(No Model.) 2 Sheets—Sheet 1.

B. FITTS.

FLUID PRESSURE REGULATOR.

No. 333,403. Patented Dec. 29, 1885.

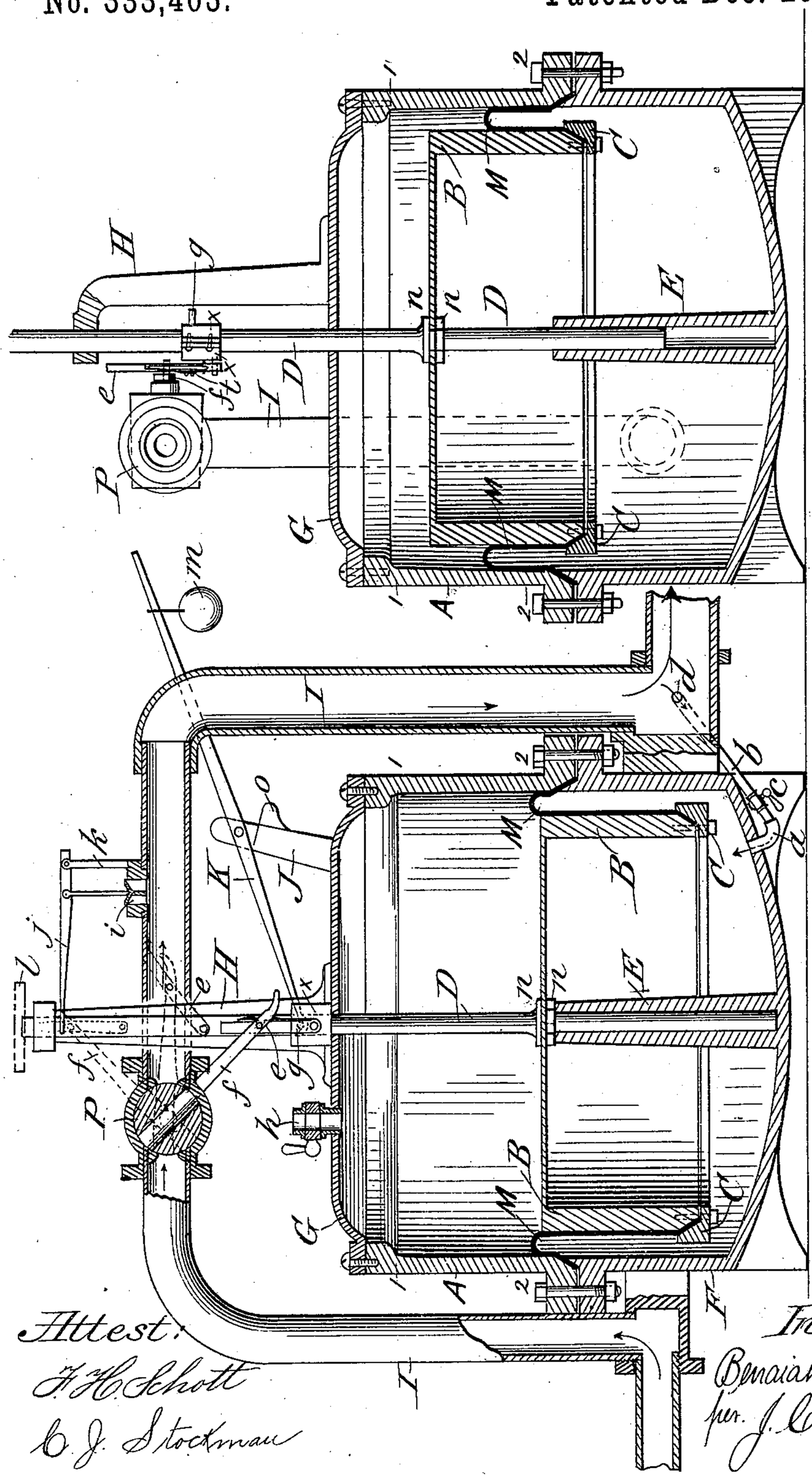

Fig. 2.

