(No Model.) 2 Sheets—Sheet 1.

J. W. WEEKS.

FLUID PRESSURE REGULATOR.

No. 597,250. Patented Jan. 11, 1898.

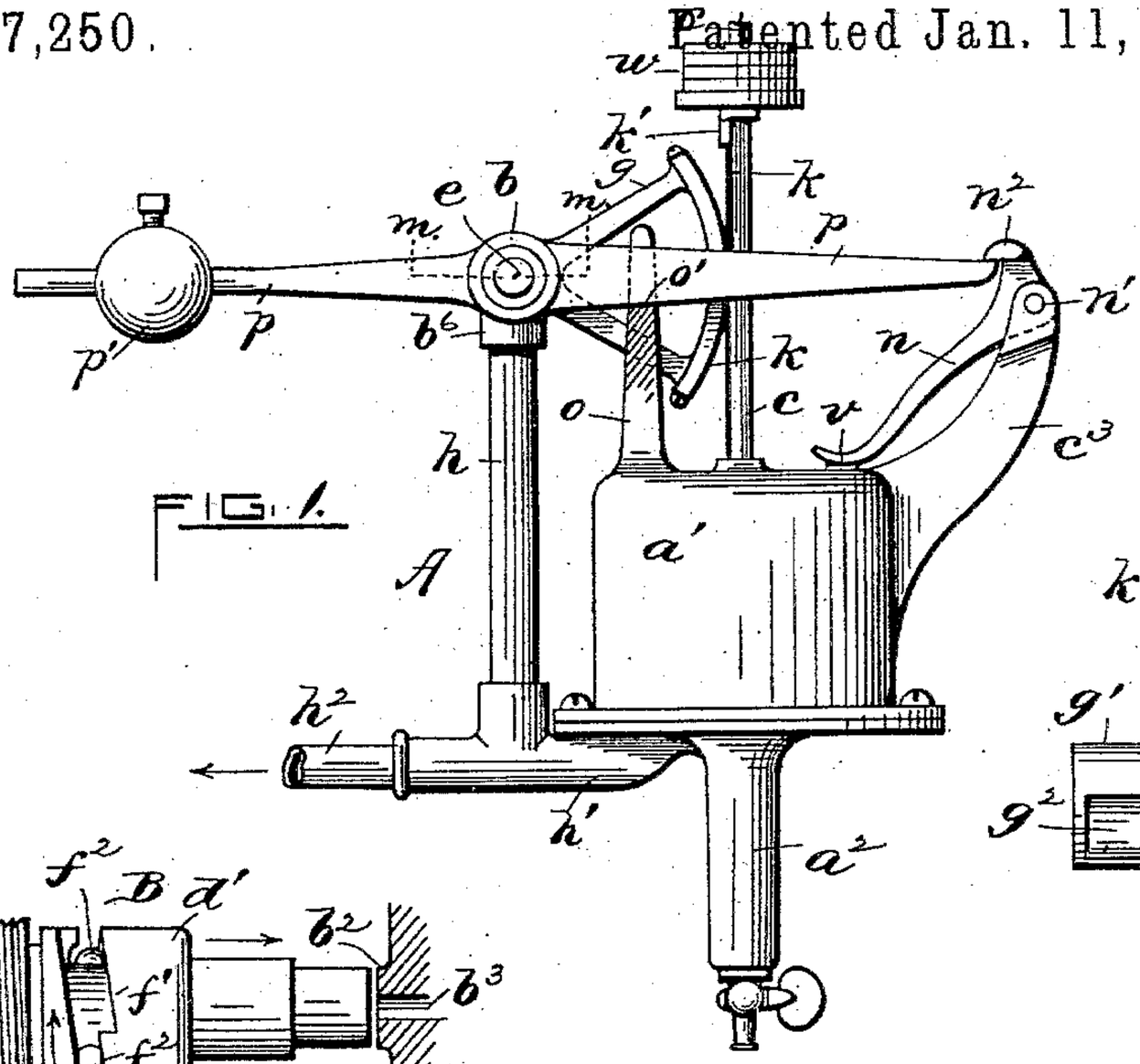

FIG. 1.

