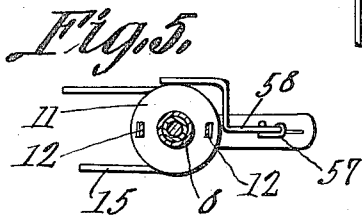
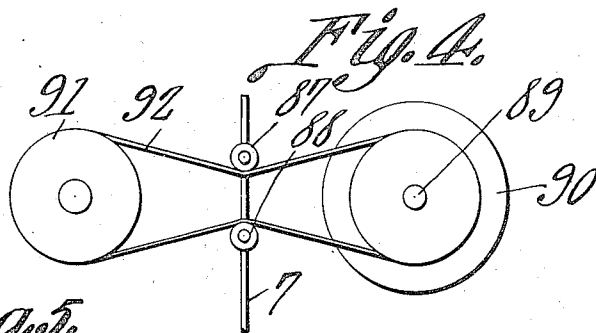
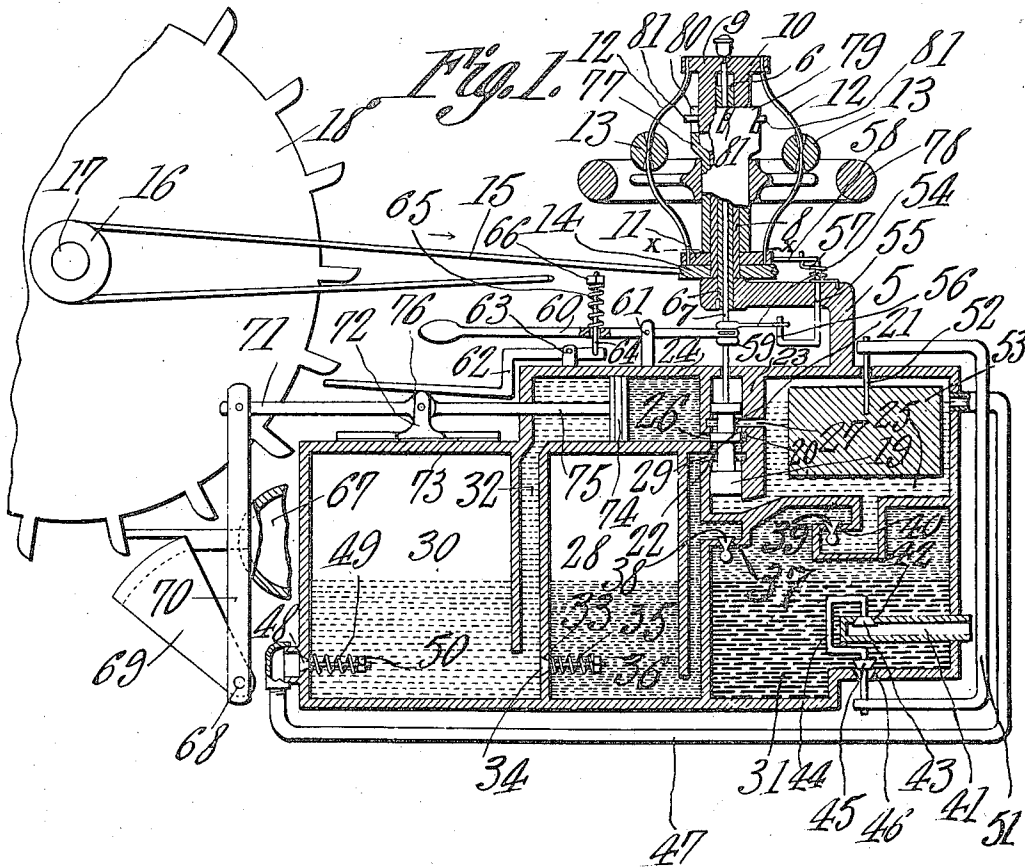


N. BALDWIN.
GOVERNOR MECHANISM.
APPLICATION FILED JULY 29, 1910.

1,130,659.

Patented Mar. 2, 1915.