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

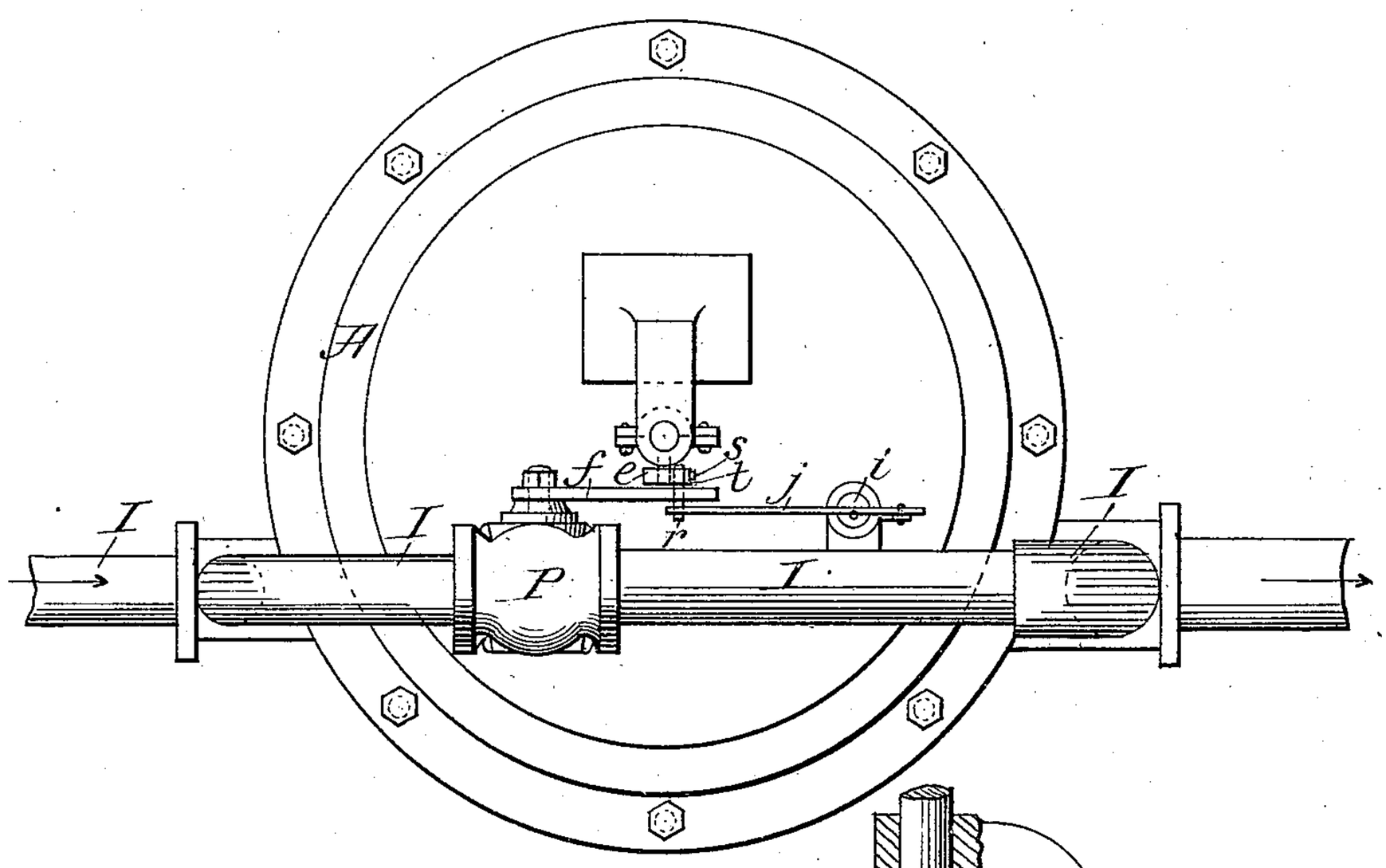


Fig. 5.

