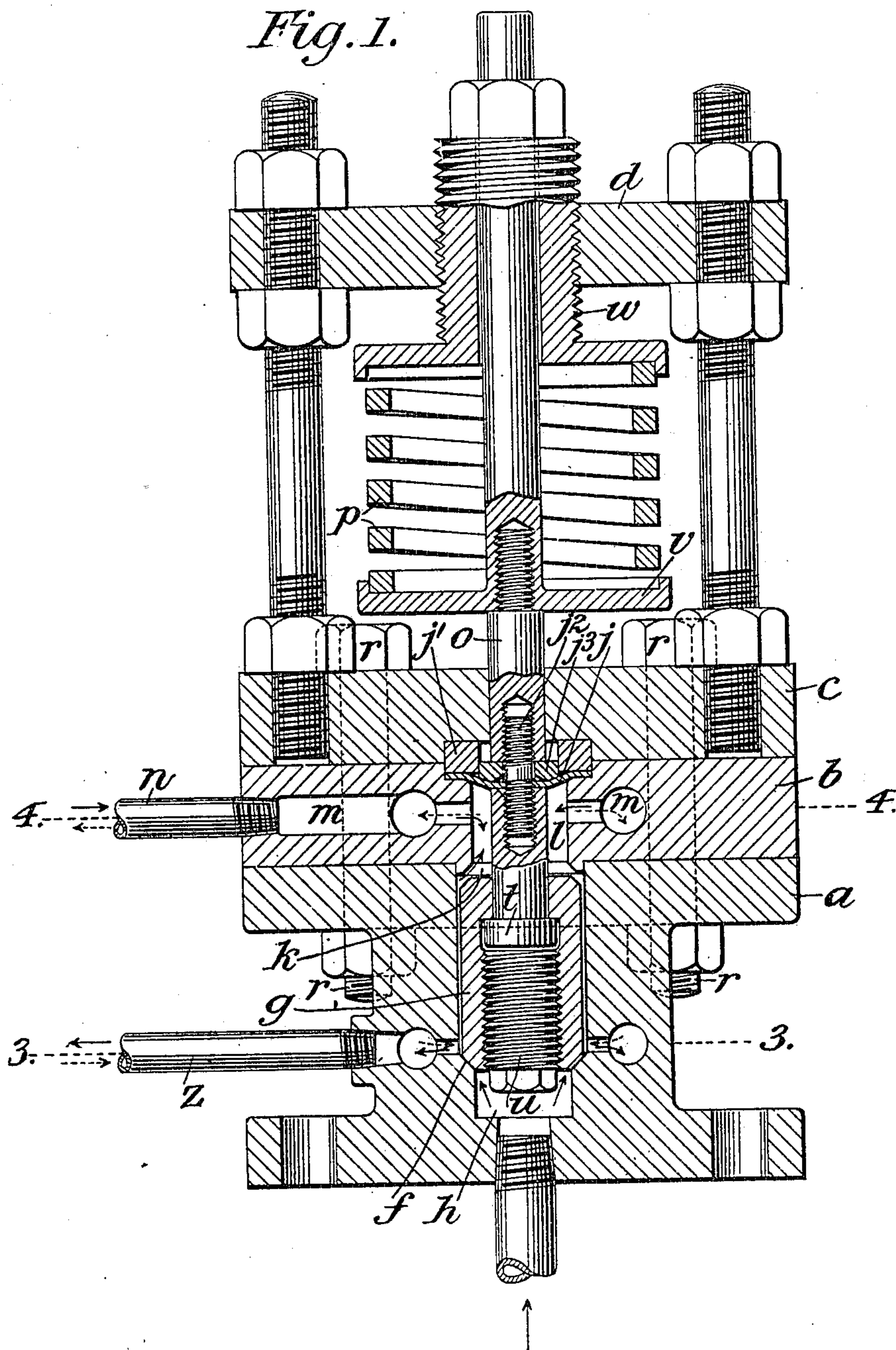


No. 831,677.