2 SHEETS-SHEET 1.



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Witnesses

J. P. Smith
J. E. Smith

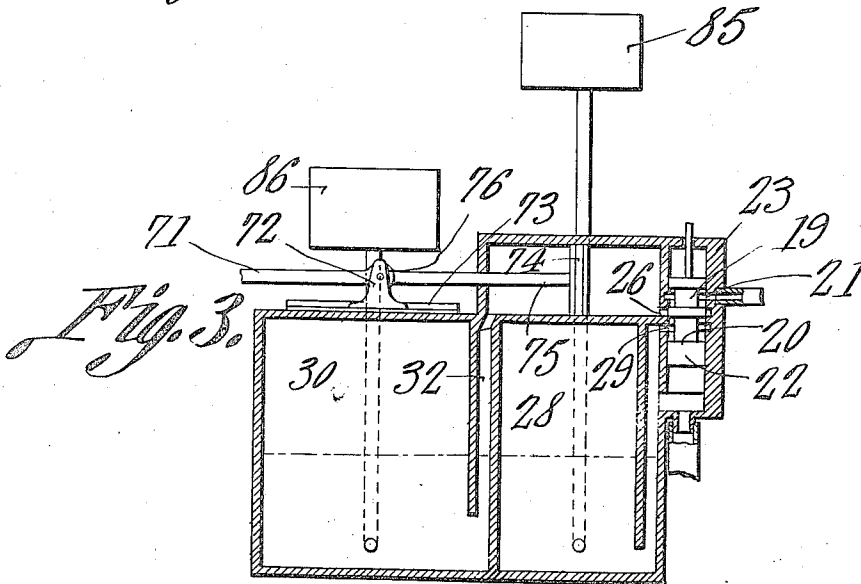
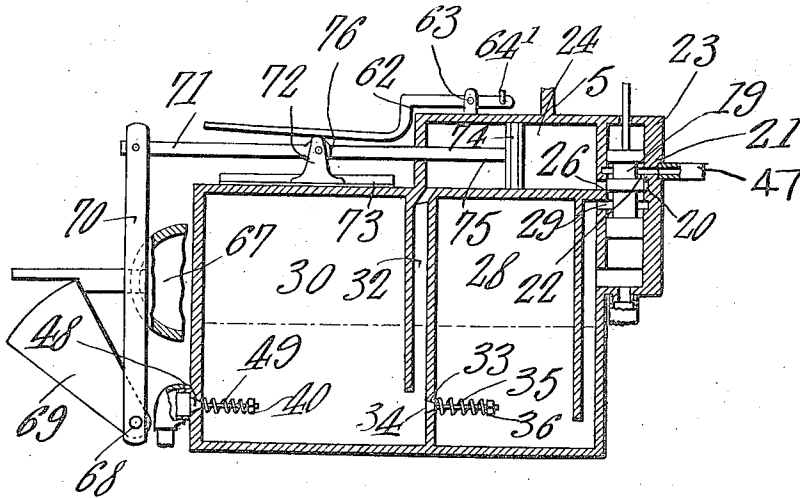
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2 SHEETS-SHEET 2.

Fig. 2.



Witnesses

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UNITED STATES PATENT OFFICE.

NATHANIEL BALDWIN, OF MIDWAY, UTAH.

GOVERNOR MECHANISM.

1,130,659.

Specification of Letters Patent.

Patented Mar. 2, 1915.

Application filed July 29, 1910. Serial No. 574,519.

To all whom it may concern:

Be it known that I, NATHANIEL BALDWIN, a citizen of the United States, residing at Midway, in the county of Wasatch and State of Utah, have invented a new and useful Governor Mechanism, of which the following is a specification.

It is the object of the present invention to provide an improved governor mechanism designed particularly to use in connection with and for the purpose of controlling the speed machinery where great uniformity of speed is required and where there are liable to be sudden changes of load.

The primary aim of the invention is to provide, in governor mechanisms, means responsive not only to variation in speed of the prime mover, but responsive also to conditions of acceleration. Ordinarily, governor mechanisms designed for the purpose of merely correcting variations in speed are ineffective when under conditions of acceleration so that where load is partially removed and the prime mover, being relieved of such load, is allowed to suddenly "race", the ordinary speed governing mechanism employed will, it is true, act to cut off to a greater or less degree the supply of power to the prime mover, but in a very gradual manner so that the speed of motion of the prime mover under conditions of load, that is the application and removal of load, is by no means rendered constant by the employment of ordinary speed governing mechanisms.

It is the aim of the present invention, therefore, to provide, in a governing mechanism for machinery, means responsive to variations in speed as well as means responsive to conditions of acceleration, the latter means being operable instantly upon the production of a condition of acceleration or retardation. Thus, whether a major portion of the load be instantly removed or a major portion instantly applied, the governing device of the present invention is designed to act instantly upon such removal or application to so regulate the supply of power to the prime mover as to bring its speed of motion to normal and maintain it at this point.

It is a further aim of the invention to provide for causing the speed of movement of the prime mover to vary with the load in any desired manner. For example, this means may be arranged to increase the speed with

the load or to decrease the speed with increase of load.

A further aim of the invention is to provide manually operable means for regulating the supply of power to the prime mover through the governor mechanism and without affecting the utility of the mechanism and without interrupting its operation.

With the above and other objects in view, the invention consists in the general construction and arrangement of parts substantially as shown in the accompanying drawings, in which,

Figure 1 is a vertical sectional view through a governor mechanism constructed in accordance with the present invention. Fig. 2 is a similar view illustrating a slight modification of the invention. Fig. 3 is a view similar to Fig. 2 illustrating a still further modification. Fig. 4 is a detail view in elevation of a slight modification of that portion of the mechanism which is responsive to conditions of acceleration. Fig. 5 is a detailed sectional view taken on the line $x-x$ of Fig. 1, viewing downwardly.

Before proceeding to a specific description of the governor mechanism embodying the present invention, it will be here stated that the mechanism as illustrated in the drawings may be rearranged or varied in its construction in a number of ways without departing from the principles of the invention and in fact the showing of the drawings is semi-diagrammatic and is intended only to illustrate the principles involved and not to indicate any specific construction or arrangement of the mechanism as a whole or of the parts thereof. For this reason, the drawings illustrate all of the several pressure chambers of the mechanism as formed integral although in practice in all probability it will be expedient to separate these chambers and connect them by pipe.

