G. M. RICHARDS.

AUTOMATIC PRESSURE GOVERNOR.

APPLICATION FILED OCT. 26, 1906.

899,263.

Patented Sept. 22, 1908.

2 SHEETS—SHEET 1.

Fig. 1.

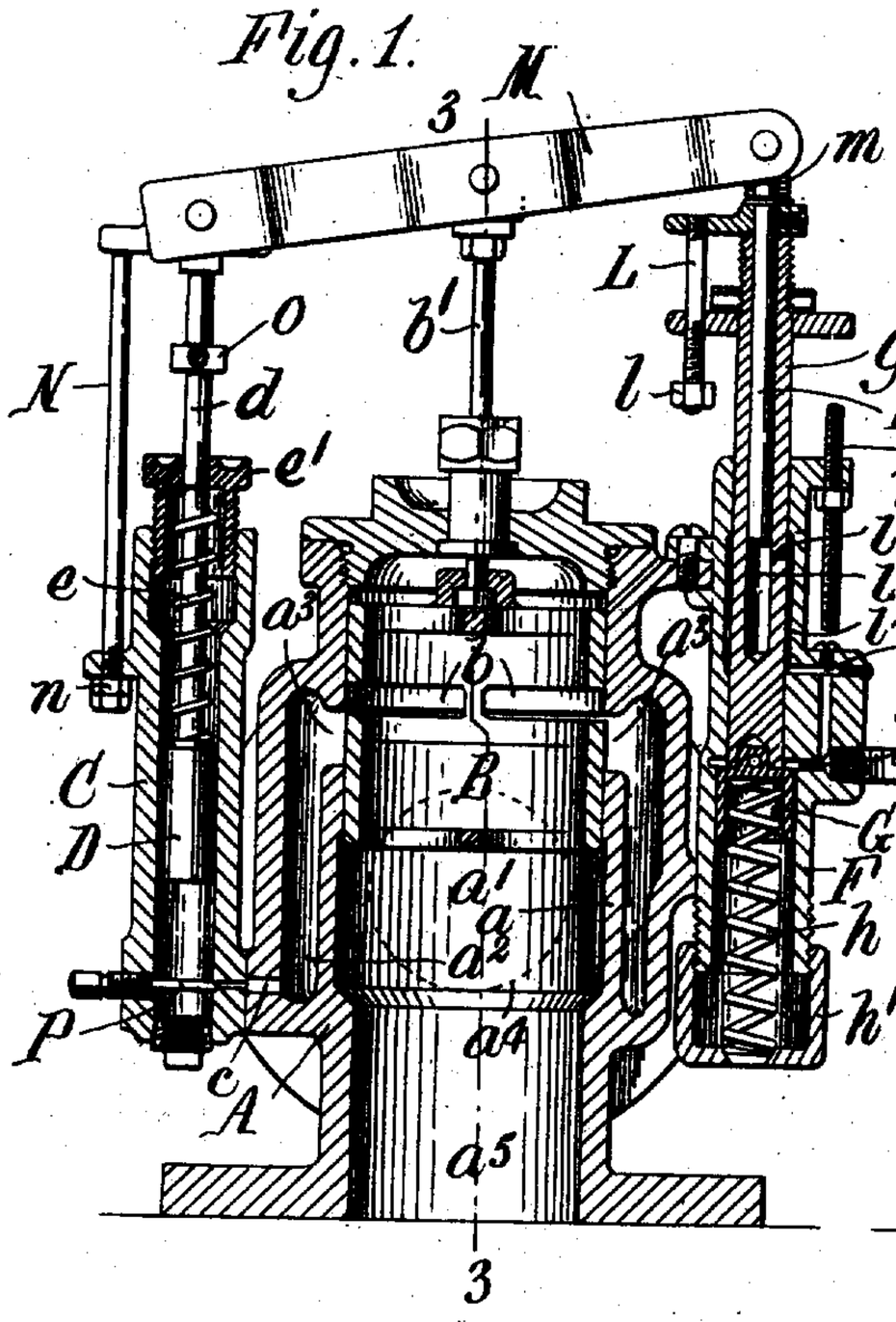


Fig. 3.