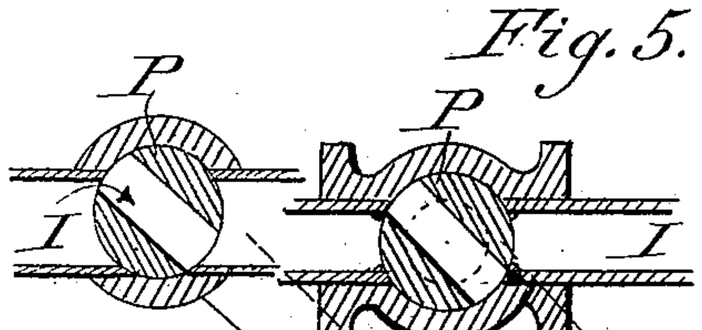


Fig. 6.

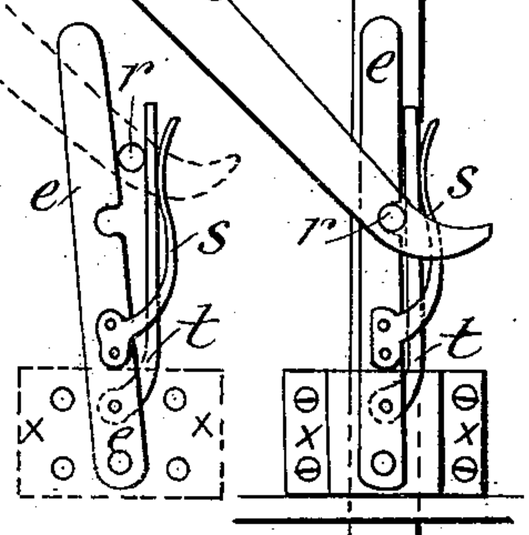
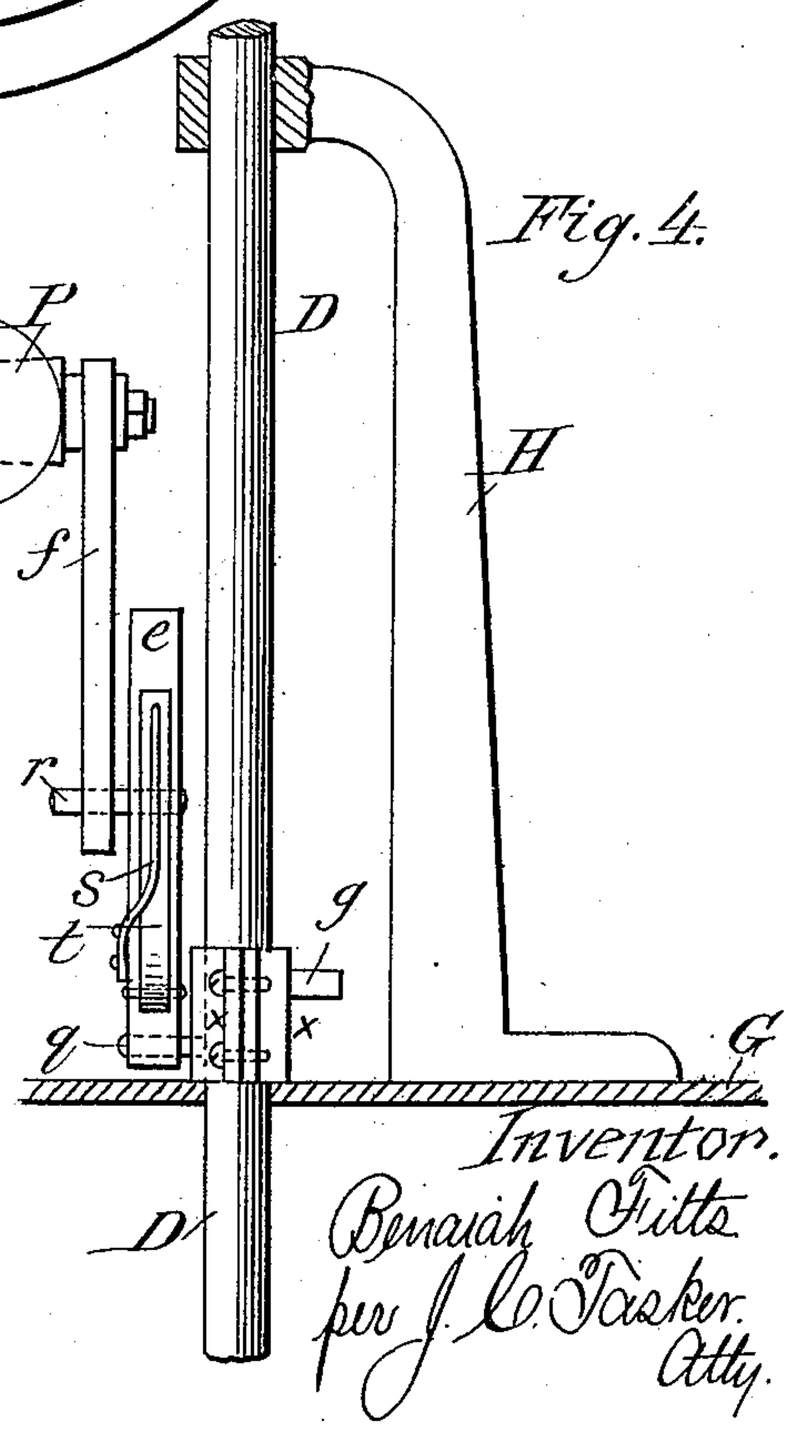


