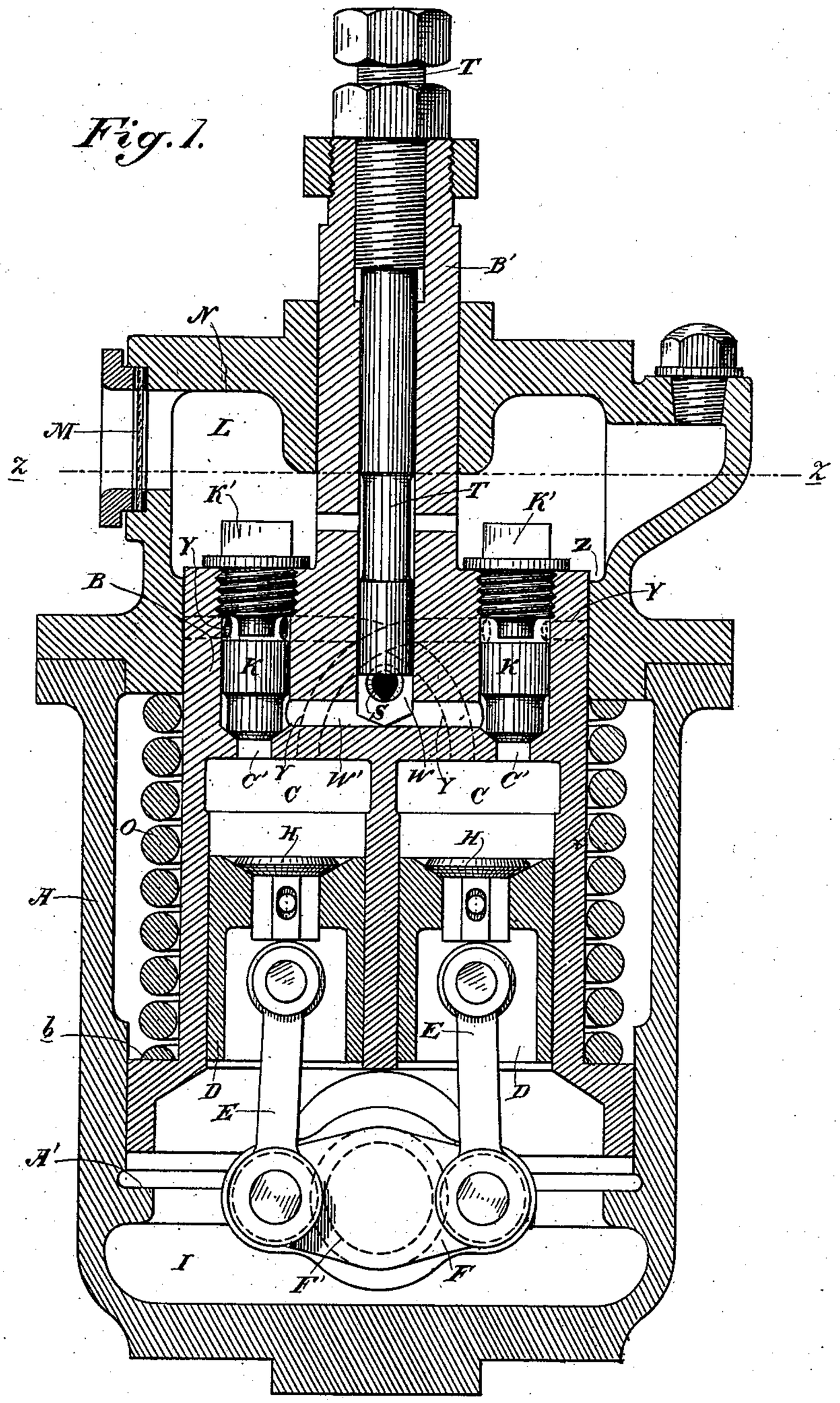
(No Model.) 3 Sheets—Sheet 1.

G. E. DOW.

ENGINE GOVERNOR.

No. 504,205. Patented Aug. 29, 1893.

Fig. 1.



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(No Model.) 3 Sheets—Sheet 2.

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Fig. 2.