FIG. 13.

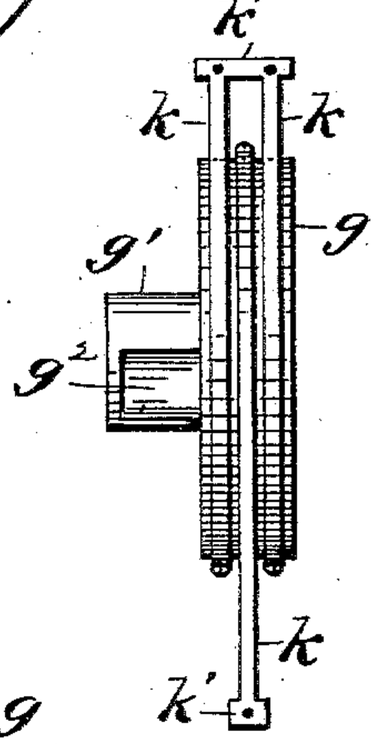

FIG. 7.

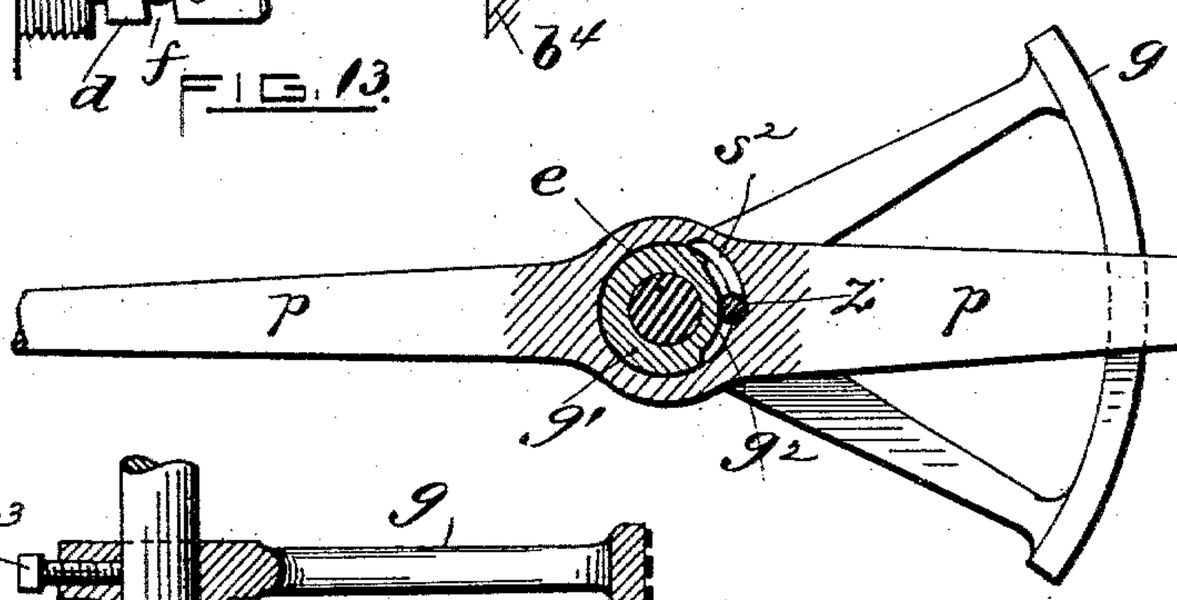

FIG. 4.