Fig. 4.



Attest

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C. J. Stockman

Inventor.

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UNITED STATES PATENT OFFICE.

BENAIAH FITTS, OF WORCESTER, MASSACHUSETTS.

FLUID-PRESSURE REGULATOR.

SPECIFICATION forming part of Letters Patent No. 333,403, dated December 29, 1885.

Application filed June 19, 1885. Serial No. 169,061. (No model.)

To all whom it may concern:

Be it known that I, BENAIAH FITTS, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Fluid-Pressure Regulators; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to an improvement in gas or fluid pressure regulators; and it consists of a construction and arrangement of parts which will be hereinafter fully described and claimed.

In the accompanying drawings, forming part of this specification, Figure 1 is a vertical section of my improved pressure-regulator, showing the piston situated at its lowest limit in the cylinder. Fig. 2 is a vertical section of the same at right angles to the section of Fig. 1, and showing the piston at about its middle position. Fig. 3 is a top view; and Figs. 4 and 5 are details of the construction.

Like letters designate like parts in the several views.

The cylinder of my machine is composed, essentially, of two castings, designated by the letters A and F, A representing the upper, and F the lower, casting. These two castings are flanged, and are secured together by bolts passing through these flanges. The lower casting, F, has its bottom preferably constructed of a curved shape, and is provided with any suitable legs or supports, such as will enable the cylinder to rest firmly upon whatever surface it is placed.