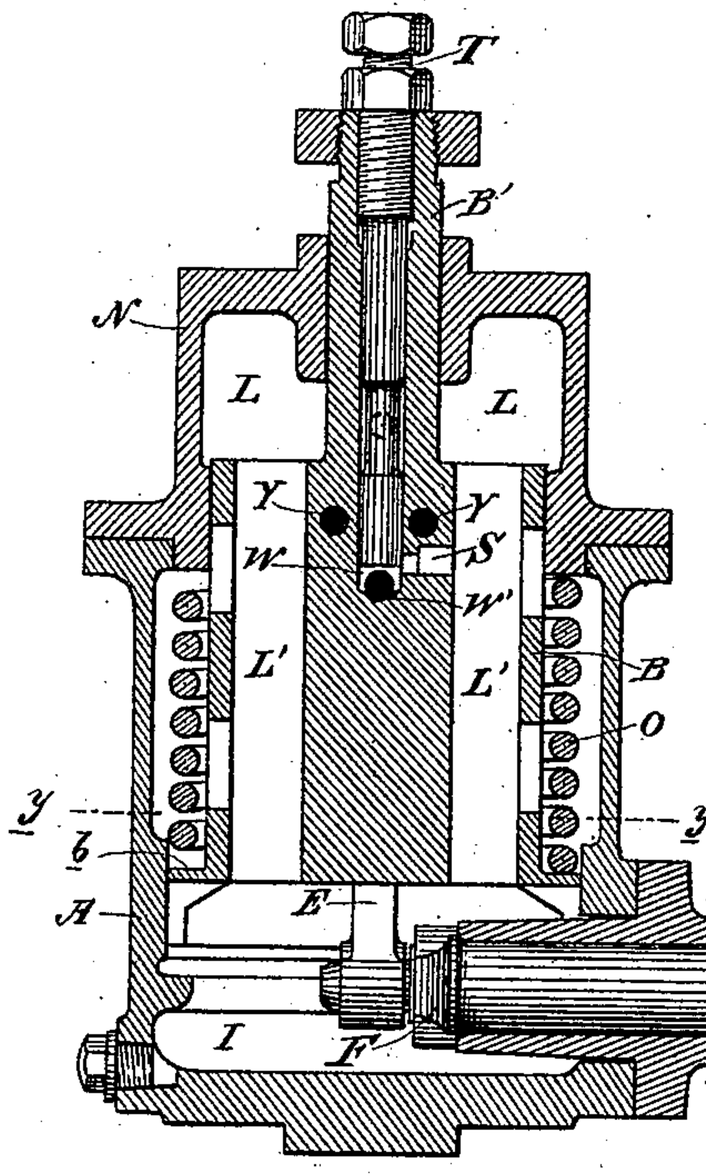


Fig. 3.