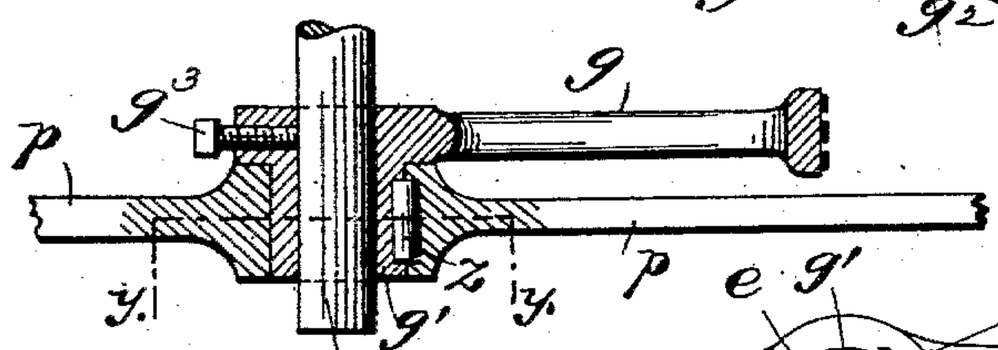

FIG. 3.

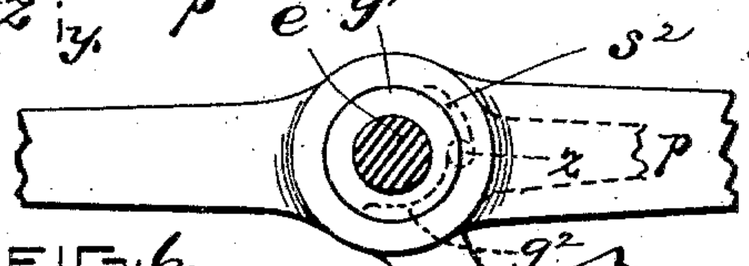

FIG. 6.

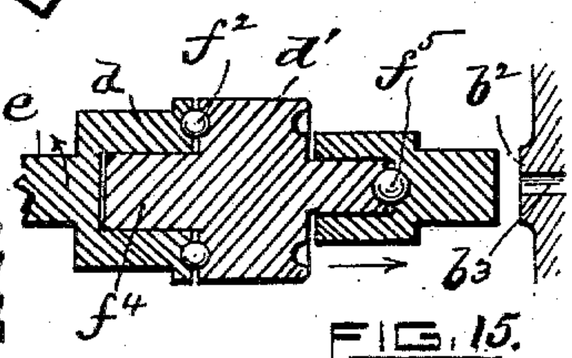

FIG. 15.

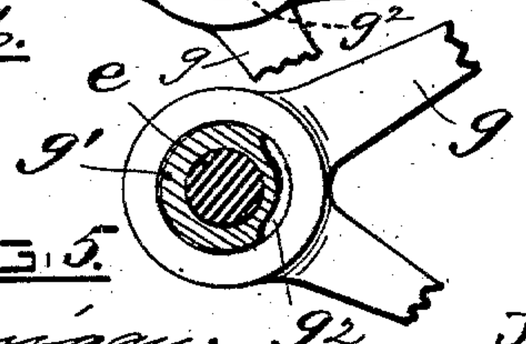

FIG. 5.

Witnesses.

Charles J. Kannigan.

Pennington Sherman

Inventor.

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By Geo. H. Remington & Co.

Attys.

(No Model.) 2 Sheets—Sheet 2.

J. W. WEEKS.

FLUID PRESSURE REGULATOR.

No. 597,250. Patented Jan. 11, 1898.