PATENTED SEPT. 25, 1906.

A. L. NOONE.
PRESSURE REGULATOR.
APPLICATION FILED MAR. 22, 1905.

2 SHEETS—SHEET 1.



Witnesses:

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APPLICATION FILED MAR. 22, 1905.

2 SHEETS—SHEET 2.

Fig. 2.

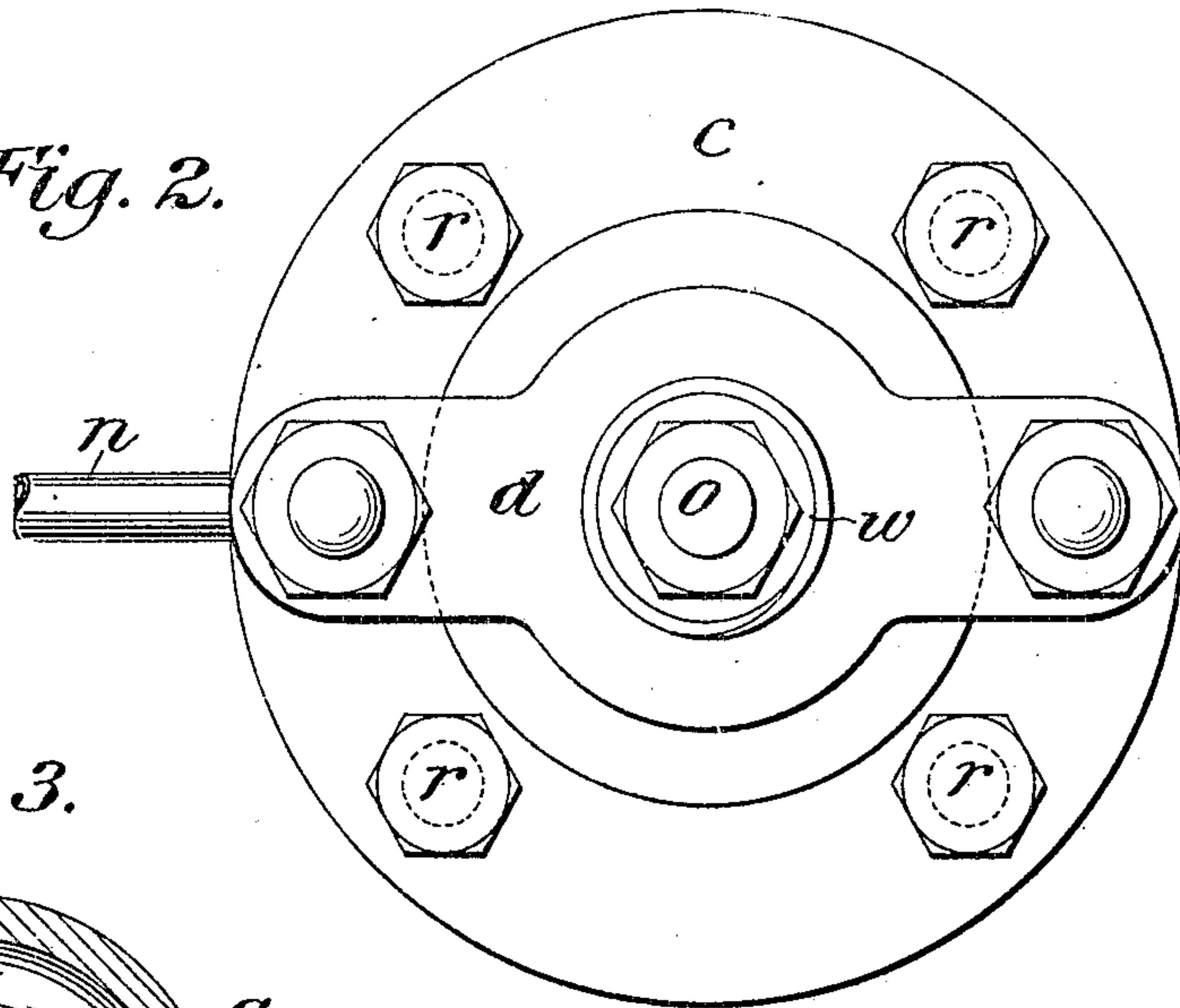


Fig. 3.