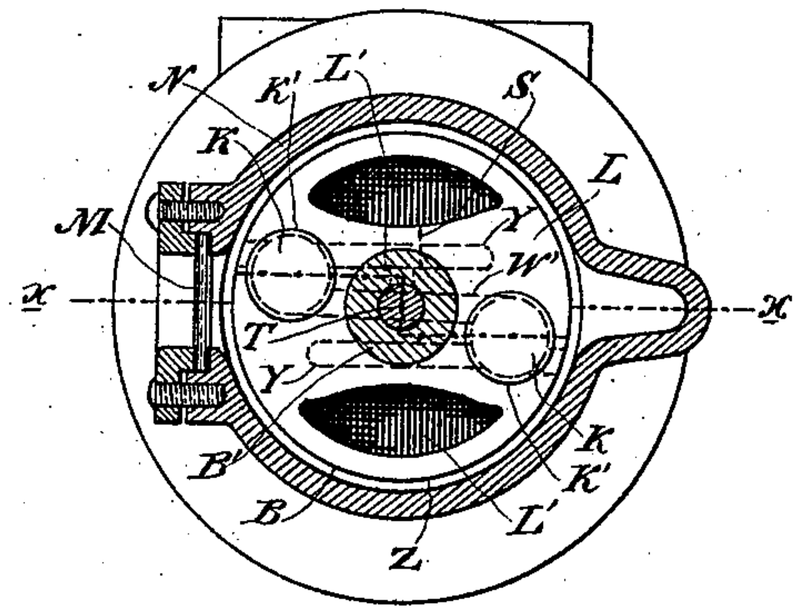
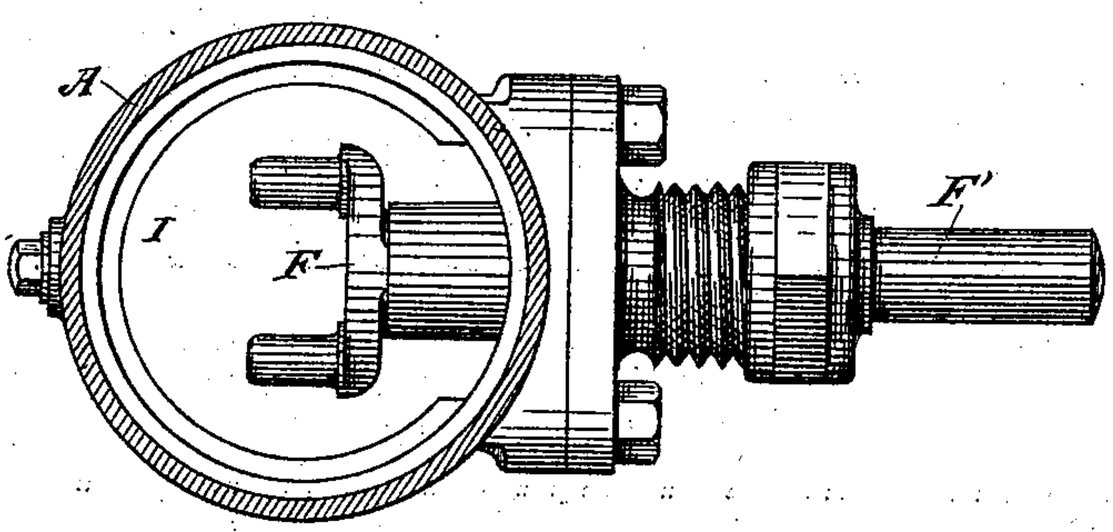


Fig. 4.



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(No Model.)

3 Sheets—Sheet 3.

G. E. DOW.

ENGINE GOVERNOR.

No. 504,205. Patented Aug. 29, 1893.

Fig. 5.