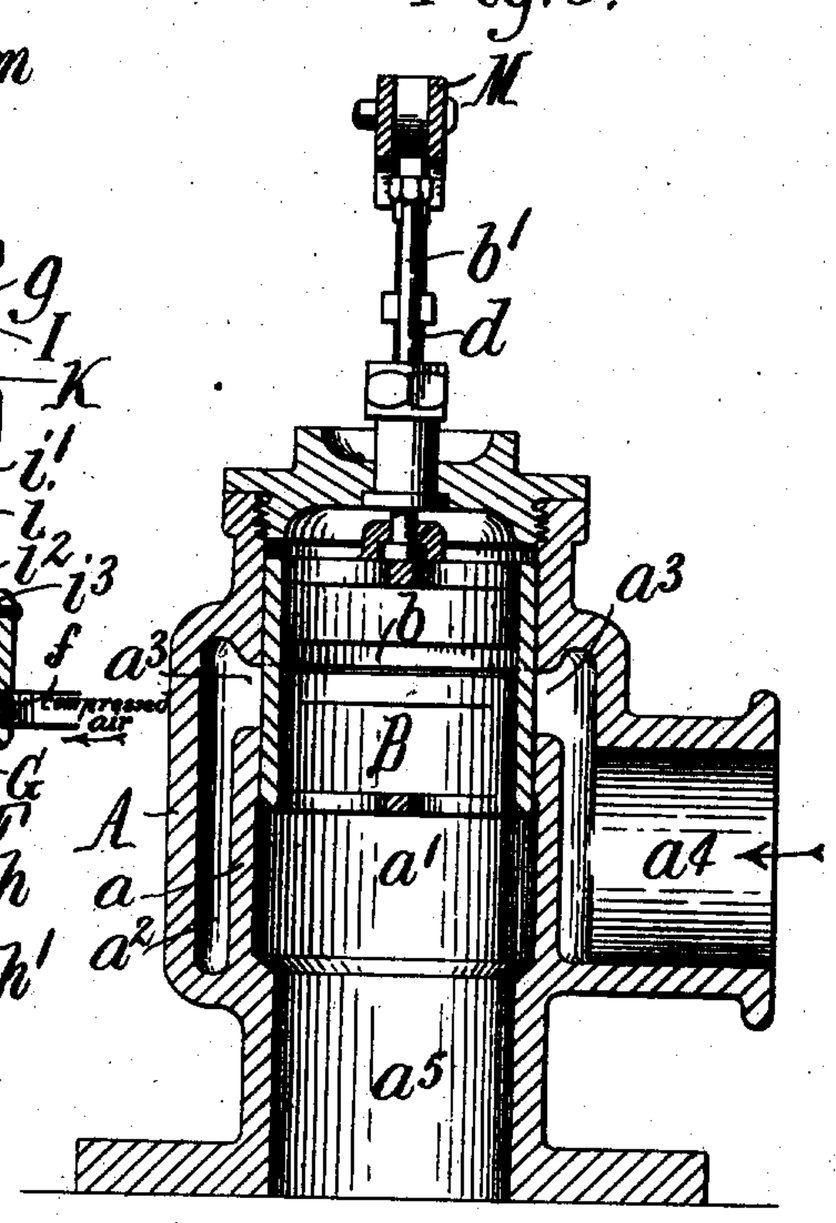


Fig. 2.