In the drawings, the numeral 5 indicates a support which is here illustrated as in the form of a bracket arm mounted upon one of the casings or chambers of the mechanism and this arm carries at its outer end an upstanding sleeve indicated by the numeral 6, the sleeve being preferably separate from the arm and secured at its lower end thereto. A valve rod indicated by the numeral 7 is loosely mounted through this sleeve. More specifically, the rod is so mounted in the sleeve that it may have not only up and

down movement therein but may also rotate to a greater or less degree for a purpose to be presently explained. Rotatably fitted upon the sleeve 6 is a sleeve shaft 8 and a similar shaft indicated by the numeral 9, fitted also upon the sleeve 6 at the upper end thereof and it is designed to have not only rotative movement upon the sleeve but also to be vertically movable thereon. This shaft 9 supports the upper head of a governor, which head is indicated by the numeral 10 and the lower head of the governor, indicated by the numeral 11 is secured at the lower end of the sleeve shaft 8. The usual bowed spring 12 carrying the centrifugal balls 13 connects the heads 10 and 11 in the same manner as the ordinary speed governor of this type and the upper head 10 has such connection with the upper end of the valve rod as to move this rod up or down depending upon the character of speed variation to which the speed governor is subjected. A pulley indicated by the numeral 14 is secured also upon the lower end of the sleeve shaft 8 and is grooved and has trained about it a rope belt 15 which also passes about a pulley 16 upon the shaft 17 of a prime mover which is here illustrated as in the nature of a tangential water wheel 18. At this point it will be readily understood that the prime mover may be of some other type if desired and that illustration in the present instance of a prime mover in the nature of a tangential water wheel is purely arbitrary and is to be so considered.

The valve stem 7, at its lower end, carries a valve which is indicated by the numeral 19, this valve being reduced to form a by path groove 20 and a similar groove 21. The formation of these grooves 20 and 21 results in an annular shoulder 22 between the two grooves. This valve 19 works in a casing 23 which is cylindrical and is located between a cylinder 24 and a receiving chamber 25, there being a port 26 opening through the wall of the valve casing into the cylinder 24 and a port 27 opening also through the said casing into the chamber 25. A high pressure chamber 28 is located beneath the cylinder 24 and a port 29 establishes communication between this chamber and the valve casing. There is embodied, in the mechanism, also, a low pressure chamber indicated by the numeral 30 and a pressure supply chamber 31 preferably located beneath the receiving chamber 25. By way of a port 32, communication is established between that end of the cylinder 24 opposite the end into which the port 26 opens, and the low pressure chamber 30 and there is an opening 33 in the wall between the high and low pressure chambers which opening is normally closed by a valve 34 and held closed by a spring 35 upon its stem, the tension of this spring being adjustable through the

medium of a nut 36 threaded upon the stem so that the greater or less pressure within the high pressure chamber 28 will be required to open the valve 34. Communication is established between the pressure supply chamber and the high pressure chamber by way of an opening 37 normally closed by a valve 38, and a valve 39 normally closes an opening 40 which establishes communication between the receiving chamber and the pressure supply chamber.

The numeral 41 indicates a water supply pipe which leads into the pressure supply chamber and is formed with a discharge opening 42 with which is associated a valve 43. The stem of this valve is indicated by the numeral 44 and carries also a valve 45 which latter valve coöperates with a drain opening 46 in the bottom of the pressure supply chamber. A pipe 47 leads from the low pressure chamber to the receiving chamber and at its point of juncture with the low pressure chamber it has arranged within it a valve 48 normally held closed by a spring 49 which, as in the case of the spring 35, may have its tension adjusted by a nut 50 upon the stem of the valve 48 whereby to adapt the valve to be opened under degrees of pressure above a predetermined degree. The stem for the valves 43 and 45 is secured at its lower end below the drain opening 46 to one end of an arm indicated by the numeral 51 which arm extends up beside the pressure supply chamber and receiving chamber and supports at its upper end, through the medium of a stem 52, a float 53 located within the receiving chamber.

The valve 48 above referred to is so arranged that when it opens under pressure, the fluid under pressure, whether it be oil, water, or air in the low pressure chamber, is permitted to flow through the pipe 47 and into the receiving chamber and in a like manner, the valve 34 is so arranged that when it opens under pressure, the oil or water under pressure in the high pressure chamber will be allowed to flow into the low pressure chamber. Furthermore, the tension of the spring 35 on the valve 34 is so adjusted that more than one half the pressure of the high pressure chamber will be required to open this valve and inasmuch as the pressure in the high pressure chamber is twice that in the low pressure chamber, the valve will be normally closed although upon lowering of the pressure in the low pressure chamber to a predetermined degree, the valve will open so as to restore the ratio of pressure between the two chambers. Furthermore, for a purpose to be presently explained, the valves 43 and 45 are so relatively arranged that when the float 53 is in lowered position, the valve 45 will be closed and the valve 43 will be opened although when the float rises, the valve 43 will move

to closed position and the valve 45 will move to open position.