B represents the frame of the interior piston, which is made of cylindrical form, the upper end being closed and the lower end open. The lower rim of this barrel-frame is provided with a beveled edge, and to the piston is fastened a ring, C, the upper side of which is fitted with a beveled flange, which, together with the corresponding beveled flange upon the piston, serves to clamp the rubber diaphragm M between them by means of screws passing through the rim C and into the piston-frame. The rubber diaphragm is also secured between the flanges of the upper and lower castings A and F, which are both provided with beveled edges for the purpose. Upon the middle of the lower casting, F, is cast or else firmly attached thereto a vertical tubular box, E, which extends upward to about midway of the cylinder. Within it is contained a rod, D, which passes through a central perforation in the top of the piston, and is provided with projections or nuts *n n*, one on each side of this top, in order that the rod D may be fastened rigidly to the piston and move coincident therewith. The top of the cylinder-casting A is provided with a cover, G, fastened to the cylinder-casting by suitable bolts or screws, and perforated for the passage of the rod D, and also perforated for a pipe, *h*, coming from the outer air, which may allow atmospheric air to pass within the cylinder above the piston, and form a sort of cushion for the piston in its upward movement. This pipe may or may not be provided with a stop-cock, as desired. The rubber diaphragm M may be a disk of rubber of suitable thickness; but I prefer it to be made in the form of a cylinder—such as a section of rubber hose—the inside diameter of which should be of the same diameter as the piston B. I prefer also in constructing my cylinder to make the interior of it somewhat tapering, so that near the top on the line 1 1 it will be of lesser diameter than at the middle portion on the line 2 2. By this mode of construction when the piston rises from a part of greater diameter into a part of lesser diameter it will become smaller by reason of the peculiar infolding of the rubber diaphragm, and more pressure will be required to raise it farther than would be needed were the cylinder of equal diameter throughout—that is to say, the reduction of the size of the piston by a reduction of the superficial area of the under surface upon which the pressure of the gas, fluid, or liquid is exerted will require a greater pressure of gas to raise a given amount of the weight of the piston. Consequently the amount of pressure required to elevate a piston within a tapering cylinder of my construction will be proportional to the varying diameter of the cylinder. This change in the diameter of the cylinder, caused by its tapering interior, is very slight, and is simply

what will be sufficient to keep the piston from ascending too rapidly. It also facilitates the downward movement of the piston, which, by its more rapid descent, regulates the valve, so as to keep a more even pressure in the pipes than would be possible with a straight cylinder.

I represents a pipe or tube coming from any source of supply of steam, gas, fluid, or liquid which the regulator is used to govern. It will be noticed that as this pipe proceeds upward over the cylinder from a point near the bottom of the cylinder on the one side to a point near the bottom of the cylinder on the opposite side, it is made of greater diameter at the last-named point than at the starting-point. This is evidently necessary to suit the expanded condition of the gas or fluid at that point. This pipe I is provided with a valve, P, a safety-valve, *i*, and a small aperture, *d*, near the outlet end, which communicates through a pipe, *b*, and an opening, *a*, into the cylinder. Pipe *b* has an ordinary shut-off cock, *c*. The apertures *d* and *a* will be graduated to any desired size as will best serve the function for which they are made, since they and the pipe *b* regulate the admission of the gas, steam, or fluid into the cylinder. The upper part of the rod D, emerging from the cylinder through the middle orifice of its cover G, has another bearing or journal in an arm, H, formed upon the top of the cylinder, as will be seen in Fig. 2, and more clearly in Fig. 4. The rod D is provided at a point which, when the piston is depressed to its lowest limit, will be near the top of the cylinder, with a couple of small circularly-recessed plates, *x x*, secured together by bolts passing through their flanges, one plate carrying a horizontally-projecting pin, *g*, and the other a similar pin, which passes through and serves as a pivot for a rod, *e*, connecting with a lever, *f*, by which the valve P is operated. This connection between the rod *e* and the lever *f* is made by means of a lug or pin, *r*, upon the lever *f*, which engages a slot upon the rod *e*, and is held within the slot by a spring, *s*, which bears upon a pivoted bar, *t*. Thus it will be seen that by relaxing the spring *s* the rod *e* and pivot-bar *t* may be separated, the pin *r* moved without the slot, and the rod and lever disengaged.

The valve P is constructed in any ordinary and usual fashion, as I reserve to myself the liberty to use at this point any stop cock suitable for the purpose, and not merely the one having a central channel, as shown in the drawings.