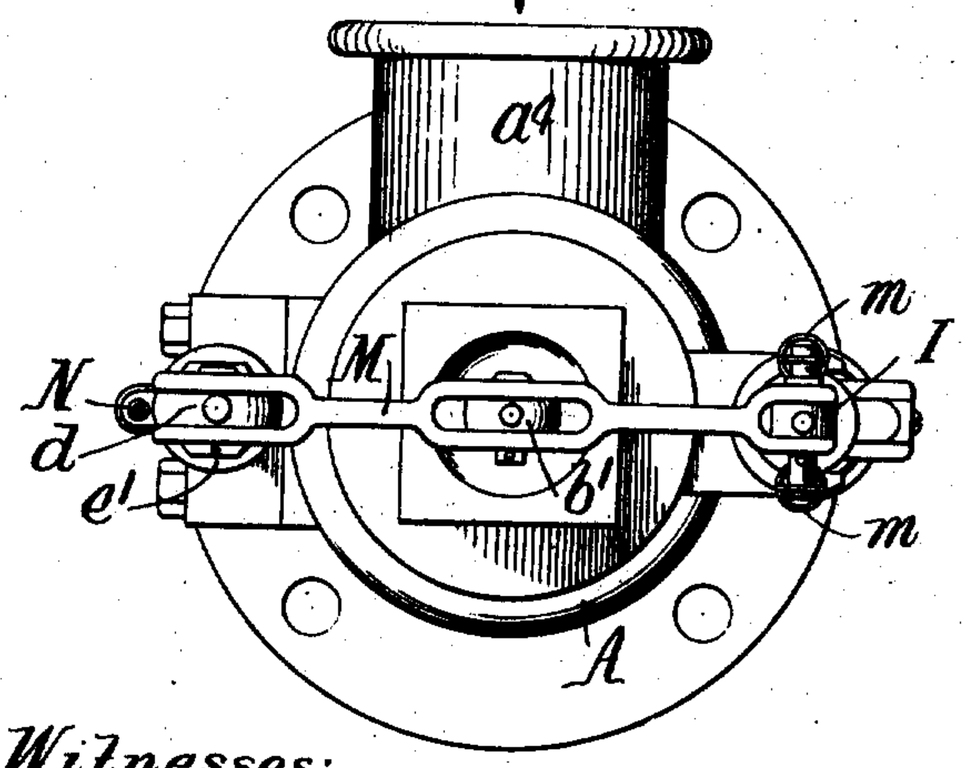
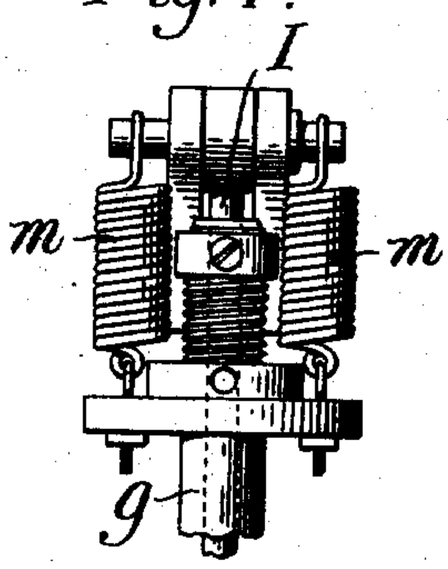


Fig. 4.