As a means for preventing sticking of the valve 19, an arm 54 is secured upon the valve rod 7 and projects outwardly therefrom beneath the arm 5 and a rocker 55 is mounted to oscillate within the arm 5 and has its lower end upturned and projecting as at 56 through an eye at the outer end of the arm 54. A spring 57 is secured at one end of the arm 5 and is wound about the rocker 55 and is secured at its other end thereto and this spring normally holds the upper end of the rocker, which is turned laterally as at 58, in engagement with the periphery of the head 11 of the governor. This head is slightly eccentric so that as the governor rotates, slight oscillatory or vibratory movement will be imparted to the rocker 55 and through the beam of the said rocker to the valve rod 7 for the purpose stated. An abutment 59 is secured upon the valve rod 7 below the arm 54 and a lever 60 has one end projecting between the arm 54 and said abutment 59, this lever arm being mounted as at 61 upon the cylinder 24, for rocking movement.

A lever arm indicated by the numeral 62 is fulcrumed as at 63 upon the cylinder 24 and connected to that end of this arm which corresponds to the end of the lever projecting between the abutment upon the valve rod, is the lower end of a stem 64, this stem having fitted upon it a spring 65 and a nut 66 which may be turned for the purpose of adjusting the tension of the spring. The stem 64, as stated, is pivoted to the lever arm 62 and extends up through the lever 60 with the spring 65 confined between the nut 66 and the said lever. Thus, a downward pressure is exerted upon that portion of the lever 60 to the left of its fulcrum in Fig. 1 of the drawings. As a consequence, the opposite end of the lever or more specifically that end which projects between the arm 54 and the abutment 59, is held normally elevated and as a consequence the valve rod and valve are held normally elevated.

The numeral 67 indicates a water nozzle through which water is supplied to the tangential water wheel 18 constituting the prime mover with which the governor mechanism is associated and arranged in juxtaposition to this nozzle is a rock shaft indicated by the numeral 68 this shaft having fixed upon it a deflector 69 which is preferably in the nature of an inverted U-shaped metal hood. An arm 70 is fixed also upon the shaft 68 and to the upper end of this arm is connected a rod 71 having pivotal connection with a cross head 72 mounted in suitable slides 73 upon the top of the low pressure chamber of the device or upon some other suitable supporting member. A piston 74 is arranged within the cylinder 24

and a piston rod 75 is carried by the piston and connects with the cross head 72. Also, for a purpose to be presently explained, a portion of the lever arm 62, indicated by the numeral 76 projects above and rests upon the cross head 72.

The governor mechanism which is responsive to the condition of acceleration and retardation embodies a sleeve 77 which is mounted upon the sleeve shaft 8 and may have limited rotative movement thereon and independently thereof under conditions to be presently explained and fixed upon this sleeve 77 is an inertia wheel 78 between the spokes of which extend the bowed springs 12 of that portion of the governor which is responsive to variations of speed. The upper end of the sleeve 77 is increased in diameter as at 79 and is formed with a plurality of inclined slots 80 and pins 81 project from the sleeve shaft 9 into these slots 80. It will be readily understood that the projection of the pins 81 into the slots 80 serves to connect the sleeve 77 for rotation with the sleeve shaft 8 under normal conditions but the independent rotative movement of the sleeve 77 independently of the sleeve shaft, above mentioned, takes place after conditions of acceleration or retardation as will presently be made apparent.

It will be observed that the low pressure cylinder 30 contains a predetermined quantity of oil under pressure as does also the high pressure cylinder although the pressure in the high pressure cylinder is, as heretofore stated, approximately twice that in the low pressure cylinder, in degree. Also, the pressure supply chamber is filled with water to about the level indicated by the heavy dotted lines and above this level with oil and the receiving chamber 25 also contains a greater or less quantity of oil. Also, the pressure upon the oil in the low pressure chamber 30 causes the oil in this chamber to fill the cylinder 24 to that side of the piston 74 at which the low pressure cylinder is located and in a like manner the oil under pressure in the high pressure cylinder 28 fills the cylinder 24 to the other side of the said piston 74.

The operation of the mechanism is as follows: The valve 19 is normally in predetermined position, for example the intermediate position illustrated in Fig. 1 of the drawings. If now the speed of rotation of the prime mover 18 gradually increases, the centrifugal force imparted to the centrifugal balls 13 will result in the governor head 10 being lowered and a corresponding movement being imparted to the valve rod 7 and valve 19 supported thereby. As this valve lowers, the oil in the cylinder 24 supplied from the high pressure chamber 28 is allowed to flow, due to its release from pressure, by way of the by path groove 21 in the