Whenever the valve shown in the drawings is used, a communication between the parts of the pipe on opposite sides thereof will be established immediately as soon as the lever *f* turns the globe so as to open its channel the smallest amount, and this communication will remain established until the lever *f*, when being raised upward, has reached a height, as represented in dotted lines in Fig. 1, great enough to cause the channel to become closed again.

As stated above, the pipe I is provided, in addition to the admission-cocks P, with a safety-valve, *i*, which consists of any suitable plug carried upon the end of a rod and entering an aperture in the pipe, said rod being pivoted to a lever, *j*, which is likewise pivoted to an upright bar, *k*, fixed upon the pipe I. When the gas within the pipe attains a sufficient pressure, it will force this valve open and escape; or an opening may be effected by the lever *f*, in its upward movement, coming in contact with the end of the lever *j*, and thus opening the aperture by lifting the plug; but this construction may be varied at pleasure, it being only necessary to have a valve that may be operated by a lever which is moved by the lever *f*. Upon the cylinder is fixed a standard or upright, J, on which is fulcrumed by means of a pivot a lever, K, hooked at one end and weighted at the other by an adjustable weight, *m*. The hooked end passes underneath the pin *g* upon the plates *x x*, or, what is the same thing, the rod D; and the standard or upright J is provided with a lug, *o*. Now, this lever K thus arranged with its weight is preferably of about the same weight as the combined weight of the piston and its rod D, and it serves to partially sustain the weight of the piston and its accompaniments. When the piston has ascended a certain distance, and the lever K, its hooked end engaging with the pin *g*, has moved upward far enough to allow the weighted end to rest upon the lug *o*, any further upward movement of the rod D will carry the pin *g* above this, and thus render said movement independent of the weighted lever. When the pressure upon the piston again diminishes, the rod D in descending will again engage the weighted lever, which will come in play again and perform its function as before.

The operation of my improved gas or fluid pressure regulator is as follows: The normal condition of the machine is represented in Fig. 1. Here the valve P is entirely closed. The piston is at rest at its lowest limit. Now, when the machine is in this position, the pressure of the gas or fluid cannot start it. It must be started by hand. This is easily done by grasping the upper end of the connecting-rod *e*, and pushing it back in the direction of the valve a short distance. At the same time the operator will lay hold of the lever *f*, and lift it out from its engagement with the rod *e* to the position shown in Fig. 6. The instant the lever *f* is raised the valve P will be opened more or less, and the gas coming through inlet-pipe I from the source of supply—as a street-main, a reservoir, &c.—will rush through the valve, expanding as it proceeds, into the larger portions of the pipe, whence it is distributed to the various places where it is to be used. It is evident that this expanded gas will pass through the aperture *d* into the cylinder-casing, and begin to force

the piston upward. When the piston begins to move upward, the rod *e* will again interlock with the rod *f*, and the connection between the two be re-established in like manner as when the machine was at rest, so that now the upward movement of the piston will open the valve P more and more to a certain limit, and the downward movement will close it, which movements are controlled of course by the pressure of the gas. As long as any gas continues to come from the source of supply the piston can never quite reach its lowest limit, and therefore the valve P can never be completely closed, for while there is any gas passing through the valve from the source of supply there will be a certain amount of pressure exerted upon the bottom of the piston, very slight indeed perhaps, but sufficient to raise it somewhat; but when the supply ceases entirely the piston will then drop completely down, there being nothing to raise it, and it cannot be again raised without the repetition of the manual operation above described. This is a great advantage, for it often happens that the supply of gas will need to be temporarily shut off, for the purposes of repair or the like. This being oftentimes done in the night and without any warning to the users of gas at the other end of the main, whose fires and lights might be burning, and whose outlet-cocks would be open for the purpose, the fires would be extinguished and the cocks would not be closed. Now, without the interposition of some device in the regulator to guard against such a result, the readmission of gas into the main would cause it to flow out through the open outlet-cocks into the houses of the individual users, and cause great damage perhaps before they could ascertain the fact; but with my improved device the cessation of the supply closes the valve entirely, and when the supply again begins to flow it will find the pipe closed, so that it cannot pass the regulator until the operator desires it to do so.