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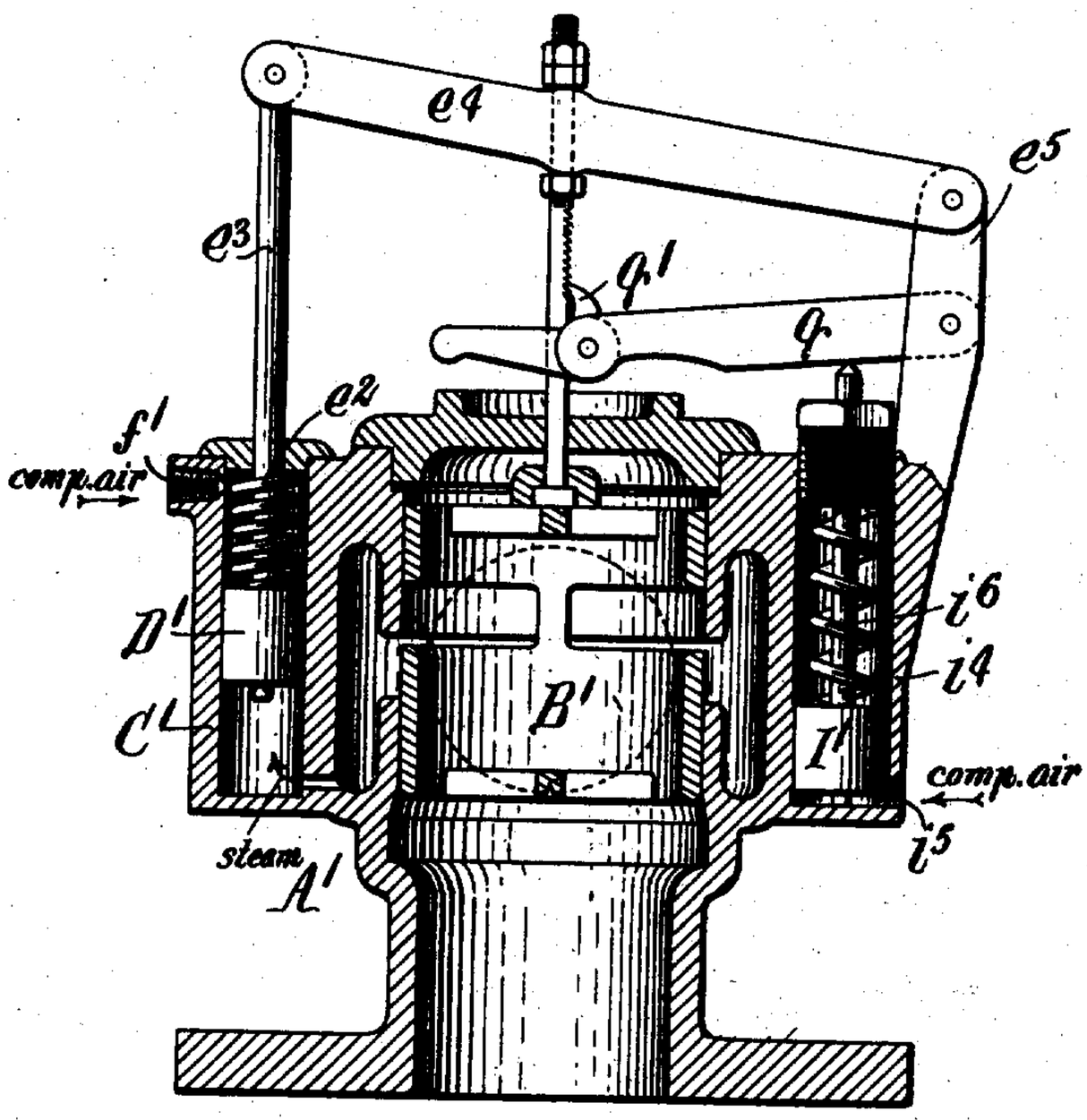
2 SHEETS—SHEET 2.

Fig. 5.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC PRESSURE-GOVERNOR.

No. 899,263. Specification of Letters Patent. Patented Sept. 22, 1908.

Application filed October 26, 1906. Serial No. 340,640.

To all whom it may concern:

Be it known that I, GEORGE M. RICHARDS, a citizen of the United States, residing at Erie, in the county of Erie and State of Pennsylvania, have invented a new and useful Improvement in Automatic Pressure-Governors, of which the following is a specification.

This invention relates to automatic pressure governors for pumping engines.