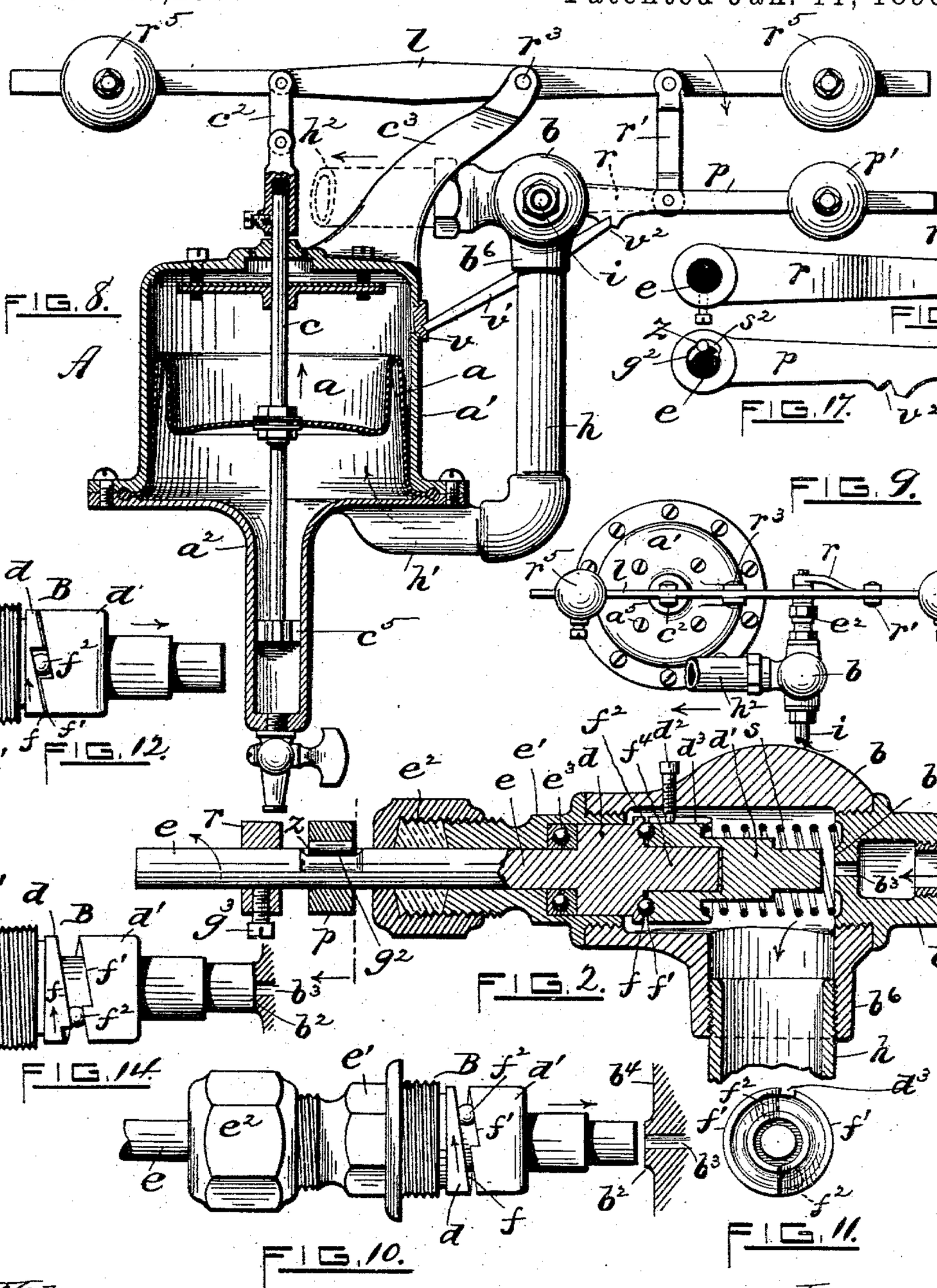

FIG. 8.

FIG. 16.

FIG. 17.

FIG. 9.

FIG. 12.

FIG. 2.

FIG. 14.

FIG. 10.

FIG. 11.

Witnesses.

Charles T. Kavanaugh

Remington Sherman

Inventor.

John W. Weeks.

by Geo. H. Remington & Co.

Atty.

UNITED STATES PATENT OFFICE.

JOHN W. WEEKS, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO JAMES G. WARREN, OF SAME PLACE.

FLUID-PRESSURE REGULATOR.

SPECIFICATION forming part of Letters Patent No. 597,250, dated January 11, 1898.

