No. 670,539. Patented Mar. 26, 1901.

J. B. ERWIN.

PRESSURE REGULATOR.

(Application filed Oct. 23, 1899. Renewed Nov. 17, 1900.)

(No Model.)

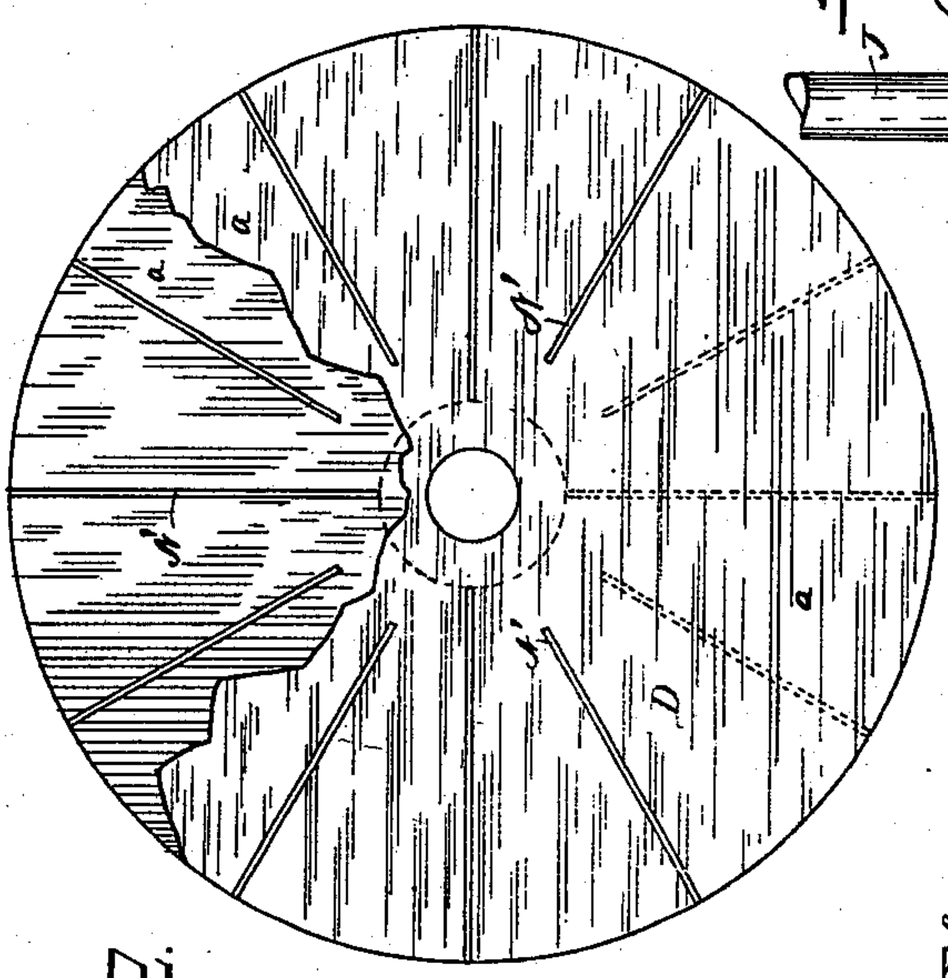

Fig. 2.