The primary object of the invention is to provide an efficient and reliable pressure governor for gradually increasing the supply of steam to the engine in such manner as the pressure and consequently the load builds up, and thereby maintain a uniform speed of the engine until a predetermined maximum pressure of the air or other fluid being pumped is reached, and for regulating the steam supply to maintain such a predetermined maximum pressure of the air or other fluid, and also for governing against variations in the steam pressure.

Another object of the invention is to improve the construction of such pressure governors in the respects hereinafter described and set forth in the claims.

In the accompanying drawings, consisting of two sheets: Figure 1 is a sectional elevation of a pressure governor embodying the invention. Fig. 2 is a plan view thereof. Fig. 3 is a transverse sectional elevation thereof in line 3—3, Fig. 1. Fig. 4 is a side elevation showing the connections between the air pistons and the valve lever. Fig. 5 is a sectional elevation of a pressure governor of modified construction.

Like letters of reference refer to like parts in the several figures.

The governor shown in Figs. 1—4 will be first described.

A represents a valve casing which is arranged in the steam supply pipe of the engine for operating the pump or compressor, and B the valve for controlling the supply of steam to the engine. The valve casing is preferably divided by a cylindrical partition a into a valve chamber a' and a surrounding annular steam chamber a^2 which communicate by an opening a^3 in the partition. The steam enters the annular chamber by a port a^4 in one side of the casing and passes out of the casing by a port a^5 at one end of the valve chamber. The steam valve is of the ordinary balanced type consisting of an open-ended hollow cylindrical shell arranged to slide endwise in the valve chamber and having side ports b adapted to register with the opening a^3 in the partition a. The passage for the steam through this opening is increased or decreased more or less by shifting the valve endwise. The opening a^3 in the partition is preferably arranged near one end of said partition where it will not be opposite to the inlet port of the casing, so that the inflowing steam will not impinge directly against the valve and the side pressure on the valve will not be so great. The steam valve has a stem b' projecting out of one end (the upper end in the construction shown) of the valve casing.

C represents a steam cylinder or piston chamber, preferably arranged vertically at one side of the valve casing and connecting by a port c at its lower end with the annular steam chamber a^2. A piston D is arranged to reciprocate in the cylinder and has a rod d which projects out of the cylinder and is connected to the steam valve for shifting it, as hereinafter described. Steam entering the cylinder beneath the piston through the port c tends to lift the piston, and a spring e between the piston and the upper end of the cylinder acts in opposition to the steam to lower the piston. The spring shown surrounds the piston rod and bears at its upper end against an adjustable screw cap e' by which its tension can be regulated.

F represents a cylinder, preferably arranged vertically at the opposite side of the valve casing. The upper end of the cylinder is connected by passages f, and a pipe (not shown) with the receiver or system supplied with air or other fluid under pressure by the pump, so that air enters said cylinder at a pressure proportional to that prevailing in the receiver or system.

G represents a piston arranged to reciprocate in the air cylinder and having a rod g passing through the upper end of the cylinder for connection with the steam valve. The air piston is lifted against the air pressure above the same by a suitable spring h. The spring shown is arranged between the piston and a screw cap h' at the lower end of the cylinder for adjusting the tension of the spring. The piston rod g is hollow or provided with a chamber i for an auxiliary piston I which is also connected to the steam valve and is movable with the primary piston G and is also movable independently thereof. The lower end of the auxiliary piston chamber is

also connected with the compressed air passage or pipe by a port i' in the piston rod, a channel or chamber i^2 in the air cylinder with which said port connects in all positions of the primary piston, and a branch passage i^3, or in any other manner, for admitting the compressed air to the auxiliary piston chamber in the different positions of the primary piston.

The downward movement of the primary piston is limited by an adjustable stop of any suitable sort, such as the screw K arranged on the air cylinder to strike a projection on the piston rod g, and the upward movement of the auxiliary piston is likewise limited by an adjustable stop, such as a screw L connected to the auxiliary piston and having an adjustable nut l to strike a projection on the primary air cylinder.