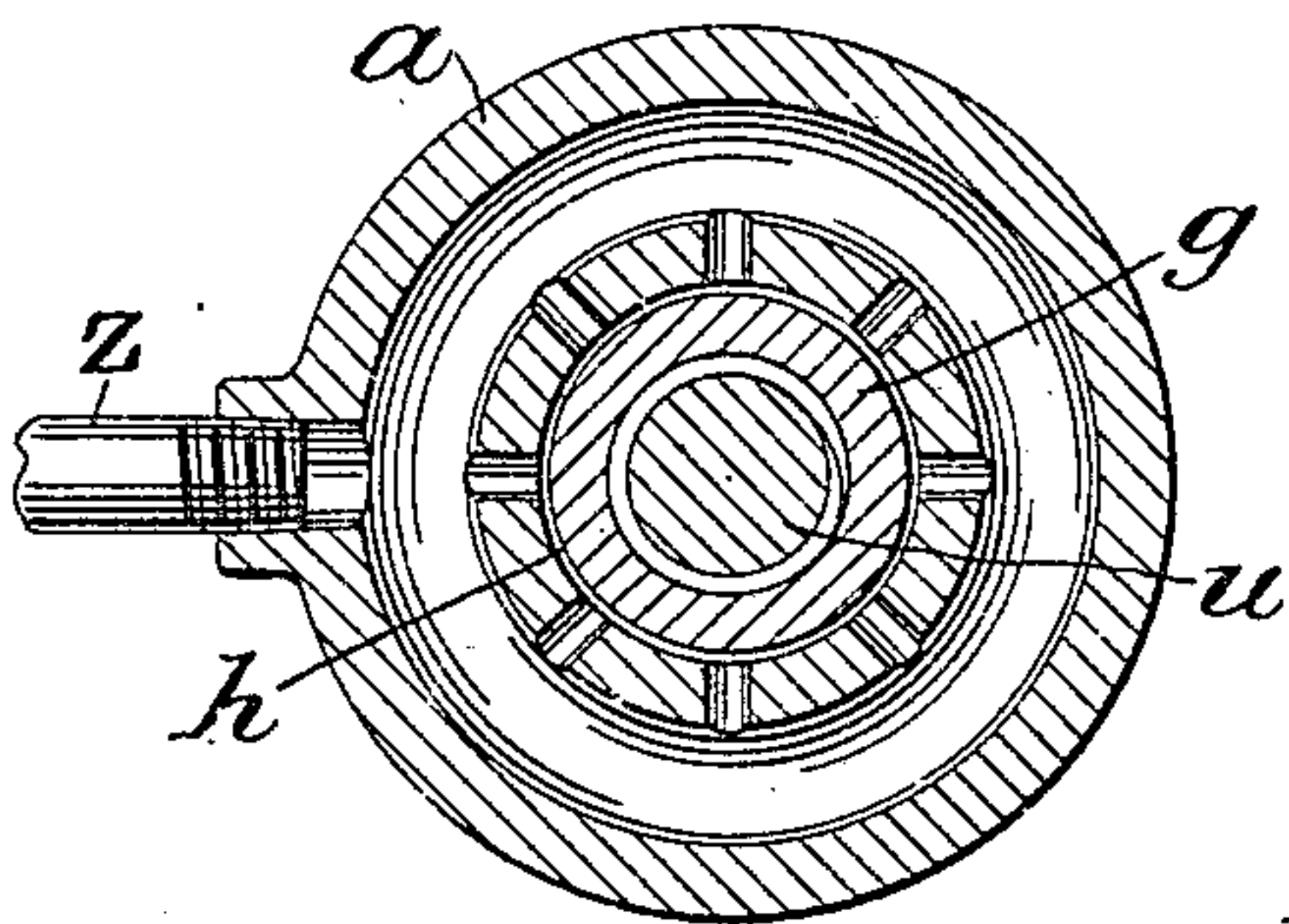