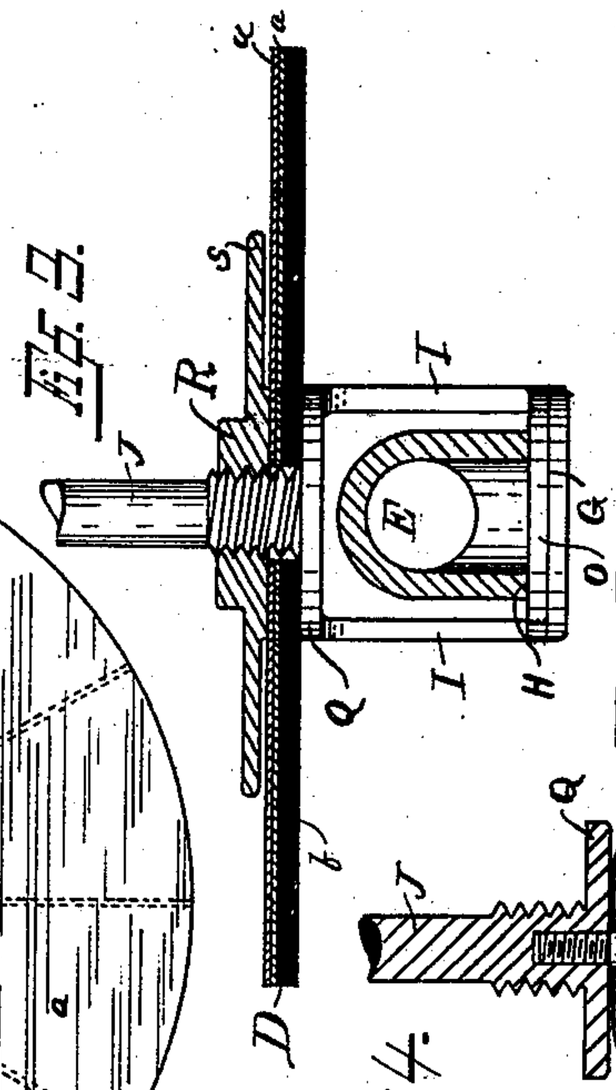

Fig. 3.

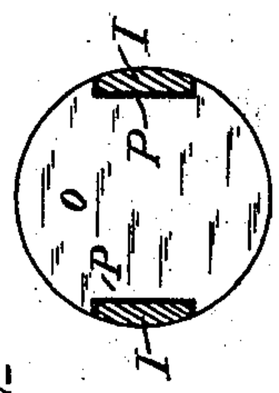

Fig. 5.

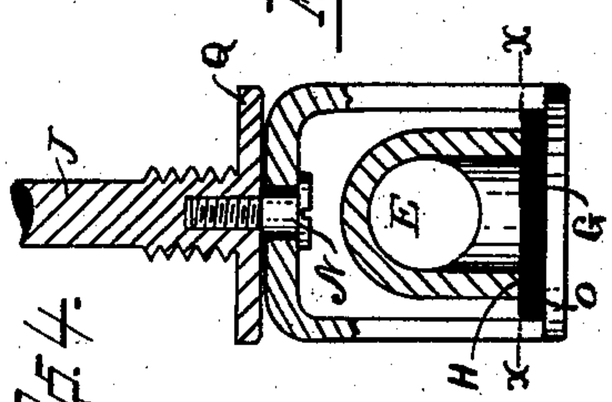

Fig. 4.