Application filed September 16, 1896. Serial No. 605,987. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. WEEKS, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Pressure-Reducing Valves; and I do hereby 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 letters of reference marked thereon, which form a part of this specification.

My invention relates to improvements in automatic pressure-regulating devices; and it consists in certain details of construction, as hereinafter fully described and claimed.

The object of my invention is to produce an automatic pressure-regulator possessing greater ranges between the maximum and minimum or inlet and outlet sides of the apparatus, the device at the same time being comparatively simple and capable of maintaining a high degree of efficiency.

In the accompanying two sheets of drawings, Figure 1 is a side elevation of my improved automatic pressure-reducing valve complete. Fig. 2 is an enlarged longitudinal section taken through the center of the valve proper, the valve being wide open. Fig. 3 is a longitudinal section taken on line *m m* of Fig. 1. Fig. 4 is a front elevation, in partial section, taken on line *y y* of Fig. 3. Fig. 5 is a similar section taken through the hub of the quadrant-lever and valve-stem. Fig. 6 is a partial front view showing the relation of the quadrant-lever and safety-lever when the first-named lever is at its lowest position, corresponding to a wide-open position of the valve. Fig. 7 is a side view of the quadrant-lever and the flexible bands or connections adapted to be secured to the diaphragm-spindle. Fig. 8 is a vertical section taken through the center of the diaphragm and the casing in which it is mounted, and also showing a modified form of the safety device. Fig. 9 is a plan view of the same in reduced scale. Fig. 10 is a side elevation of the valve, &c., detached from the valve body or housing, corresponding to Fig. 2. Fig. 11 is an end view of the angular or beveled face of one of the parts of the valve. Fig. 12 is a side view showing the relation of the two parts of the valve proper when it is wide open, the valve-seat being omitted. Fig. 13 is a similar view showing the valve nearly closed. Fig. 14 shows it fully closed or seated. Fig. 15 is a longitudinal central sectional view, corresponding to Fig. 2, showing a modified form of the valve; and Figs. 16 and 17 are front views of the operating and safety levers employed in the arrangement shown in Fig. 8.

Again referring to the drawings, A indicates my improved automatically-operating pressure-reducing regulator complete, its supporting parts or frame being of any suitable construction adapted to carry the operating mechanism.

The device is as drawn provided with a suitable flexible circular diaphragm *a*, (shown sectionally in Fig. 8,) having its outer edge clamped to the bottom of the casing *a'*, inclosing the diaphragm, the latter being secured to a central spindle or rod *c*, mounted vertically in and extending through the top of the casing. The said spindle *c* moves in unison with the diaphragm and carries at its upper end the levers, &c., soon to be described, through which the action of the valve proper is automatically controlled.

The valve portion of my improved pressure-reducing apparatus consists of the globe or body *b*, communicating with an inlet-pipe *i*, adapted to be connected to a tank or other source containing the gas, air, or fluid under high or maximum pressure, which expansive medium in passing through the regulating device constituting a part of my invention is automatically reduced in pressure to any predetermined degree. The said valve portion also comprises the two-part valve B, the latter being the valve proper and consisting of the revoluble head part or member *d* and the longitudinally-movable non-revoluble part *d'*. The adjacent faces *f f'* of said parts *d* and *d'* of the valve are cut at an angle or spirally, as clearly shown. The said spiral faces are grooved and are kept normally separated by means of the antifriction-balls f^2, mounted in said grooves. One part of the valve is provided with a central extension,

as f^4, Fig. 2, the same being fitted to a corresponding hole formed in the other member of the valve, thus forming a support therefor. I prefer, however, to arrange these parts substantially as represented in Fig. 15, wherein a ball f^5 is interposed between the adjacent ends, thus adapting the valve within fixed limits to automatically accommodate itself to the valve-seat b^2.