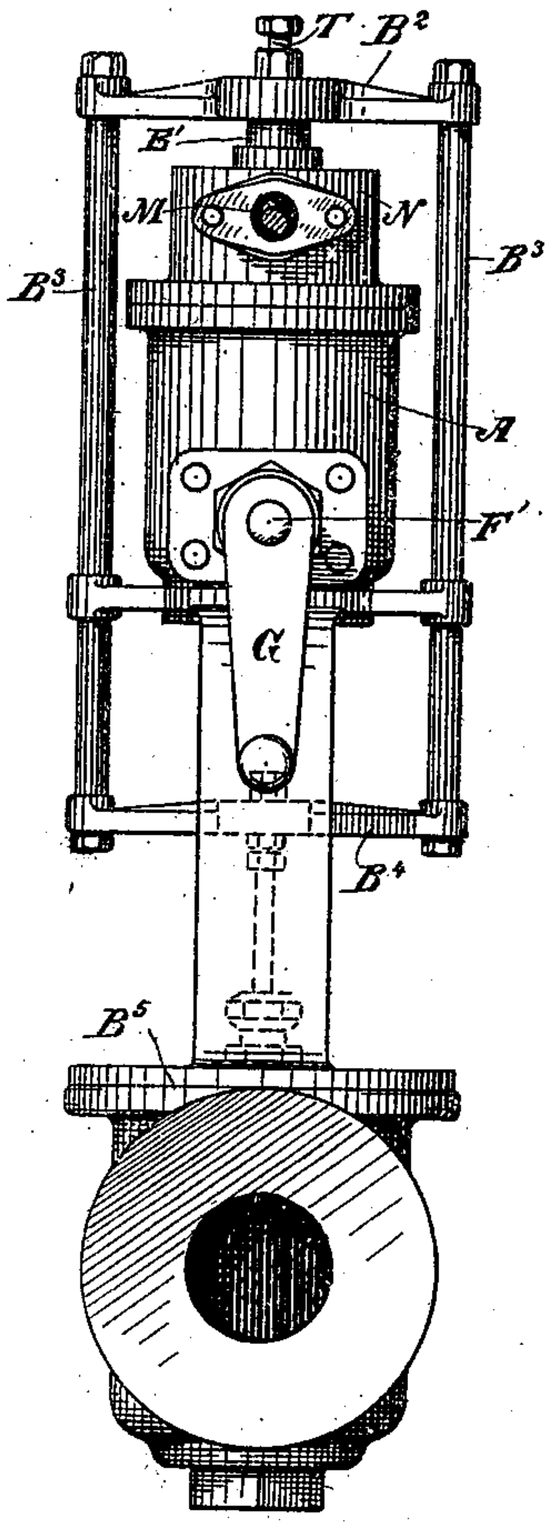
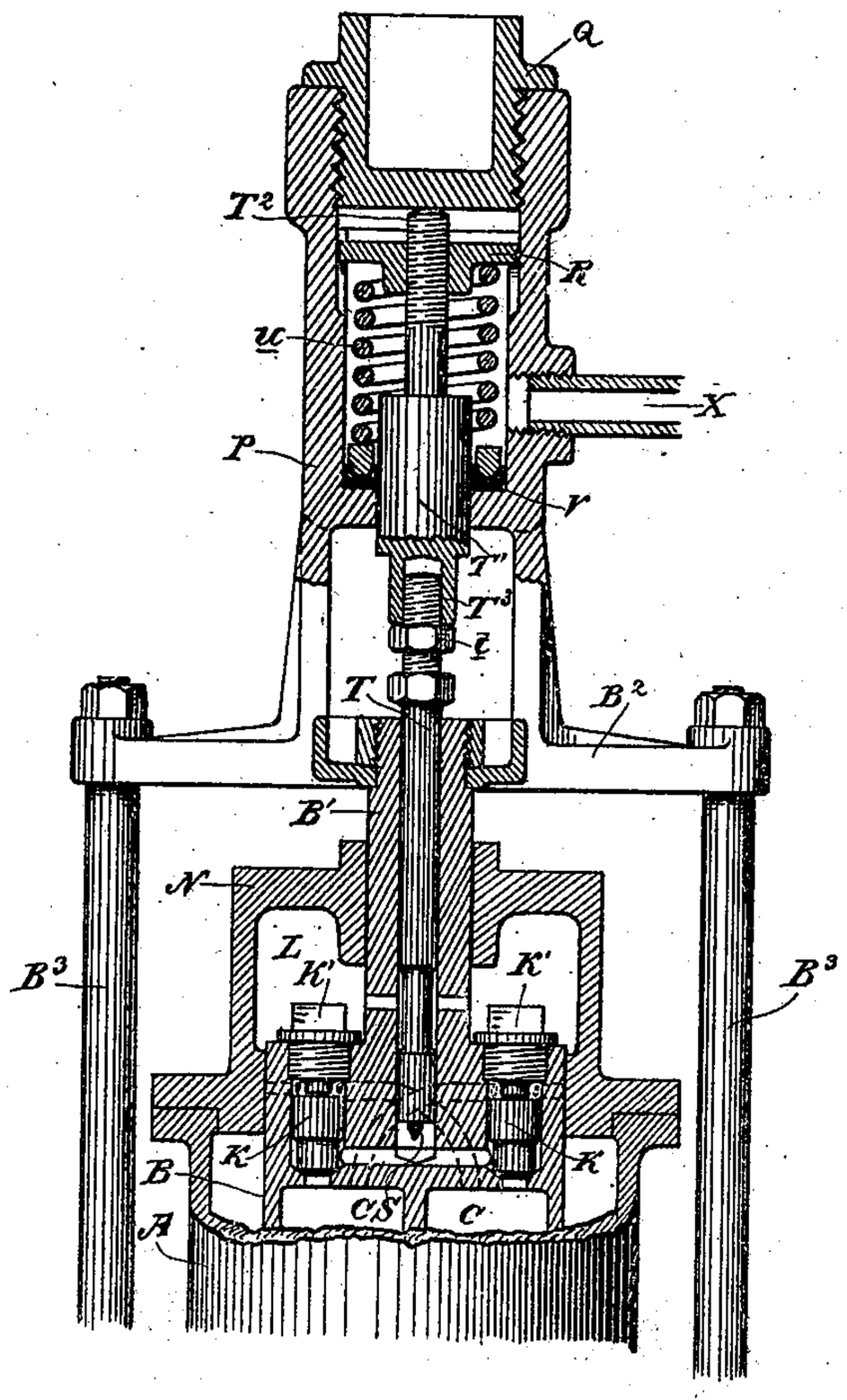


Fig. 6.