M represents a lever which is connected between its ends in any suitable manner to the stem of the steam valve. One end of the lever is pivoted to the auxiliary air piston I and is also yieldingly connected, as by springs m, to the rod of the primary air piston G. The opposite end of the lever is pivoted to the rod of the steam piston D.

The operation of the governor is as follows: The tension of the spring e for the steam piston is so adjusted by its screw cap e' that the piston will be raised by the steam pressure beneath it far enough to partially compress the spring and move the steam valve B through the lever M to a position such that the proper amount of steam will be admitted to the engine for driving it at the desired speed at the commencement of the compressing operation. The auxiliary air piston I affords a fulcrum for the lever to enable the movement of the valve by the steam piston. Should the steam pressure decrease, the piston will be moved by its spring to open the steam valve wider to give more steam to the engine, while if the steam pressure increases it will raise the piston and partially close the steam valve and reduce the amount of steam to the engine, thus maintaining a constant speed of the engine. The steam valve is prevented from completely closing and stopping the engine by any suitable stop device, such, for example, as the rod N connected to the steam piston rod and provided with an adjustable nut n for engagement with a projection on the steam cylinder. The primary air piston G is exposed to the pressure of the air or other fluid being compressed or pumped, and as the pressure builds up the piston will be gradually moved against the action of its spring and through the springs and lever M will gradually open the steam valve wider, thus keeping the speed of the engine constant notwithstanding the increasing load. The steam piston rod d serves as a fulcrum support for the lever M when moved by the air pistons. The stop screw K is adjusted to arrest the opening movement of this air piston G when the predetermined maximum air pressure is reached. This air piston will reciprocate with fluctuations in the air pressure below the predetermined maximum and thus enlarge or reduce the steam passage of the valve to properly govern the engine. Should the air pressure rise above the desired maximum, it cannot further move the primary air piston G, but the increased pressure will move the auxiliary air piston I against the action of the springs which, through the lever M, will partially close the valve and slow down the engine, thus maintaining a practically constant maximum air pressure. The stop L will prevent the complete closing of the steam valve and stopping of the engine. The governor thus operates automatically to govern the speed of the engine as required by variations in load and steam pressure and insures a practically constant air pressure.

Fairly good governing in conformity with fluctuations in the air pressure only can be obtained by securing the steam piston D from movement so that its rod d will act as a fixed fulcrum for the lever M. A collar O adjustably secured on the piston rod d is shown for this purpose, By sliding the collar down on the rod against the screw cap e' on the steam cylinder and securing it, the rod will be held stationary. Any other securing means could be employed. When the steam piston is fixed, the valve will be operated by the compressed air only.

P represents an adjustable valve for regulating the size of the port c connecting the steam cylinder with the annular steam chamber of the valve casing, to prevent sudden variations of steam pressure in the steam cylinder which would be caused by an unusually early cut-off of the steam engine.

The governor could be of other construction and automatically govern the engine in substantially the manner described. Fig. 5 shows a different construction in which A′ is the steam valve casing, and B′ the balanced valve. A piston D′ in a cylinder C′ is moved in one direction against the action of a spring e^2 by steam admitted at one end of the cylinder and the piston is connected by a rod e^3 and lever e^4 to the stem of the steam valve. The lever e^4 in this construction is fulcrumed to a fixed support e^5. Compressed air from the system or receiver supplied by the pump enters the opposite end of the cylinder through a port f' and, aided by the spring e^2, will move the piston D′ to gradually open the valve wider to give more steam to the engine as the air pressure and load increase. An auxiliary air piston I′ in a cylinder i^4 is employed for reducing the steam supply and slowing down the engine when the predetermined air pressure is reached. Compressed

air enters the cylinder at i^5 and when the desired pressure is reached will move the auxiliary piston against the action of a spring i^6. The rod of the auxiliary piston I′ actuates a lever q provided with a pawl q' which engages teeth on the stem of the steam valve. This piston, like the auxiliary piston in the other construction, is not brought into action unless the predetermined maximum pressure is exceeded, when it will be moved and shift the valve B′ to restrict the supply of steam to the engine.