In order to prevent the forward part or member d' of the valve B from axial movement, I provide a longitudinal groove d^3 therein adapted to receive the end of a fixed screw or pin d^2. (See Figs. 2 and 11.) Thus it will be seen that while the valve part d' is free to move endwise or longitudinally it is at the same time kept from axial movement. The other part or rear member d of the valve B is secured to or made integral with the stem e, the same extending outwardly through the packing-head e', screwed into the corresponding end of the body b. The said member e' is provided with a stuffing-box and gland e^2 for the valve-stem, substantially as common. The valve-member d is as drawn capable of being rotated a partial revolution, but is prevented from endwise movement. In order to adapt it to withstand the great pressure or endwise thrust to which the valve may at times be subjected, I prefer to interpose an antifriction or ball bearing e^3 between the adjacent faces of the parts d and e', as clearly shown in Fig. 2.

A seat-carrying fitting or cap b^4 is screwed into the globe or body b. The high-pressure or inlet pipe i enters this fitting b^4, communication between the latter and the valve-chamber being through the small hole or passage b^3, formed in the center of the valve-seat b^2. It will be observed (see Fig. 2) that a spring s is interposed between the valve and seat members d' and b^4, the same being employed for keeping the adjacent grooved faces $f\,f'$ of the valve in snug contact at all times with the balls or antifriction members f^2, thereby also keeping the latter in the proper relation to each other.

From the foregoing it is apparent that the valve is ever ready to withstand the maximum or high pressure flowing through pipe i, plus the force of the spring s. Therefore the work required of the automatically-operating valve-controlling mechanism, about to be described, is to close the valve against said pressure, to a greater or less extent, according to the volume of gas (or other medium passing through the open valve from pipe i) being used or consumed.

The valve-body b is provided at the bottom side with a nozzle b^6, into which is screwed a pipe h, which in turn is secured to a tubular connection h', fixed to the base of the diaphragm-casing a'. The said construction not only forms a continuously-open communication from the valve to the diaphragm, but is also utilized as a support for the valve-operating mechanism.

Referring to Fig. 1, it is seen that the horizontally-mounted valve-stem e is provided with a quadrant-shaped lever g, to which are secured oppositely-arranged flexible metallic bands or connections k, the ends k' thereof being enlarged and fixed to the diaphragm carrying spindle c. Fig. 7 shows the arrangement of said connections k in enlarged scale. As drawn, the center part of the lever g is elongated on one side to form the hub g', (see also Fig. 3,) the latter being provided with a semigroove g^2, its length peripherally being substantially equal to the angular movement of the lever, and since the lever is secured to the valve-stem by a set-screw g^3 (shown in Fig. 3) it follows that the valve-stem will always vibrate in unison with the movements of the diaphragm, the construction being such that the movements of the parts are effected without "play" or lost motion. The spindle c is arranged to be weighted on top by adjustable weights w, whereby in conjunction with the working area of the diaphragm the pressure of the gas issuing from the outlet or discharge pipe h^2 may be regulated or controlled. The lower head of the diaphragm-holder a' is elongated, (see a^2, Fig. 8,) thereby forming an added support for the spindle c and its grooved piston c^5, and when filled with a fluid, as water, it also serves to prevent too sudden changes or fluctuations taking place in the diaphragm's movement.

The following is a description of the safety device: It consists substantially of the lever p, loosely mounted on the hub g' of the quadrant-lever. The safety-lever p is provided with a semigroove s^2, the same forming practically the counterpart of said groove g^2 of the lever-hub g'. A rolling key z is interposed between said grooves, as clearly shown in Figs. 3 to 6. From the side of the diaphragm-casing (see Fig. 1) a bracket c^3 extends, in which a tripping-lever n is pivoted at n'. The lower end of the lever bears upon a safety valve or plug v, extending through the top of the casing. The opposite end of this lever is provided with a hook n^2, adapted to engage the adjacent end of said lever p. The other arm of the latter lever carries an adjustable weight p'. Now in order to relieve the valve-stem from the weight of the safety-lever when the valve B is open and in normal action I provide a fixed standard o, forked at its upper end to receive the lever p, thus forming a guide and support for it. The upper part of the standard is broken away (see Fig. 1) so as to show the lever resting firmly therein at o'. I may add that the center hole or fulcrum formed in the lever p is somewhat larger than the diameter of the hub g'.

