July 10, 1923. 1,461,086

M. A. FESLER

DIAPHRAGM DEVICE

Filed July 2, 1920

Fig. 2

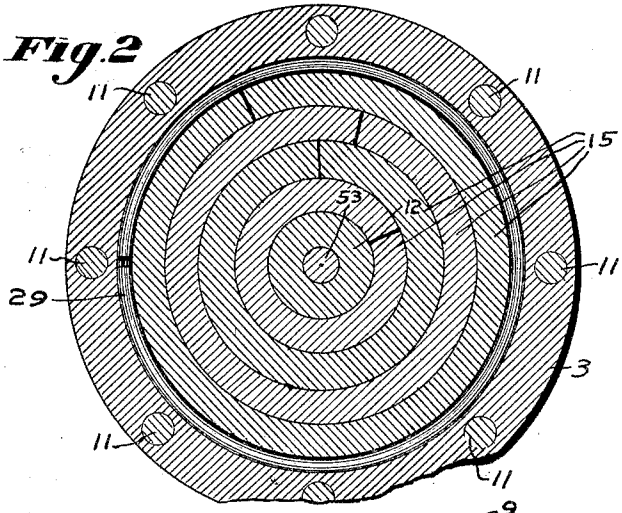



Fig. 1

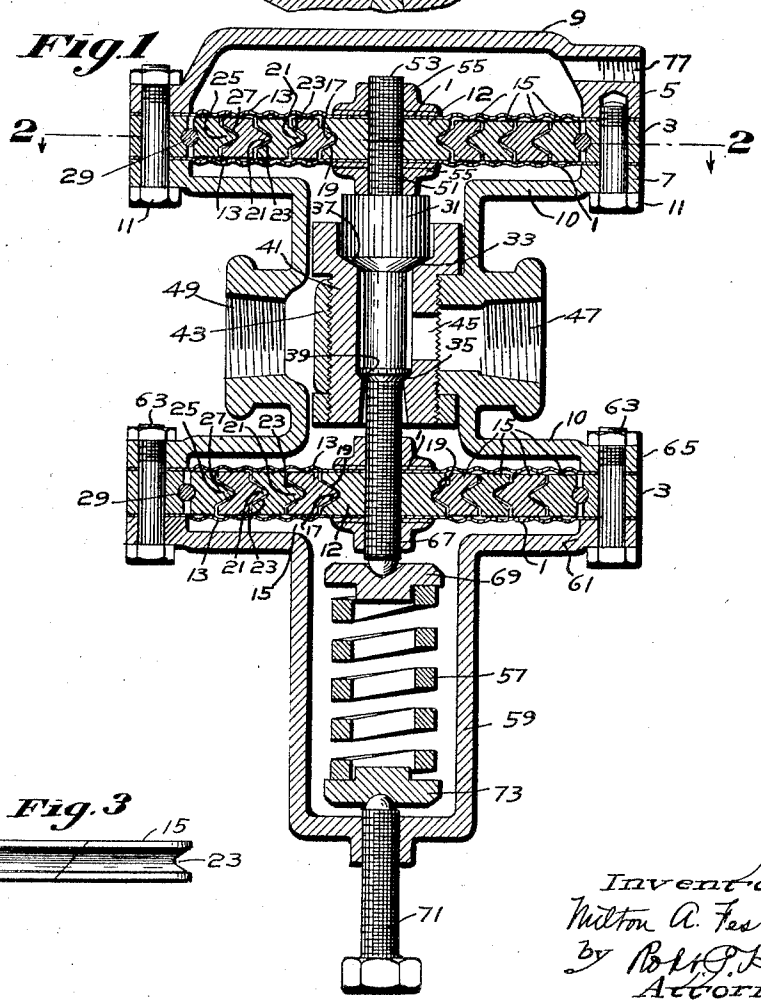



Fig. 3




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# UNITED STATES PATENT OFFICE.

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## DIAPHRAGM DEVICE.

Application filed July 2, 1920. Serial No. 393,647.