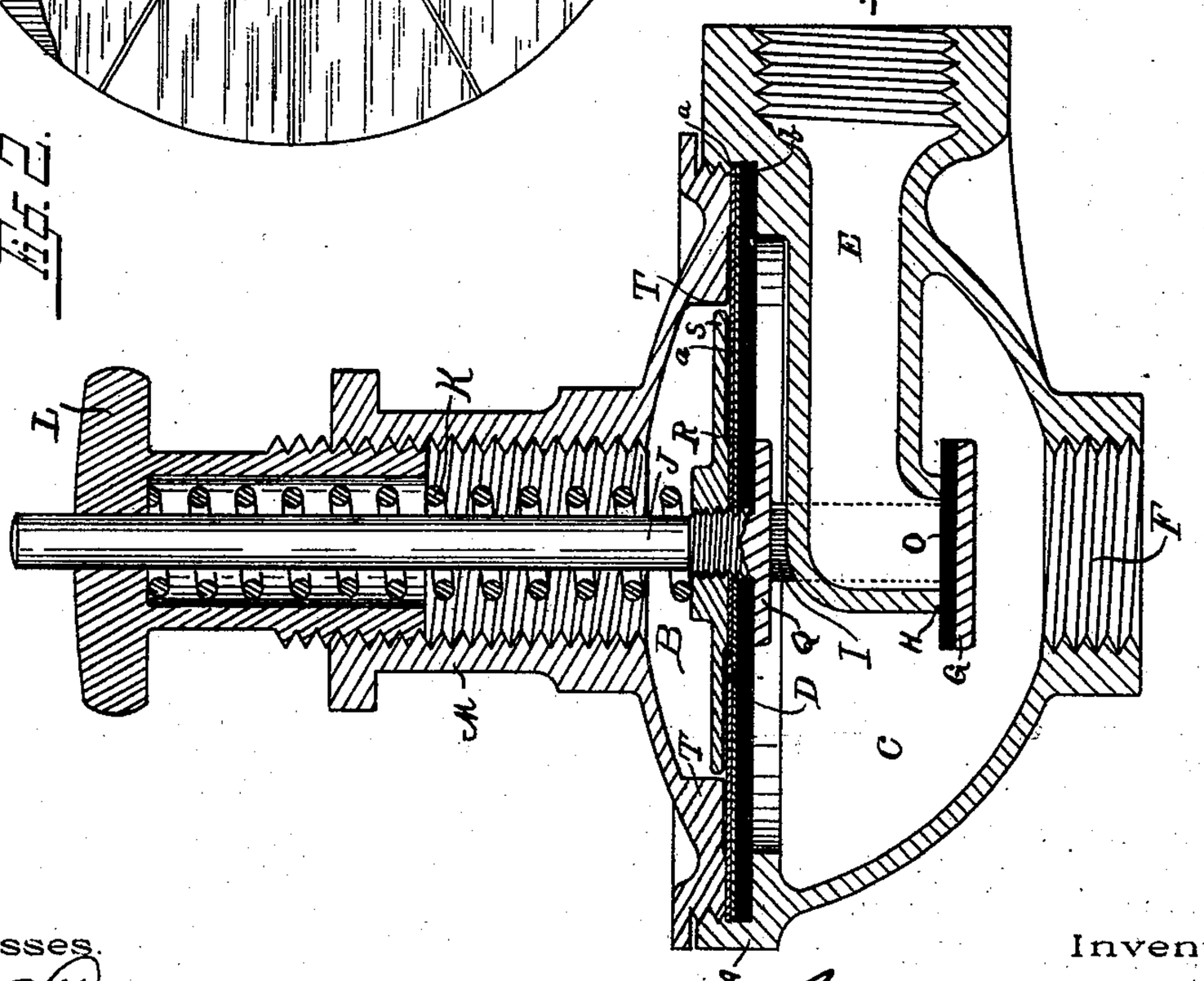

Fig. 7.

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UNITED STATES PATENT OFFICE.

JAMES B. ERWIN, OF MILWAUKEE, WISCONSIN.

PRESSURE-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 670,539, dated March 26, 1901.

Application filed October 23, 1899. Renewed November 17, 1900. Serial No. 36,823. (No model.)

To all whom it may concern:

Be it known that I, JAMES B. ERWIN, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Pressure-Regulators, of which the following is a specification.

My invention relates to improvements in fluid-pressure regulators; and it pertains to that class in which the fluid-controlling valve is actuated by a flexible diaphragm.

The construction of my invention is explained by reference to the accompanying drawings, in which—

Figure 1 represents a vertical section of the regulator. Fig. 2 is a detail showing two metallic diaphragms used in the regulator, the upper one of which is broken away to show the one below. Fig. 3 is a detail representing the inlet-duct and parts connected therewith, partly in section, drawn at right angles to that shown in Fig. 1. Fig. 4 is a detail showing a preferred form of device for connecting the valve-supporting stirrup with the valve-stem. Fig. 5 is a top view of the valve and a cross-section of the supporting-stirrup, drawn on line x x of Fig. 4.

Like parts are referred to by the same reference-letters throughout the several views.

A represents the valve-chamber, which is subdivided into two compartments B and C by the diaphragm D. The diaphragm D is clamped at its periphery between the walls of the compartments B and C. Water or other fluid under pressure is admitted to the compartment C through the inlet-duct E and escapes therefrom through the exhaust-duct F.

