in shell 15′ would cause relative movement between the piston and shell, the shell moving downward to close the opening 6^e. This would cause the pressure to rise in chambers 6^b and 6^d, and the valve 6′ to move into seated or closed position, the movement of the valve 6′ of course being only just sufficient to create an annular opening about the head 15^a of area equal to the opening 6^a.

Referring to Fig. 7: The ducts 51′ and 52′ communicate with annular passages in the guide 53′. Between these passages of the guide is the controllable opening 53″ operable as a cataract device. Fluid passing through the ducts 51′ and 52′ is conducted to the differential piston 54′ in the shell 55′. The shell 55′ has the upward extension 56′ serving as a guide for the stem of the piston 54′. The stem of the piston 54′ has the eye 54″ for engagement with the floating lever. Mounted on the stem of the piston 54′ is the yieldable device 57′. In the lower portion of the guide 53′ is the passage 47^a leading to the exhaust. The shell 55′ has the head 55^a.

The structure shown in Fig. 7 is designed for fluid coupling with the valve similar to the showing in Fig. 5.

What is claimed and it is desired to secure by Letters Patent is:—

1. The combination in a governor, of a fluid actuated driven member, a chamber provided with a port to which a fluid is adapted to be admitted to actuate said driven member, a valve for controlling the flow of fluid through said port, a floating lever having connection to said governor, said valve, and said driven member, a fluid actuated expansible member forming a part of said connections, and means whereby any pressure existing in said chamber automatically has a corresponding pressure developed to actuate said expansible member.

2. The combination with a governor, of a driven member adapted to be actuated by a fluid, a chamber provided with a port to which a fluid is adapted to be admitted to operate said driven member, a valve adapted to control the flow of a fluid through said port, a floating lever connected to said governor, said valve, and said driven member in such a manner as to include a mutually slidable shell and piston therein, and a duct connecting the chamber and shell.

3. The combination with a governor, of a driven member provided with a piston, a chamber inclosing said piston and provided with ports on opposite sides of said piston,

through which ports fluid is adapted to be introduced within said chamber to operate said driven member, a valve controlling said ports, a shell connected to said valve, a piston in said shell, said shell being provided with ports on opposite sides of said piston, ducts adapted to place said ports in said shell in communication with the interior of said chamber, and a floating lever to which said piston, said driven member and said governor are each connected.

4. The combination with a governor, of a driven member provided with a piston, a chamber inclosing said piston, said chamber being provided with ports on opposite sides of said piston adapted to admit a fluid thereto, a valve adapted to admit the flow of a fluid to, or the exhaust of a fluid from, said chamber, a shell secured to said valve, a piston inclosed by said shell, said shell being provided with ports on opposite sides of said piston, ducts adapted to form a communication between said ports and said chamber on opposite sides of said piston, a floating lever, said valve, driven member and governor each being connected with said floating lever in such a manner that movements of the governor are transmitted to said piston, thereby causing said valve to move and admit fluid to said chamber on that side of said piston which is in communication with the port in said shell away from which said piston tended to be moved by said governor.

In testimony whereof I affix my signature in presence of two witnesses.

RUDOLPH SIEGMUND.

Witnesses:
GEO. E. KIRK,
G. F. DE WEIN.