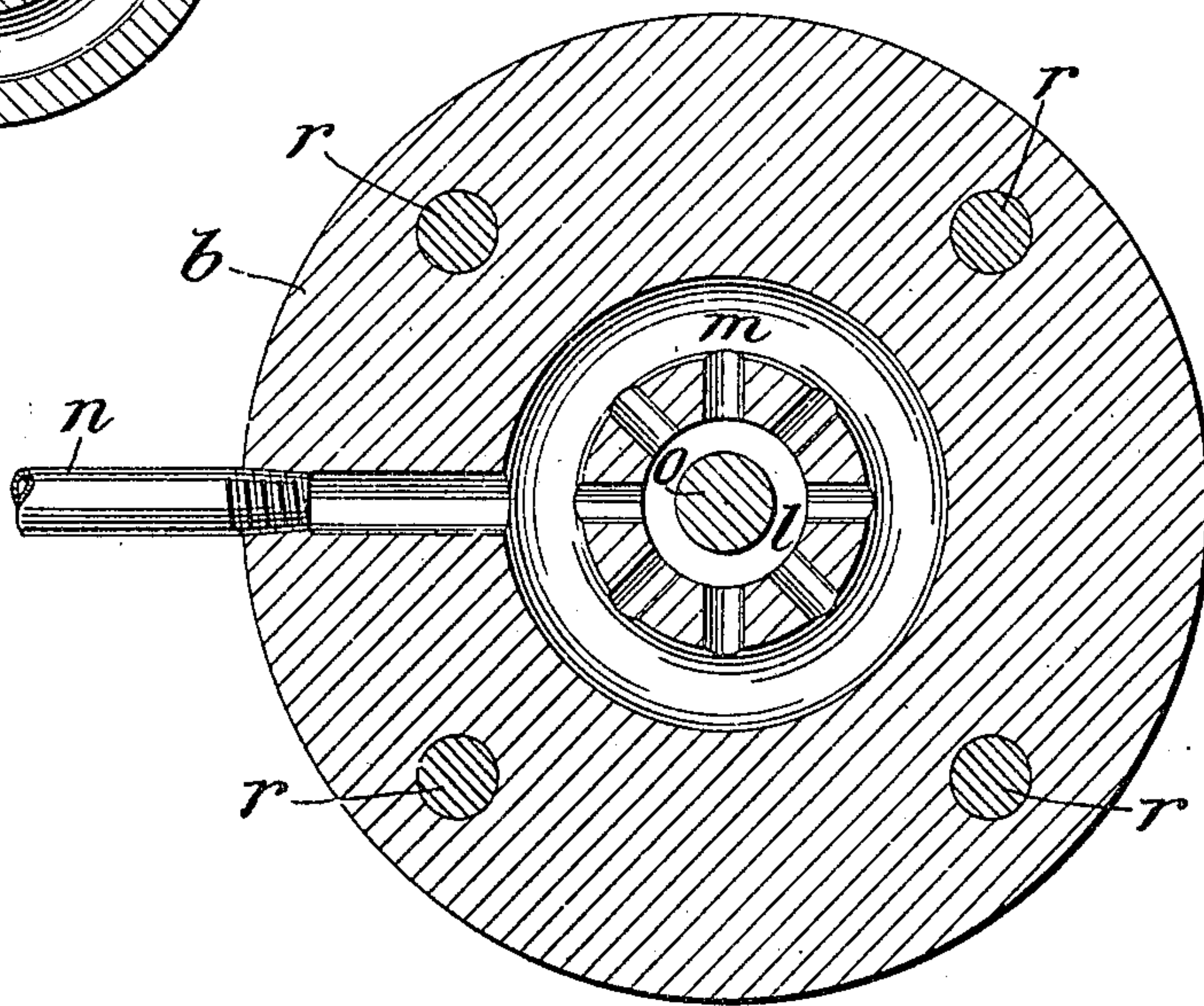