The inlet-duct E is formed integral with the walls of the inclosing chamber, from which it extends inwardly parallel with the diaphragm. The mouth of the discharge is in line with the valve-stem and center of the diaphragm, and the valve-seat formed thereon is turned away from said diaphragm toward the outlet of said chamber, whereby it is accessible and may be finished through said outlet-opening. The discharge end of the inlet-duct being thus unconnected with the walls, it is obvious that I am enabled not only to conveniently reach and finish the valve-seat, but also to thereby loop the valve-supporting stirrup I around it in such a manner as to bring the face of the valve O, which is supported from said stirrup, in contact with the seat as the diaphragm is forced outwardly by the pressure of the water, by which construction I am enabled to form the stirrup I integral with the stem, and thereby simplify the construction and reduce the cost.

The passage of the fluid through the regulator is governed by the valve G, which valve is supported from the diaphragm in front of its seat H by the stirrup I. The stirrup I is preferably connected with the stem J by a swivel-bolt N, as shown in Fig. 4, whereby the valve is free to seat itself regardless of any slight variation in the surface of the seat or the movement of the valve-stem or diaphragm. It may, however, be formed integral with the stem, as shown in Figs. 1 and 3.

Presuming the regulator to be connected with the inlet water-pipe of a building by the duct E and that the discharge pipes and faucets of the building are connected with the outlet-duct F, it will be understood that when any of such faucets are closed a back pressure will thereby be produced in the compartment C of the valve-chamber, whereby the diaphragm D will be forced outwardly, carrying with it the valve G, which is connected therewith, to its seat, as shown in Fig. 1, whereby the valve is closed and the further admission of fluid to the valve-chamber is stopped. When, however, any of such faucets are opened, the pressure against said diaphragm is thereby reduced, when the diaphragm will be forced inward by the recoil of the spiral spring K and said valve will be opened. As the area of the diaphragm is usually about forty times greater than that of the valve, it will be understood that one pound pressure in the diaphragm-chamber will close the valve against forty pounds pressure in the water-mains, less the resistance of the tension-spring and the diaphragm, and that when the resistance of the diaphragm and spring is removed the fluid-controlling valve will be closed with a uniform low pressure in the valve-chamber regardless of the varying pressure of the water in the mains. When, however, a higher pressure is desired, it can be raised as required up to the full pressure in the water-mains by increasing the resistance of said spring, which end is accomplished by

turning down the hand-nut L in the sleeve M against it. Thus any desired pressure less than that of the supply may be obtained by the proper adjustment of the hand-nut against said tension-spring.

To obtain the best results, the diaphragm should be as flexible as possible consistent with the strength required, and in view of the fact that the thinnest and most flexible metal is liable to have minute fissures in it when made or to sometimes split in line with the grain when being used I have found it necessary or preferable in making the diaphragms to use one or more thin sheets of metal *a a* in connection with a sheet of rubber or other similar lining *b*, which lining is located upon the pressure side of the metallic disk *a*, in which case the metallic disk gives the required strength to the diaphragm, while the rubber lining prevents the liability of leakage through the fissures, if any, of the metal. When two metallic disks are thus used, the grain of the metal of one disk is arranged at right angles to the grain of the metal of the other disk, whereby the liability of such disk becoming split by excessive pressure is avoided.

To facilitate the action of the diaphragms and prevent them from buckling or breaking as they are bent inwardly and outwardly by the pressure against them, they are preferably provided with radial slits N′. When two metallic diaphragms are thus used together, the radial slits of one are arranged at right angles to the slits of the other, while the radial slits of each are formed substantially parallel with the grain of the metal, as indicated in Fig. 2.

The valve G is provided with an elastic cushion O, which is retained in place upon the valve by the sides of the stirrup I, which sides engage in the recesses P P of the cushion.

The diaphragm D is secured at its center to the valve-stem J by and between the stationary collar Q and the clamping-nut R. The clamping-nut R is preferably provided with an annular bearing-flange S, which extends outwardly beyond the clamping-surface of said nut and serves to support the central unclamped portion of the diaphragm against the pressure of the fluid within, while the remaining unclamped portion of the diaphragm is supported on its upper side against said pressure by the bearing-surface T. Thus it will be obvious that when the faucets connected with the exhaust of the regulator are closed and the diaphragm is forced back by the resultant internal pressure the diaphragm will be supported against such pressure by said rigid bearing-surfaces T and S, whereby the liability of the diaphragm being broken by excessive pressure from within is obviated. It therefore follows that the diaphragm is always supported from without when subjected to the highest pressure and that it is never moved away from its supporting-bearings except only when the pressure in the chamber is reduced by opening the faucets connected with the exhaust.