In both constructions described a single valve controls the steam or motive fluid to the engine and the several controlling devices are actuated by the pressure of the motive fluid and of the air or other fluid compressed by the pump to operate upon this one valve. This same result could be accomplished by still other constructions.

I claim as my invention:

1. The combination of a valve controlling the supply of motive fluid to an engine, a device operated by fluid pressure produced by said engine for gradually opening said valve wider as said pressure increases, and a normally inactive auxiliary device operated by the fluid pressure created by the engine to move said valve in opposition to said first mentioned device, substantially as set forth.

2. The combination of a valve controlling the supply of steam to an engine, a primary piston operated by fluid pressure produced by said engine for gradually opening said valve wider as said pressure increases, and a normally inactive auxiliary piston operated by said fluid pressure when a predetermined pressure is reached to move said valve in opposition to said primary piston, substantially as set forth.

3. The combination of a valve controlling the supply of motive fluid to an engine, means controlled by the pressure of the motive fluid for shifting said valve in accordance with fluctuations in said pressure, means operated by fluid pressure produced by said engine and connected to said valve for shifting the same in accordance with variations in the fluid pressure produced by said engine, and a normally inactive auxiliary device operated by the fluid pressure produced by said engine to shift said valve when a predetermined pressure is reached, substantially as set forth.

4. The combination of a valve controlling the supply of steam to an engine, a piston controlled by the steam pressure for shifting said valve in accordance with fluctuations in the steam pressure, and a piston operated by fluid pressure produced by said engine and connected to said valve for shifting the same in accordance with variations in the fluid pressure produced by said engine, substantially as set forth.

5. The combination of a valve controlling the supply of steam to an engine, a piston controlled by the steam pressure for shifting said valve in accordance with fluctuations in the steam pressure, a piston operated by fluid pressure produced by said engine and connected to said valve for shifting the same, and a normally inactive piston operated by said fluid pressure when a predetermined pressure is reached for moving said valve to reduce the supply of steam to the engine, substantially as set forth.

6. The combination of a valve controlling the supply of steam to an engine, a device controlled by the steam pressure, a device operated by fluid pressure produced by said engine, and a lever connected between its ends to said valve and at opposite ends to said two devices, substantially as set forth.

7. The combination of a valve controlling the supply of steam to an engine, a device controlled by the steam pressure, a device operated by fluid pressure produced by said engine, a lever connected between its ends to said valve and at opposite ends to said two devices, and a normally inactive auxiliary device controlled by the fluid pressure produced by the engine and also connected to said lever, substantially as set forth.

8. The combination of a valve controlling the supply of motive fluid to an engine, a primary fluid-operated device having a yielding connection with said valve for moving it in one direction, and an auxiliary device which moves with said primary device and is connected to said valve and which is operated by fluid pressure to move said valve in the opposite direction, substantially as set forth.

9. The combination of a valve controlling the supply of motive fluid to an engine, a primary fluid-operated piston having a yielding connection with said valve for moving it in one direction, and an auxiliary piston which is arranged in a chamber in said primary piston and is connected to said valve and is operated by fluid pressure to move said valve in the opposite direction, substantially as set forth.

10. The combination of a valve controlling the supply of motive fluid to an engine, a primary fluid-operated device having a yielding connection with said valve for moving it in one direction, an auxiliary device which moves with said primary device and is connected to said valve and which is operated by fluid pressure to move said valve in the opposite direction, and adjustable stops for limiting the operative movements of said devices and the valve, substantially as set forth.

Witness my hand, this 22d day of October, 1906.

GEORGE M. RICHARDS.

Witnesses:
J. M. STEARNS,
WM. J. SELL.