valve 19, and port 27 in the valve casing, into the receiving chamber 25. The pressure upon this side of the piston being thus removed, to a greater or less degree, the pressure in the low pressure chamber 30 is then of sufficient degree to force the piston toward the right in Fig. 1. This movement of the piston will slide the cross head 72 in a like direction and will result in the shaft 68 being so run as to swing the deflector 69 in an upward direction and toward the supply nozzle 67. This movement of the deflector will serve to partially cut off or deflect the stream issuing from the nozzle and impinging against the blade of the wheel 18. Thus less power will be supplied to the wheel and its speed will gradually lower. As the speed of the prime mover lowers, the governor head 10 will gradually rise and move the valve 19 toward normal position and this movement of the valve, provided the valve is elevated above the position shown in Fig. 1 of the drawings, will cut off the flow of oil from the cylinder 24 to the receiving chamber and will allow oil under pressure to flow from the high pressure cylinder by way of the by path groove 21 and into the right hand end of the cylinder 24. This inrush of oil under pressure into the said end of the cylinder will of course force the piston 24 toward the left in Fig. 1 and thus swing the deflector 69 in a downward direction and allowing a greater portion of the stream of water issuing from the nozzle 67 to impinge against the blades or buckets of the wheel 18. This will of course also take place if the speed of the prime mover increases. At this point it will be stated that as the level of the oil in the receiving chamber 25 rises, the float 53 will also rise and this movement of the float will close the valve 43 and open the valve 45 thereby cutting off the supply of water under pressure through the pipe 41 and allowing a quantity of the water in the pressure supply chamber to drain off through the opening 46. As the water leaves the pressure supply chamber, the valve 39 will open thus allowing a sufficient quantity of oil to flow from the receiving chamber into the pressure supply chamber. While the above described operation takes place under conditions of variations in speed, marked acceleration or retardation caused by a sudden removal of load or the sudden application of load will not be rectified as quickly as is necessary in machines of such type and it is under such conditions of acceleration or retardation that the inertia wheel and the sleeve by which it is carried serve to bring about an instantaneous variation in the power supply and consequently a practically instantaneous change in speed from abnormal to normal.

Supposing the governor as an entirety

to be rotating at the speed at which it would rotate when the prime mover is rotating at normal speed, and supposing sudden load to be applied to the machine driven by the prime mover, the speed of rotation of the sleeves 8 and 9 will be suddenly slackened and the inertia wheel 78 will then cause or tend to cause a more rapid rotation of the sleeve 77 than that of the sleeve shaft 8. As a consequence, the sleeve 77 will rotate about the sleeve shaft 8 to a greater or less degree in a forward direction or in other words in the direction of rotation of the said shaft 8. As this takes place, the right hand edges of the slots in said Fig. 1 of the drawings will ride beneath the respective pins 81 and the sleeve shaft 9 together with the governor head 10 carried thereby will be elevated to a greater or less degree, suddenly. This sudden elevation of the head 10 will result in a greater quantity of oil being admitted to the right hand end of the cylinder in Fig. 1 and in a sudden movement of the piston 74 toward the left in the said Fig. 1 thereby allowing a greater portion of the power stream from the nozzle to impinge against the blades or buckets of the wheel 18. The degree of movement of the valve 19 under these conditions is of course proportionate to the degree of retardation which in turn is proportionate to the increase in load. When the prime mover has received the proper amount of power to balance the additional load, the valve 19 will return to normal or intermediate position except for the action of the centrifugal device which will hold the valve slightly raised until the speed is back to normal. If by any means, too much power is supplied to the wheel 18, suddenly, to balance the load, there will be a condition of acceleration immediately established and the valve 19 will be lowered to decrease the supply of power even before the speed is normal. Hence, by the time the speed reaches a normal degree, the supply of power will have been adjusted to balance the load. When load is removed from the prime mover 18, the instantaneous increase in speed of rotation of the sleeve shafts 8 and 9 will result in the pins 81 riding against the left hand edges of the slots in Fig. 1 of the drawings. As a result, a downward pull will be exerted upon the sleeve shaft 9 and its head 10. This movement of the head 10 will result in a lowering of the valve rod 7 and a cutting off of the supply of power in proportion to the acceleration caused by the removal of the load, the degree of acceleration being proportional to the load removed. It will be readily understood that the lowering of the valve 19 is against the tension of the spring 65 and consequently, by adjusting the nut 66, the tension of the spring 65 may be so varied as to provide for

rotation of the prime mover 18 at any desired normal speed. It will further be understood that by grasping the left hand end of the lever 60 this lever may be manually
 5 rocked so as to raise or lower the valve 19 and thereby increase or decrease the speed of rotation of the prime mover or cut off entirely the supply of power to the same.

It will be observed that the portion 76 of the lever arm 62, heretofore referred to, when resting upon the cross head 72, extends at an acute angle with respect to the horizontal plane in which the top of the said cross head moves and, as a consequence,
 10 as the cross head 72 is moved by the piston toward the left in Fig. 1 of the drawings, and the power is supplied more fully to the prime mover 18, the left hand end of the lever arm will move down thereby relieving
 15 the spring 65 of a portion of the tension normally placed upon it. This partial release from tension of the spring 65 of course permits of the valve 19 being more readily lowered than under normal condition and so the supply of power to the prime
 20 mover is increased in proportion to the increase in load and inasmuch as the portion 76 of the lever arm is straight, this increase in power supply will be uniform. It will be readily understood however that where it
 25 is desired that the power supply shall be increased more or less rapidly beyond a certain speed and beyond a certain load imposed, the portion 76 of the lever arm is to be curved and where the increase in power
 30 supply is to be more rapid beyond a certain point, the said portion of the lever arm, in addition to being curved as above stated, has its convex edge resting upon the cross head
 35 72 and when it is desired, on the other hand, to increase the supply of power less rapidly, the concaved edge of the said portion of the lever arm rests upon the cross head 72.