Fig. 4.



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UNITED STATES PATENT OFFICE.

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PRESSURE-REGULATOR.

No. 831,677.

Specification of Letters Patent.

Patented Sept. 25, 1906.

Application filed March 22, 1905. Serial No. 251,408.

To all whom it may concern:

Be it known that I, ANTHONY L. NOONE, a citizen of the United States, and a resident of the borough of Brooklyn, in the city of New York, in the State of New York, have invented certain new and useful Improvements in Pressure-Regulators, of which the following is the specification, reference being had to the accompanying drawings, forming a part hereof.

The object of this invention is to provide a simple device for regulating with great accuracy the pressure of gas transmitted through it, whereby gas under reduced pressure may be supplied to any system from a source of gas-supply.

Devices of this sort in use heretofore have generally been complicated structures and have not possessed all the sensitiveness that could be desired, and on this account they have not been entirely successful in keeping up a constant pressure of the desired degree in the system in which they have been employed.

In accordance with the present improvements one regulating-valve is employed which is arranged loosely between its inclosing walls, so as to prevent as far as possible all friction in the operation thereof. This valve coöperates with two valve-seats which are provided at either end thereof, and said valve is also provided with a valve-stem, which is held loosely in said valve, whereby the moving out of true of the stem does not throw the valve out of center, but permits it at all times to seat itself squarely. Furthermore, a diaphragm is provided whereby the adjustment of the valve for a particular pressure may be made to a nicety and whereby the operation of the valve is rendered very sensitive.

In the drawings, in which the invention is illustrated, Figure 1 is a view of a regulator in central vertical section. Fig. 2 is a top view thereof; and Figs. 3 and 4 are sectional views on the planes indicated, respectively, by the lines 3 3 and 4 4 in Fig. 1.

In the present embodiment of the invention the body of the regulator is made up of three castings *a*, *b*, and *c*, the first of these castings being preferably formed so as to be conveniently attachable to some part of the apparatus in connection with which it is to be used, and said castings are secured to-

gether by suitable fastening-pieces, such as the bolts *r*.

The casting *a* is formed with a valve-seat *f* for the valve-plug *g*. Said casting is also hollowed to form a relatively small chamber or space *h* at one end of the valve-plug for the return-gas, as will be explained hereinafter, and said space broadens out above the valve-seat *f*, thereby providing a place for the valve-plug to reciprocate in, the arc of which is sufficient to form a space around the valve-plug. In this space around the valve-plug the gas is adapted to circulate, and from said space it is discharged into the system in which the regulator is employed through a suitable discharge-pipe, (indicated at *z*,) said discharge-pipe being located between the upper and lower ends of the valve. The other end of the valve—that is, the upper end—coöperates with the valve-seat *k*, formed in the casting *b*, which casting is hollowed to form a central space *l* at that end of the valve and spaces *m* of any suitable design for the reception of the gas from a source of supply, (indicated at *n*.) The valve-seat *k* preferably forms a circular flange upon the casting *b*, which flange enters the hollow space in the casting *a*, thereby forming a tight joint between these two castings as well as forming the upper valve-seat. The casting *c*, which is also hollowed centrally to permit the valve-stem *o* to extend there-through, has secured thereto a frame *d*, by means of which a regulating-spring *p*, surrounding the valve-stem, is held down against the flange *v* on the valve-stem. The valve-stem *o* is loosely secured to the valve-plug, and for this purpose it is provided with a head *t*, the stem being inserted through an opening in the top of the valve-plug and held therein with a certain amount of play by a nut *u*, threaded at the bottom of the valve-plug. The upper end of the stem has a regulating-nut *w* threaded in the frame *d*, by means of which nut the regulating-spring *p* may be extended or compressed, thus regulating the tension thereof.