The operation of the safety-valve *i* has already been more or less explained. The pressure of the expanded gas within the pipes may open it, or it may be opened by the lever *f* acting upon the lever *j* to raise it, as is shown by dotted lines in Fig. 1. There is, therefore, a double safeguard in the provision of two modes of operating the valve.

It has been found in using pressure-regulators with certain kinds of gases or fluids that the pressure of the gas would throw the piston up very rapidly, and then as the pressure diminished the piston would descend as rapidly. Thus there would be no equality or evenness of movement, but this vibration would occur, and was both annoying and dangerous. To effectually guard against this, I have provided the top of the cylinder with an inlet for the admission of atmospheric air. The inlet shown in the drawings is a tube entering an aperture and regulated by a stop-cock; but any other equivalent will do as well, for, instead of having an opening in the cover G itself, I may just as effectually admit air by not closing the cover tightly, but leaving a space between it and the cylinder. This admission of air will regulate the rapidity of the motion of the piston and stop the vibration. As an additional safeguard against this evil of "pumping," as it is called, I have found it advantageous to graduate the inlet-opening *a* where the expanded gas enters the cylinder. By making this opening greater or less I can regulate the pressure upon the piston so as to obviate vibration.

If it should be desired for any reason to make the piston itself heavier, weights may be placed upon a plate, *l*, which is affixed to the upper extremity of the rod D for the purpose.

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

1. In a gas or fluid pressure regulator, the piston frame B, having piston-rod D, provided with plates *x x*, to which is pivoted a slotted connecting-rod, *e*, provided with bar *t* and spring *s*, in combination with the valve P, whose lever *f* is adapted to engage the rod *e* by means of a pin, *r*, substantially as shown, and for the purpose set forth.

2. A gas or fluid pressure regulator consisting, essentially, of a cylinder, A F, perforated cover G, piston B C, diaphragm M, piston-rod D, inlet-channel *a*, and tubular box E, all arranged and operating in the manner substantially as shown and described.

3. In a gas or fluid pressure regulator, the combination, with a cylinder having a conical or tapering interior, of the piston B C and the diaphragm M, arranged and operating substantially in the manner shown and described.

4. In a gas or fluid pressure regulator, the combination of cylinder A F, piston B C, diaphragm M, piston-rod D, connecting-lever *f*, valve P, and pipe I, substantially as shown and described.

5. In a gas or fluid pressure regulator, the safety-valve *i*, consisting, essentially, of a plug-carrying rod pivoted to a lever, *j*, fulcrumed upon an upright, *k*, and adapted to be operated by the pressure of the gas within the pipe, and also by the lever *f* coming in contact with and raising as it ascends the lever *j*, substantially as shown, and for the purpose specified.

6. In a gas or fluid pressure regulator, a cylinder, A F, provided with upright post J, upon which is fulcrumed a hooked ball-carrying lever, K, within which cylinder moves a piston, B, having piston-rod D, provided with a pin, *g*, for the engagement of the hook upon the lever K, and also with a plate, *l*, at its upper extremity, substantially as shown, and for the purpose set forth and specified.

7. In a gas or fluid pressure regulator, the

combination of the piston-rod D, having pin *g*, and the lever K, weighted at one end, hooked at the other, and fulcrumed upon an upright, J, which is provided with a lug, *o*, said hooked lever engaging normally with the pin *g*, but adapted when rod D attains a certain height to rest upon the lug *o* and thus become temporarily disengaged, substantially as shown and described.

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

BENAIAH FITTS.

Witnesses:
PHILIP MAURO,
FRED E. TASKER.