Inasmuch as the pressure in the high
 45 pressure chamber will force the oil in the chamber into the low pressure chamber 30 to restore the pressure therein to normal pressure when it becomes lowered, the pressure in the high pressure chamber will
 50 at such time lower and as the pressure in the supply chamber is the same as the normal pressure in the high pressure chamber, the valve 38, at such time, will open and oil will flow from the pressure
 55 supply chamber into the high pressure chamber. It will be understood that the head of water entering by way of the pipe 41 into the pressure supply chamber is under the same pressure as the oil in the high
 60 pressure chamber to produce this result. In other words, when the receiving chamber 25 is empty, the weight of the float 53 will keep the valve 45 closed and the valve 43 opened. This will allow water under pressure
 65 to enter the pressure supply chamber

and this pressure will close the valve 45 and closes the valve 39 and opens the valve 38 and force oil through the opening 37 into the high pressure chamber 28 until the pressure in this chamber balances the water
 70 pressure. In the meantime, the low pressure chamber 30 will receive its proportion of oil under pressure and a certain amount of this oil will flow by way of the pipe 47 into the receiving chamber 25 whereupon
 75 the float in this chamber will rise and the valve 43 will be closed and the valve 45 opened. As the water drains from the chamber 31 through the opening 46, the valve 39 will open and admit oil from the
 80 chamber 25 into the chamber 31 to take the place of the water drained therefrom. When a sufficient amount of oil has been discharged from the receiving chamber, the float will again lower and this operation
 85 will be repeated.

It will be obvious that various modifications may be made in the construction and arrangement of the parts of the mechanism shown in Fig. 1 and one of the modifications
 90 is shown in Fig. 2 of the drawings. In this figure, the pressure supply chamber and also the receiving chamber are omitted and the pipe 47 leads directly from the low pressure chamber to a suitable waste. Without
 95 giving an extended explanation of the operation of this modified structure it will be readily understood that inasmuch as the water supply pipe 41 is connected directly to the high pressure chamber and the pipe
 100 47, as stated, leads from the low pressure chamber to a waste, the operation is in all essential points the same as given in connection with Fig. 1 of the drawings. In the arrangement shown in Fig. 3 of the drawings,
 105 the construction is substantially the same as Fig. 2 except that the water pressure is supplied from an elevated tank 85 to the high pressure cylinder and from a tank at a lower elevation to the low pressure
 110 cylinder, this latter tank being indicated by the numeral 86. It will be understood of course that in both arrangements shown in Figs. 2 and 3, the governor proper is the same as shown in Fig. 1.
 115

Instead of employing the inertia wheel 78 and its sleeve 77, the valve rod 7 may be extended above the head 10 and may carry idler pulleys 87 and 88 as shown in Fig. 4 of the drawings and an inertia wheel
 120 mounted upon a counter-shaft 89 and indicated by the numeral 90 may be driven from the prime mover 91 through the medium of a belt 92 trained over the pulleys 87 and 88. Under conditions of acceleration,
 125 the stress would be placed principally upon the lower stretch of the belt 92 thereupon downward pressure would be brought to bear against the pulley 88 thereby lowering the valve rod and the valve carried
 130

thereby whereas on the other hand, a condition of retardation would result in the valve rod being elevated. It will be readily understood that in place of employing oil, water may be fully as well employed and that various other modifications of this character may be made without in any way departing from the principles of the invention.

What is claimed is:—

1. A governor comprising a piston arranged for the control of power supplying means for a prime-mover, a valve, a valve-rod carrying said valve, means operatively connected with said rod for controlling the same and responsive to conditions of speed, inertia controlling means associated with the second mentioned means and responsive to conditions of acceleration, including a lever having operative connection with said valve-rod, a lever-arm, and tension-controlling means between said lever and said lever-arm, said lever-arm being adapted to be oscillated upon the movement of said piston.

2. A governor comprising a piston arranged for the control of power supplying means for a prime-mover, a valve, a valve-rod carrying said valve, means operatively connected with said rod for controlling the same and responsive to conditions of speed, and inertia-controlling means associated with the second mentioned means and responsive to conditions of acceleration and retardation, including a lever having operative connection with said valve-rod, a lever-arm, and tension-controlling means between said lever and said lever-arm, said lever-arm being adapted to be oscillated upon the movement of said piston.