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

1. In a pressure-regulator, the combination of a valve-chamber; a flexible diaphragm formed of metallic and non-metallic disks; a valve-stem centrally secured to said diaphragm and protruding at one end from one side of said chamber, and provided at its opposite end with a valve-supporting stirrup; an inlet-duct formed integral with and supported from one side only of said valve-chamber, and extending inwardly parallel with said diaphragm, and having its discharge-orifice and valve-seat facing the discharge-opening of said chamber, whereby said seat may be finished through said outlet-opening and said stirrup may be looped over the unconnected end of said inlet-duct; a tension-spring; an adjusting-nut surrounding said spring and adapted to adjust the tension of said spring against said diaphragm, substantially as and for the purpose specified.

2. In a pressure-regulator, the combination of a valve-chamber; a flexible diaphragm formed of a non-metallic disk and two metallic disks, the grain of the metal of one disk being arranged at right angles to the grain of the metal of the other disk; a valve-stem centrally secured to said diaphragm and protruding at one end from one side of said chamber, and provided at its opposite end with a valve-supporting stirrup; an inlet-duct formed integral with and supported from one side only of said valve-chamber, and extending inwardly parallel with said diaphragm, and having its discharge-orifice and valve-seat facing the discharge-opening of said chamber; a tension-spring; an adjusting-nut surrounding said spring and adapted to adjust the tension of said spring against said diaphragm, substantially as and for the purpose specified.

3. In a pressure-regulator, the combination of a valve-chamber; a flexible diaphragm formed of metallic and non-metallic disks, subdividing said chamber into two compartments; an inlet-duct formed parallel to said diaphragm, having its discharge-orifice facing the outlet-duct of said chamber; a valve-stem centrally secured to said diaphragm, protruding at one end from the side of said valve-chamber, and provided at its opposite end with a valve; a tension-spring adapted to act against the exterior side of said diaphragm; an adjustable hand-nut surrounding said valve-stem and spring, and adapted to adjust the tension of said spring against said diaphragm; a central annular bearing-flange formed integral with the diaphragm-clamping nut, and adapted to support the unclamped central portion of said diaphragm; and an exterior annular bearing-flange formed integral with the upper wall of said valve-chamber, and adapted to support the un-

clamped external portion of said diaphragm, all substantially as and for the purpose specified.

4. In a pressure-regulator, the combination of a valve-chamber; a flexible diaphragm formed of metallic and non-metallic disks; a valve-stem centrally secured to said diaphragm and protruding at one end from one side of said chamber; a valve-supporting stirrup pivotally secured to the opposite end of said valve-stem; an inlet-duct formed integral with and supported from one side only of said valve-chamber, and extending inwardly parallel with said diaphragm, and having its discharge-orifice and valve-seat facing the discharge-opening of said chamber, whereby said seat may be finished through said outlet-opening and said stirrup may be looped over the unconnected end of said inlet-duct; a tension-spring; an adjusting-nut surrounding said spring and adapted to adjust the tension of said spring against said diaphragm, substantially as and for the purpose specified.

5. In a pressure-regulator, the combination of a valve-chamber; a flexible diaphragm formed of one or more metallic disks, provided with radial slots or cuts extending from the clamping-nuts outwardly to the periphery; and a non-metallic disk located upon the pressure side of said metallic disk or disks; an inlet-duct having its discharge-orifice within said valve-chamber; a valve adapted to close said inlet-duct connected with said diaphragm; a valve-stem secured to said diaphragm and protruding from the side of said valve-chamber; a tension-spring adapted to act against the exterior side of said diaphragm; and an adjustable hand-screw adapted to adjust the tension of said spring against said diaphragm, substantially as and for the purpose specified.

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

JAMES B. ERWIN.

Witnesses:

CHAS. B. PERRY,

CLARA L. ROESCH.