Between the castings *b* and *c* a suitable packing should be provided in order to prevent leakage, and in the present case a combination packing and regulating device is provided. This device preferably comprises a diaphragm *j*, which is preferably circular and of some flexible substance, such as soft

rubber, such diaphragm being held tightly around its border by a ring j' between the two castings. The valve-stem o is preferably divided at this point and the diaphragm is held upon the stem between the division, the two divisions being secured together by a double screw j^2 . There is also provided upon the valve-stem and preferably between the two divisions thereof a disk j^3 , which bears down upon the diaphragm and tends to press away a portion of the border of the diaphragm from against the ring j' . It will be obvious, therefore, that the position of the disk upon the stem and with respect to the ring and diaphragm will determine within certain limits the amount of border of the diaphragm which rests against the ring j' . It will also be obvious that the greater the area of the diaphragm which rests against this ring the less will be the extent of the surface of the diaphragm upon which the gas in the space l can operate.

The operation of the regulator when employed as a means to maintain a constant pressure in a system is as follows: The main gas enters and fills the spaces l and m above the valve. If the operative surface of the diaphragm is less than that of the top of the valve, against both of which surfaces the main pressure acts, the gas will flow directly down and around the valve into the system to be supplied through the discharge-pipe z . As soon as the pressure on the bottom of the valve, which is effected through the return gas from the system in space h , combined with the pressure of the gas-supply on the diaphragm equals that on the top of the valve an equilibrium will be established and further supply of gas to the system will cause the pressure in the space h and on the bottom of the valve to increase, thus destroying the equilibrium and either diminishing or entirely cutting off the further supply of gas to the system on account of the lifting of the valve which will take place.

It will be observed that the spring p does not enter into the above operation, it having been assumed in that case that the pressure of the spring was zero. If, however, the spring be compressed through the turning of the regulating-screw, then such tension is added to the pressure of the supply-gas upon the top of the valve and a greater pressure upon the bottom of the valve, and therefore in the system, will be required to force the valve upward. It will be clear, therefore, that in this way the pressure in the system may be regulated to remain constant at a minimum amount or at any amount between the minimum amount and the pressure of the supply-gas.

If instead of being less than the operative surface of the top of the valve the operative surface of the diaphragm is exactly equal to that of the top of the valve, these two sur-

faces, so far as the pressure in the space l is concerned, may be said to be at an equilibrium, and therefore the pressure in the system necessary to raise the valve from its lower seat will be precisely what is required to offset the tension of the spring. It will therefore be clear that the pressure of the supply-gas may vary without affecting at all the constant pressure which it is desired to maintain in the system being supplied and which constant pressure, as before stated, depends alone upon the tension of the spring when the operative surfaces of the upper side of the valve and the diaphragm balance each other. On the other hand, if the size of the disk and ring be varied or if the disk be varied in position upon the valve-stem so that the operative surface of the diaphragm becomes greater than the operative surface of the upper end of the valve then of course with the gas supplied to the space l the tension of the spring must at least be great enough to assist the pressure upon the upper end of the valve, so that the combined effect of the said pressure and spring will be equal to that of the pressure upon the diaphragm.