Witnesses,
G. B. Turner
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Inventor,
George E. Dow
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UNITED STATES PATENT OFFICE.

GEORGE E. DOW, OF SAN FRANCISCO, CALIFORNIA.

ENGINE-GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 504,205, dated August 29, 1893.

Application filed August 1, 1892. Serial No. 441,852. (No model.)

To all whom it may concern.

Be it known that I, GEORGE E. DOW, a citizen of the United States, residing in the city and county of San Francisco, State of California, have invented an Improvement in Engine-Governors; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to an improved speed governor or regulator which is adapted to control the admission of steam, gases or fluids, such as may be employed in operating different kinds of engines of the reciprocating piston type for the purpose of maintaining a uniform speed under variations in pressure, or resistance of the load.

It consists mainly in the employment of single oppositely acting plungers operated by the engine to be governed, and acting through the medium of a liquid fulcrum upon the engine valve, and in certain details of construction which will be more fully explained by reference to the accompanying drawings in which—

Figure 1 is a vertical section on theline *x—x* of Fig. 3. Fig. 2 is a vertical section taken at right angles to Fig. 1. Fig. 3 is a horizontal section on line *z—z* of Fig. 1. Fig. 4 is a horizontal section on line *y—y* of Fig. 2. Fig. 5 shows its connection with a valve below. Fig. 6 shows the connection of a supplemental plunger with the regulating stem T.

In a former patent issued to me June 28, 1887, No. 365,508 I have described a governor of this description which my present device resembles in some particulars.

A is a cylinder, preferably placed in a vertical position and partially filled with oil or other suitable liquid, the quantity of which may be indicated and observed by a gage tube or sight-glass M, or other means. Within this cylinder the pump chamber B is fitted to move vertically. The upper end of the pump chamber fits in the upper section or portion N of the cylinder which is made of the proper diameter at that point, and the lower end of the chamber correspondingly fits the lower portion of the chamber A, as shown. Intermediate between these two points is seated a spiral spring O, the upper portion of which rests against the inside flange of the section N, while the lower portion rests and presses upon a projecting ledge or flange *b* made by the enlargement of the pump chamber B at this point to fit the interior diameter of the cylinder A. This spring tends to press the pump chamber down, and in a state of rest, the chamber will rest upon the ledge A′ formed in the lower part of the cylinder. A weight or lever as a substitute for this spring can be used when preferred, to press downward on the pump chamber B. Within this pump chamber are fitted two plungers D. These plungers are long enough and have sufficient bearing in their respective chambers to guide themselves properly without any supplemental guides.

In the lower part of the cylinder A, beneath the pump chamber B, is an oscillating double arm lever F fixed to the inner end of a horizontal shaft F′ which extends through a suitable stuffing-box into the chamber. The opposite ends of this oscillating lever F are connected with the plungers D by pitmen E. Upon the outer end of this shaft F is a rocker arm G which is connected with any reciprocating portion of the engine so as to cause the movement of the plungers D coincident with the reciprocating movements of the engine piston.

Above the pump chamber B in the section N, is an open space L, and this space connects with the space I below the pump chamber by means of passages L′, made through chamber B (Figs. 2 and 3).

In the upper part of the pump chamber B and above the chambers of the plungers D are fitted valves K closing downwardly over the ports C′, and in the upper ends of the plungers D are upwardly opening valves H which also close downwardly, and shut the ports passing through these plungers. From the bottom of the chambers in which the valves K move, passages W′ (Figs. 1 and 2) connect with a vertical central passage W which extends upwardly from the passages W′ and within the upper part of the pump chamber B. From this passage W another passage S leads outwardly and discharges the liquid into the chamber I below the pump chamber B (Fig. 2). The pump chamber B has a smaller extension B′, as shown in the present case, which extends upwardly through the upper section N of the cylinder A, and a screw stem T fitting a corresponding opening in this extension, which practically forms an

extension of the passage W, is made movable so as to partially or entirely close the transverse passage S. This passage S preferably has its lower portion made V-shaped (Fig. 1) so that as the stem T is raised or depressed to enlarge or decrease the opening S, it will always maintain the same shape which experience has shown will be the best to produce an even flow of liquid through it.