3. A governor comprising a piston arranged for the control of power-supplying means for a prime-mover, a valve, a rod carrying said valve, means having operative connection with the valve-rod and responsive to conditions of speed for raising and lowering said valve-rod, and inertia-controlling means associated with the second mentioned means and movable independently thereof and responsive to conditions of acceleration, said inertia controlling means being arranged to actuate said valve-rod through the medium of the means responsive to conditions of speed, including a lever having operative connection with said valve-rod, a lever-arm, and tension-controlling means between said lever and said lever-arm, said lever-arm being adapted to be oscillated upon the movement of said piston.

4. A governor comprising a piston arranged for the control of power supplying means for a prime-mover, a valve, a valve-rod, means having operative connection with the valve-rod and responsive to conditions of speed for raising and lowering said

valve-rod, and inertia-controlling means associated with the second mentioned means and movable independently thereof and responsive to conditions of acceleration and retardation including a lever having operative connection with said valve-rod, a lever-arm, and tension-controlling means between said lever and said lever-arm, said lever-arm being adapted to be oscillated upon the movement of said piston.

5. In a governor, a valve rod, a sleeve shaft mounted to rotate upon the valve rod, governor heads carried by the sleeve shaft, means connecting the heads for relative movement and responsive to conditions of speed, one of said heads being connected with the valve rod, and inertia controlling means responsive to conditions of acceleration, mounted upon the said sleeve shaft and operatively connected with that one of the shafts carrying the governor head which is connected with the valve rod, a lever having operative connection with said valve-rod, a lever-arm, tension-controlling means between said lever and said lever-arm, and means for controlling the supply of the motive agent for a prime-mover, said lever-arm being adapted to be oscillated by the action of said last-referred to means.

6. In a governor, a valve rod, sleeve shafts mounted to rotate upon the valve rod, governor heads carried by the sleeve shafts, means connecting the heads for relative movement and responsive to conditions of speed, one of said heads being connected with the valve rod, and inertia controlling means responsive to conditions of acceleration, and retardation, a lever having operative connection with said valve-rod, a lever-arm, tension-controlling means between said lever and lever-arm, and means for controlling the supply of the motive agent for a prime-mover, said lever-arm being adapted to be oscillated by the action of said last-referred to means.

7. In a governor, a valve rod, sleeve shafts mounted to rotate about the valve rod, a governor head carried by each sleeve shaft, means connecting the governor heads and responsive to conditions of speed for relatively moving said governor heads, one of said heads being connected with the valve rod, a sleeve fitted upon the other governor head, and independently rotatable thereon, the last mentioned sleeve being formed with inclined slides, pins carried by that sleeve shaft which supports the governor head which is connected to the valve rod, said pins projecting into the slots in the said sleeve, and an inertia controlling wheel fixed upon the said sleeve, a lever having operative connection with said valve-rod, a lever-arm, tension-controlling means between said lever and said lever-arm, and means for controlling the supply of the motive agent for

a prime-mover, said lever-arm being adapted to be oscillated by the action of said last-referred to means.

8. In a governor, a valve rod, a governor
5 means responsive to conditions of speed and including a rotatable head, said head being eccentric with respect to the valve rod, an oscillatory member having a portion bearing against the head, and an arm upon the
10 valve rod having operative connection with the oscillatory member.

9. In a device of the character described, a governor means responsive to conditions of speed, including a rotatable head, said
15 head being eccentric with respect to the valve-rod, an oscillating member having a portion bearing against said head and an arm upon said valve-rod having operative connection with said oscillating member, a
20 lever having operative connection with said valve-rod, a lever-arm, tension-controlling means between said lever and said lever-arm, and means for controlling the supply of the motive agent for a prime-mover, said lever-arm being adapted to be oscillated by the
25 action of said last-referred to means.

10. In a governor, a valve rod, governor means operatively connected to the valve rod, a manually operable lever having operative
30 connection with the valve rod, a piston, a cylinder in which said piston works, means for supplying pressure to said cylinder, a valve carried by the valve rod and controlling the supply of pressure to the cylinder,
35 and tension means operatively connected with the manually operable lever and arranged to have its tension varied by the movement of said piston.

11. In a governor, a cylinder, a piston
40 working in said cylinder and arranged for the control of power supplying means for the prime mover, means for supplying fluid under pressure to said cylinder, a valve, a valve rod, means connected with the valve
45 rod responsive to conditions of speed for controlling the movement of said rod, a lever having operative connection with the valve rod, a lever arm, said lever arm being adapted to be oscillated upon movement of
50 the piston, and tension means connecting the lever arm and the said lever, differential pressure-chambers, said valve being adapted to control the different pressures therein and inertia-controlling means responsive to conditions of acceleration.

12. In a governor, a cylinder, a piston working in said cylinder and arranged for the control of power supplying means for the prime mover, means for supplying fluid
60 under pressure to said cylinder, a valve, a valve rod, means connected with the valve rod responsive to conditions of speed for controlling the movement of said rod, a lever having operative connection with the
65 valve rod, a lever arm, said lever arm being

adapted to be oscillated upon movement of the piston, and adjustable tension means connecting the lever arm and the said lever, differential pressure-chambers, said valve
70 being adapted to control the different pressures therein and inertia-controlling means responsive to conditions of acceleration.