When the device is used for a damper-regulator and the spring acts to hold the valve upon its lower seat, the operation is as follows: The steam or other gas enters the space h from a boiler or other source of supply, and when the pressure thereof has overcome the force of the spring, which has been set for the desired tension, the valve is raised and the steam or other gas flows around the valve and into the outlet z , which in the case supposed would be connected with a cylinder or some suitable device for operating the damper or a lever. When the pressure in the space h falls below the degree necessary to hold up the valve, the valve drops and the discharge from the cylinder or other like device takes place around the valve, such discharge entering the space l above the valve and thence the pipe n , which in this case would be an exhaust. The operative area of the diaphragm for this purpose should be equal to or less than the operative area of the top of the valve, so that the exhaust will not disturb the position of the valve upon its lower seat.

I claim as my invention—

1. In a pressure-regulator, the combination of a valve, and a valve-casing, said valve and valve-casing being constructed to form a space around the valve for the passage of gas a space at one end of the valve to receive the gas and a space at the other end of the valve for the return from a system, a valve-seat cooperating with one end of the valve to control communication between the first-named space and the second-named space, a valve-seat cooperating with the other end of the valve to control communication between the first-named space and the third-named

space, said valve resting normally upon the second-named valve-seat, and means to assist the gas in the third-named space to lift the valve from the second-named valve-seat.

5 2. In a pressure-regulator, the combination of a valve, and a valve-casing, said valve and valve-casing being constructed to form a space around the valve for the passage of gas a space at one end of the valve to receive
10 the gas and a space at the other end of the valve for the return from a system, a valve-seat cooperating with one end of the valve to control communication between the first-named space and the second-named space, a
15 valve-seat cooperating with the other end of the valve to control communication between the first-named space and the third-named space, a valve-stem, and a diaphragm upon the valve-stem in the first-named space to as-
20 sist the gas in the third-named space to lift the valve from the second-named valve-seat.

3. In a pressure-regulator, the combination of a valve, and a valve-casing, said valve and valve-casing being constructed to form a
25 space around the valve for the passage of gas a space at one end of the valve to receive the gas and a space at the other end of the valve for the return from a system, a valve-seat cooperating with one end of the valve to control com-
30 munication between the first-named space and the second-named space, a valve-seat cooperating with the other end of the valve to control communication between the first-named space and the third-named space, a
35 spring to hold the valve normally upon the second-named valve-seat, and means to assist the gas in the third-named space to lift the valve from the second-named valve-seat.

4. In a pressure-regulator, the combina-
40 tion of a circular diaphragm adapted to be exposed to gas or some other pressure medium, a central stem secured thereto, a ring against which the periphery of the diaphragm rests, and a disk upon the stem to
45 bring a greater or less border area of the dia-

phragm normally into contact with the ring to vary the extent of the diaphragm upon which the medium operates.

5. In a pressure-regulator having a space for the supply-gas and a space for the return
50 from a system, the combination of a valve between said spaces, a valve-stem, and means on the valve-stem against which the pressure of the supply-gas may act said
55 means presenting the same operative area to the space for the supply-gas as does the valve.

6. In a pressure-regulator having a space for the supply-gas and a space for the return
60 of a system, the combination of a valve between said spaces, a valve-stem, means on the valve-stem against which the pressure of the supply-gas may act said means present-
65 ing the same operative area to the space for the supply-gas as does the valve and means to hold the valve yieldingly against the action of pressure in the other space.

7. In a pressure-regulator having a space for the supply-gas and a space for the return
70 from a system, the combination of a valve between said spaces, a valve-stem, and a diaphragm on the valve-stem presenting the same operative area to the space for the supply-gas as does the valve.

8. In a pressure-regulator having a space for the supply-gas and a space for the return
75 from a system, the combination of a valve between said spaces, valve-seats at each end of the valve, a valve-stem extending through the space for the supply-gas, a diaphragm on
80 the valve-stem presenting the same operative area to the space for the supply-gas as does the valve, and a spring to hold the valve yieldingly on the valve-seat between the valve and the other space.

This specification signed and witnessed
85 this 17th day of March, A. D. 1905.

ANTHONY L. NOONE.

In presence of—

LUCIUS E. VARNEY,

ANTHONY N. JESBERA.