The operation will then be as follows:—When the engine is set in motion, the plungers D are caused to reciprocate in unison with the reciprocations of the engine piston. As each plunger is drawn downwardly, its valve H opens to allow the oil or other liquid to pass from the chamber I up through the plunger into the upper part of its chamber C and above the plunger. When the plunger moves upwardly, the valve H closes, and the valve K in the plunger chamber upon that side is opened so as to allow the liquid to pass freely through the port C′ into the passage W′, and thence into the passage W from which it passes out through the transverse regulating passage S into the chamber L, thence returning through the passages L′ to the chamber I in the lower part of the cylinder A. It will be manifest that the constant reciprocations of these plungers D will tend to raise the plunger chamber B, and the extent to which this chamber is raised depends altogether upon the size or adjustment of the escape passage S by which the liquid is allowed to pass out of the passage W.

When it is desirable to connect this governor with an engine valve situated below, the upper part or extension B′ of the pump chamber B is connected (see Fig. 5) with a transverse yoke B^2 and side rods B^3 extending downwardly from the outer ends of this yoke, connecting it with another yoke B^4 below. From this yoke connection is made with the engine valve B^5 to be governed. When the plunger D upon one side is moving upward and forcing liquid through the valve K upon that side, and the other plunger D is moving downward, it is necessary to retain the valve K which is above the downwardly moving plunger, closed by a positive pressure, and in order to do this I have shown passages Y extending from each chamber C in which the plungers D move to a point above the valve of the opposite chamber; that is, the passage which leads from the chamber of the plunger which is moving upwardly, delivers a portion of the liquid into the space above the chamber containing the valve K in that plunger which at that time is moving downwardly, and, consequently, the pressure which is caused by the weighted pump chamber and its attachments and the comparatively small orifice allowed for the escape of the liquid through the passage S will serve to retain that valve K positively closed, as long as its piston is moving downward and the other one moving upward. At the same time the passage Y which connects the chamber of the downwardly moving piston with the chamber of the upwardly opening valve K, relieves the latter of all pressure and thus allows it to open freely for the escape of liquid from the plunger chamber C. This construction is especially desirable, because it also keeps both the valves closed at the instant when the engine piston and the plungers D have reached one end of their stroke, and are for the moment stationary. Unless the pump chamber B could be retained in the position which it occupied at that instant, it would sink, causing an opening of the steam valve during the pause of reversing, and would consequently act to open the valve which it is intended to govern at the instant when the return stroke commenced, and when it was least desirable to have the valve so opened. By reason of these passages Y which lead from the plunger chambers to the valve chambers, it will be seen that any tendency of the plunger chamber to sink, will cause a pressure of liquid through these passages Y into the valve chambers K, which will serve to retain the valves K closely upon their seats, and thus prevent any escape of the liquid into the discharge passages W and W′. The lift of the valves K is limited by the plugs K′ which close the upper ends of their respective chambers. The discharge through the passages S is the only point of restriction of the flow and where the entire regulation is effected by its adjustment. The passages Y are extended from a point above the valves K to open against the inner sides of the cylinder A where the pump chamber B fits it, and as long as the pump chamber does not rise above a certain point, there will be no escape for liquid through the ends of these passages, but if by any cause the pump chamber B is forced upward beyond its normal working position, the ends of the passages Y will be raised above the point Z of the top chamber L, and will thus allow a free escape of liquid from the plunger chamber C through the passages Y into this upper chamber whence it would return as previously described to the lower chamber I. By this construction I am enabled to control a governor, the entire operation of which is regulated by a single adjustable opening S and screw stem T. The valves K prevent all outward flow of oil during the period of rest of the plungers incident to reversing the movements or any prolonged pause.