13. In a governor, a cylinder, a piston working in said cylinder and arranged for the control of power supplying means for the prime mover, means for supplying fluid
75 under pressure to the cylinder, a valve, a valve rod, means connected with the valve rod and responsive to conditions of speed for controlling the movement of said rod, a cross head to which the piston is connected, a lever having operative connection with the valve rod, a lever arm mounted for oscillatory movement and having a portion
80 resting upon the cross head and so arranged that movement of the piston will oscillate said lever arm, and connection between the lever arm and the lever, differential pressure-chambers, said valve being adapted to control the different pressures therein and inertia-controlling means responsive to conditions of acceleration.

14. In a governor, a cylinder, a piston working in said cylinder and arranged for the control of power supplying means for the prime mover, means for supplying fluid
95 under pressure to the cylinder, a valve, a valve rod, means connected with the valve rod and responsive to conditions of speed for controlling the movement of said rod, a cross head to which the piston is connected, a lever having operative connection with the valve rod, a lever arm mounted for oscillatory movement and having a portion resting upon the cross head and so arranged
100 that movement of the piston will oscillate said lever arm, and tension means connecting the lever arm and lever, differential pressure-chambers, said valve being adapted to control the different pressures therein and inertia-controlling means responsive to conditions of acceleration.

15. In a governor, a cylinder, a piston working in said cylinder and arranged for the control of power supplying means for the prime mover, means for supplying fluid
115 under pressure to the cylinder, a valve, a valve rod, means connected with the valve rod and responsive to conditions of speed for controlling the movement of said rod, a cross head to which the piston is connected, a lever having operative connection with the valve rod, a lever arm mounted for oscillatory movement and having a portion resting upon the cross head and so arranged that movement of the piston will oscillate said lever arm, and adjustable tension means connecting the lever arm and lever, differential pressure-chambers, said valve being
120 adapted to control the different pressures
125
130

therein and inertia-controlling means responsive to conditions of acceleration.

16. In a governor, a valve-rod, means operatively connected to the rod for controlling the same and responsive to speed-conditions, and inertia controlling means including a rotatable head, said head being eccentric with respect to the valve-rod, an oscillating member having a portion bearing against said head, and an arm upon said valve-rod having operative connection with said oscillating member.

17. In a governor, a cylinder, a piston working in said cylinder and arranged for the control of power supplying means for a prime mover, means for supplying fluid under pressure to one end of said cylinder, means for supplying fluid under a greater pressure to other end of said cylinder, a valve controlling the supply of fluid to the last mentioned end of the cylinder, a valve rod, a lever operatively connected with the valve rod, a cross-head connected to the piston-rod, a lever-arm having an acute-angled disposed portion controlled by the action of said cross-head, a resilient or tension connection between said lever and said lever arm.

18. In a governor, a cylinder, a piston working in said cylinder and arranged for the control of power supply for a prime mover, means for supplying fluid under pressure to one end of said cylinder, means for supplying fluid under a greater pressure to the other end of said cylinder, a valve controlling the supply of fluid to the last mentioned cylinder, a valve rod, means connected with the valve rod for controlling the movement of the same and responsive to speed conditions, a lever having operative connection with the valve rod, an oscillatory lever arm, a cross head to which the piston is connected, said lever arm cooperating with said cross head and adapted to be oscillated through the movement of said cross head, and connection between said lever and said lever arm.

19. In a governor, a cylinder, a piston working in said cylinder and arranged for the control of power supply for a prime mover, means for supplying fluid under pressure to one end of said cylinder, means for

supplying fluid under a greater pressure to the other end of said cylinder, a valve controlling the supply of fluid to the last mentioned cylinder, a valve rod, means connected with the valve rod for controlling the movement of the same and responsive to speed conditions, a lever having operative connection with the valve rod, an oscillatory lever arm, a cross head to which the piston is connected, said lever arm cooperating with said cross head and adapted to be oscillated through the movement of said cross head, and a resilient connection between said lever and said lever-arm, the pressure of which is delivered to said lever and which pressure is controlled by said lever-arm, through the action of said cross-head and said piston.

20. In a governor, a cylinder, a piston working in said cylinder and arranged for the control of power supplying means for a prime mover, a fluid pressure chamber in communication with the cylinder at one end thereof, a fluid pressure chamber in communication with the cylinder at the other end thereof, a valve controlling the way of communication between the last mentioned chamber and the last mentioned end of the cylinder, a valve rod, means responsive to speed conditions and connected to the valve rod for controlling the movement of the same, a pressure supply chamber, means for admitting fluid under pressure to said chamber, an exhaust from said chamber, said chamber being in communication with the last mentioned fluid pressure chamber, a receiving chamber in communication with the first mentioned fluid pressure chamber, a float in the receiving chamber, and a valve controlling the supply of fluid under pressure to the pressure supply chamber and controlling the exhaust from said chamber, said valve having operative connection with said float.

In testimony that I claim the foregoing as my own, I have hereto affixed by signature in the presence of two witnesses.

NATHANIEL BALDWIN.

Witnesses:

J. W. ORROCK,
WM. BROADBENT.