From the foregoing it will be evident that the normal movements of the diaphragm within fixed limits will be unaffected by the safety-lever, since the groove g^2 of the quadrant-hub is sufficiently long circumferentially to allow of such movements; but in case the pressure in the diaphragm-chamber should

exceed the predetermined pressure from any cause such pressure will force the valve or plug v outwardly, thereby elevating lever n and releasing the safety-lever, at which instant the weight p' thereof causes the lever to swing rearwardly on its pivot or fulcrum, thereby, too, at the same time causing the round key z in its movement to engage the upper end of the hub-groove g^2, the momentum of the weight, &c., then operating to rotate the lever g and valve-stem e in the same direction until the valve B is fully closed against the seat b^2, thereby automatically shutting off the supply of gas from the valve.

It is to be borne in mind that the valve B when in its normal position is open more or less according to the volume of gas being used and passing through the outlet-pipe h^2. Therefore the function of the safety device is to always close the valve.

In Figs. 8 and 9 I have represented a modified form of the device for transmitting the movements of the diaphragm a to the valve-stem e. In this case a lever r, in lieu of the quadrant-lever, is secured to said stem. To the extension or bracket c^3 is fulcrumed at r^3 an operating-lever l, the same being jointed to the diaphragm-spindle c by a link c^2 and to the free end of said lever r by a similar link or connection r'. The opposite arms of the lever l are provided with suitable adjustable weights r^5. From this construction and arrangement it is obvious that the valve-stem e and the valve B will move concurrently with and by the action of the diaphragm. I may add, however, that this device is somewhat objectionable from the fact that it consists of a greater number of parts and joints. Therefore it is not so sensitive or capable of responding to the diaphragm's movements so readily as the arrangement shown in Fig. 1.

The safety device shown in Fig. 1 is substantially the same as represented in Fig. 8. In the latter the stem e itself is provided with a semigroove g^2, the safety-lever p being loosely fitted to the stem and having a corresponding groove s^2 and also having the interposed key or roll z. (See Figs. 2 and 17.) This lever p has a notch v^2 therein arranged to receive one end of the supporting-tie v', the other end resting in the safety-plug v, let into the side of the casing-chamber a'. The free end of the lever p carries a sliding weight p'. From this it will be apparent that, as in the former case, when the pressure in the diaphragm-chamber exceeds the predetermined limit such pressure will force the plug v from its seat, thus freeing the lever-supporting tie v', after which the weighted lever p instantly falls, thereby rotating the valve-stem and closing the valve B, substantially as before described.

In my improved automatic pressure-reducing valve or apparatus the valve proper, B, is normally open, the action of the device being to close the valve to a greater or less extent. When wide open, the position of the valve B is substantially as shown in Figs. 2 and 12, the interposed balls f^2 keeping the adjacent beveled faces ff' separated at all times. As the part d of the valve is capable of rotation, but is prevented from moving longitudinally, it follows that any axial movement thereof in the arrow direction will force the other or non-revoluble member d' endwise a corresponding extent. Fig. 10 shows the valve partly closed, Fig. 13 nearly closed, and Fig. 14 fully closed. The spring s is omitted from all of said figures except Fig. 2.

By means of my invention I have produced a valve in which the regulation is effected and controlled from the low-pressure or discharge side thereof. It is more sensitive to changes in pressures and volume than reducing-valves hitherto made. In fact, it can be adjusted so as to work perfectly against a head or pressure of several hundred pounds when the outlet-pressure required is only a small fraction of a pound. By making the opposed beveled working faces ff' of the two parts d d' of the valve B substantially like sections of a double screw-thread, combined with antifriction or rolling members located between and in contact with said faces, a comparatively small angular movement of the valve-stem will cause the endwise-movable member d to travel an increased distance, thereby insuring quick action. In opening the valve B, as well as in closing it, the spring s serves to keep the several parts thereof in normal relation to one another.