In some cases it may be found desirable to regulate the movement of the screw stem T and the size of the opening S automatically, as in case where it is applied to pumps to control their speed, and in which it is not desirable to have the working pressure exceed a certain degree. In order to effect this I have shown in Fig. 6 a cylinder P connected with the upper part of the extension B′ of the pump chamber B and movable with it. In this case the upper end of the stem T screws into the bottom extension T^3 of the plunger T′. This

plunger extends through the lower end of the cylinder P, and at the point where it enters the cylinder is surrounded by cup leather packing V upon which rests a washer to receive a spring *u*. The upper end of the cylinder P is closed by a screw plug Q, and the plunger T′ has an upper extension stem T², the upper end of which rests against the screw plug Q. The upper end of this stem is screw-threaded, and upon it is fitted a circular nut or flange R loosely fitted, but which cannot revolve in the cylinder P. The lower end of spring *u* rests upon the washer at the bottom which rests upon the cup leather V, and the upper end presses against the flange or disk R. The action of this spring is to normally hold the plunger T′ up with the stem at its upper end in contact with the plug Q, and through this the stem T is also held up so that the opening S will be of the size to which the normal working speed of the engine requires it to be adjusted, the adjustment being made, as before described, by screwing the stem T up or down, and securing it with the lock-nut *t* at the bottom of the plunger extension T³.

X is a passage opening into the interior of the cylinder P and to which a small flexible pipe is to be attached to connect with the discharge of the pump, and when the pressure reaches or passes the limit which has been set, the water will be forced through the passage X into the cylinder P, and acting upon the plunger T′, will overcome the tension of the spring *u*, and thus force the plunger T′ down a little, carrying with it the stem T, and thus reducing the passage S. As soon as the engine has again reached its normal rate of speed, the tension of the spring *u* will overcome the pressure introduced through the passage X, and the plunger T′ and the stem T will again be raised, enlarging the passage S to its normal size. By this construction I have reduced the number of adjusting parts, have steadied the working of the governor and made it better applicable to the class of machinery for which it is intended.

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

1. A governor consisting of a cylinder containing liquid, a pump chamber movable therein and connected with the supply valve of the engine, alternately reciprocating plungers in the pump chamber, and deriving motion from a moving part of the engine to be governed, said plungers having upwardly opening valves in them, and upwardly opening outer valves from the plunger chambers through which the liquid is forced by the action of the plungers, in combination with passages leading from the outer valve chambers, and an adjustable or controllable transverse passage through which the liquid escapes into the chamber below the pump chamber, substantially as herein described.

2. An exterior liquid containing cylinder, a pump chamber movable therein and connected with the steam inlet valve of the engine, reciprocating plungers fitted in the pump chamber and deriving motion from a moving part of the engine, said plungers having valves for the admission of liquid from below, outlet valves in the upper part of the pump chamber through which said liquid is forced by the action of the plungers, and an adjustable or controllable discharge passage or passages through which said liquid is returned to a point below the pump chamber, in combination with passages leading from each of the plunger chambers to the outlet valve chamber of the opposite plunger whereby the outlet valve from the descending plunger chamber is closed by positive pressure supplied by the ascending plunger, substantially as herein described.

3. A governor consisting of the cylinder containing liquid, a pump chamber movable therein, and connected with the supply valve of the engine, alternately reciprocating plungers operating in corresponding and separate chambers in the pump chamber and deriving motion from a reciprocating part of the engine, inlet and outlet valves through which the liquid is pumped from below the pump chamber, passages by which the liquid is returned to the chamber below, a transverse V-shaped passage S through which the liquid passes, and the screw-stem by which the size of this passage is regulated, substantially as herein described.

4. A governor, consisting of a cylinder containing liquid, a pump chamber movable therein and connected with the supply valve of the engine, alternately reciprocating plungers operated by a moving part of the engine and having inlet and outlet valves, adjustable circulating passages, and the spring O acting upon the pump chamber to force it downwardly, substantially as herein described.

5. A governor consisting of a cylinder containing liquid, a pump chamber movable therein and connected with the engine valve to be governed, alternately reciprocating plungers operated by a moving part of the engine and moving in separate chambers in the pump chamber with inlet and outlet valves and circulating passages, and a transverse passage S with the stem T by which its size is regulated, in combination with a supplemental cylinder carried upon the upper end of the pump chamber, and having a passage by which liquid is admitted into said cylinder, a plunger moving therein and having the upper end of the adjusting stem T connected therewith, and the spring controlling said plunger, substantially as herein described.

In witness whereof I have hereunto set my hand.

GEO. E. DOW.

Witnesses:
S. H. NOURSE,
WM. F. BOOTH.