In my improved pressure-reducing apparatus it will be seen that the valve proper is adapted to positively close the inlet-opening b^3 automatically through the medium of the safety device, the counterweight thereof serving to keep the valve closed and prevent it from being reopened until the parts are again readjusted or set—that is to say, assuming that the inlet-pipe i is connected with a reservoir containing illuminating-gas under considerable pressure and that the outlet or service pipe h^2 conducts the gas, reduced in pressure, to a series of burners. Now in case the pressure on the diaphragm exceeds the predetermined working limit the safety device is automatically brought into action, thereby instantly closing the valve and extinguishing the burning gas-jets and preventing the further flow of gas.

I do not claim, broadly, as my invention an apparatus for automatically regulating the flow of gas or fluid passing through a valve by means of pressure exerted against a diaphragm.

I claim as my invention and desire to secure by United States Letters Patent—

1. In an automatic pressure-regulating device, the combination with the inlet-valve having its stem portion made in two parts, as d, d', the adjacent end faces of said parts being parallel and inclined and having antifriction-balls interposed between them, of a

mounted diaphragm communicating freely with said valve, and a system of levers and connections interposed between and secured to the said valve-stem and diaphragm, substantially as hereinbefore described and for the purpose set forth.

2. In an automatic pressure-regulating apparatus, a suitable inclosed movable diaphragm, a valve-casing having inlet and outlet openings, corresponding to the high and low pressure sides respectively, the low-pressure side communicating with said diaphragm, a valve movably mounted in said casing, comprising the endwise-movable spring-resisted part d' adapted to keep said inlet-opening normally open, the axially-movable stem-carrying part d, and having the adjacent ends or faces of the parts $d\,d'$ inclined to form spiral wedges having antifriction-balls between them, a series of suitably-mounted balls e^3 forming a thrust-bearing for the stem part d, and an operating-lever secured to the valve-stem and actuated by the diaphragm's movements, in combination with a weighted safety-lever, and a releasing device connected with said safety-lever and made operative by pressure within the diaphragm-chamber, whereby upon releasing the safety-lever the latter will engage the said operating-lever, the combined action of both levers then operating to close or seat the valve, substantially as hereinbefore described.

3. In an automatic pressure-regulating apparatus, provided with a valve, an operating-lever secured to the valve-stem having a semi-groove extending a distance around its hub, a safety-lever loosely mounted on the said operating-lever having a semigroove formed in the bore of the safety-lever and located contiguous to the said groove of the operating-lever and forming a curved space or chamber, a key or roll z mounted in said space and in engagement with both of said grooves, and means for controlling the movements of said levers, substantially as hereinbefore described and for the purpose set forth.

4. In an automatic pressure-regulating apparatus, a suitably-mounted movable flexible diaphragm, a guided spindle secured to said diaphragm, and a valve for controlling the admission of gas, air, &c., under high pressure to the apparatus, in combination with a curved or quadrant-shaped operating-lever secured to the valve-stem, and flexible connections, as k, fastened both to the operating-lever and to the said diaphragm-spindle, whereby one or the other of said connections k is in tension at all times, substantially as described.

5. In an automatic pressure-regulating apparatus, the combination with the valve-casing thereof provided with inlet and outlet passages for the air, gas or other expansible medium employed, of an endwise-movable non-revoluble valve member d' adapted to close said inlet-passage, a revoluble but non-longitudinally-movable fellow member d coacting with the first-named valve member, the adjacent faces of said members $d'\,d$ being cut spirally and separated by an antifriction medium, as balls, a valve-stem e fixed to said member d extending through the valve-casing, and means for controlling the movements of the valve mounted on the valve-stem, substantially as hereinbefore described and for the purpose set forth.

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

JOHN W. WEEKS.

Witnesses:

GEO. H. REMINGTON,

REMINGTON SHERMAN.