*To all whom it may concern:*

Be it known that I, MILTON A. FESLER, a citizen of the United States, residing at Oakland, in the county of Alameda and State of California, have invented an Improvement in Diaphragm Devices, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

The invention to be hereinafter described relates to diaphragm devices for use in apparatus for regulating combustion and other purposes.

A diaphragm device has been provided comprising a pair of spaced thin flexible plates having confined margins, a central block and separate concentric rings between said plates to hold the same in spaced relation. The block may be connected to a valve or other device to be operated. Since the plates are thin they will readily flex in response to pressure, but they are desirably strengthened by the block and rings to give the diaphragm the requisite strength to withstand heavy pressures.

In practice it is found that pressure on the diaphragm plates tends to cause the same to bulge or distort in the circumferential zones opposite said rings, so that when pressure is applied to the opposite side thereof, it will be objectionably resisted by the arched or bulged form thus given to the plates, thereby preventing the plates from flexing readily and uniformly in response to such pressure. Also, such bulging or distortion prevents the central block or member from promptly and properly moving in response to variations in pressure on the diaphragm plates, and therefore, prevents prompt and proper movement of the valve or other device connected to or actuated by the block.

The aim and purpose of the present invention, therefore, is to provide means to prevent the local bulging or distortion referred to. In carrying this feature of the invention into practical effect, in the present instance of the invention, the diaphragm device is provided with rings or members so interconnected that they will have limited relative movement, the construction being such that the objectionable bulging or distortion of the thin diaphragm plates is prevented.

The character of the invention will be best understood by reference to the following description of one good form thereof shown in the accompanying drawing, wherein:—

Fig. 1 is a vertical section through a pressure control valve provided with diaphragm devices embodying the invention;

Fig. 2 is a horizontal section taken on line 2—2 of Fig. 1; and

Fig. 3 is an edge view of one of the intermediate rings.

Referring to the drawing, the diaphragm device shown therein as one good form of the invention, comprises a pair of thin, flexible plates 1 of copper or other suitable material, the margins of which may be suitably confined. To accomplish this, in the present instance of the invention, said margins are confined by a spacing ring 3 interposed between said margins, and flanges 5 and 7 of casings 9 and 10 at opposite sides of the spacing ring 3. Said margins, spacing ring and flanges may be detachably secured together by suitable bolts 11.

Mounted between the flexible plates 1 is a spacing block or member 12 desirably located centrally of said plates, and adapted to be connected to a valve or instrumentality to be operated by the diaphragm device, as more fully hereinafter described. To contribute to ready flexibility of the plates 1, the circumferential zones or portions 13 thereof may be of a corrugated or undulatory character.

Intermediate the block 12 and the spacing ring 3 are a plurality of rings or elements 15, in the present instnace, four being shown, but the number thereof may be varied as desired. These rings may have a thickness substantially equal to the block 12 and the spacing ring 3 so as desirably to occupy the space between the corrugated portions 13 of the plates 1.

To prevent the objectionable sagging or distortion of the zones 13 of the plates intermediate the spacing ring 3 and the block 12, the rings may have a jointed relation with respect to each other, the innermost ring may have a jointed relation with respect to the block 12, and the outermost ring may have a jointed relation with respect to the spacing ring 3. In the present instance of the invention, the inner ring

may have a circumferential rib or projection 17 extending inwardly therefrom into a groove 19 in the block 12. The intermediate rings may have ribs or projections 21 projecting inwardly therefrom into outer grooves 23 in the adjacent rings. The outer ring may have a rib or projection 25 extending into an outer groove 27 in one of the intermediate rings. The outer ring and the spacing ring may have opposed grooves receiving an interrupted wire 29. A small amount of clearance is provided between the cooperating ribs and grooves to permit limited movement there-between, and the rings 15 may be split preferably obliquely with respect to the plane thereof to facilitate assembly of the rings in concentric relation.

The construction is such that the rings may have a limited movement with respect to each other and with respect to the block and spacing ring, but the relative movement of any two adjacent rings is not great enough to permit local bulging or sagging of the zones 13 relatively to the confined margins of the diaphragms and the central portions thereof opposite the block 12. Consequently, when pressure is applied to either side of the diaphragm device, the plates 1 will flex in response to slight or substantial variations in pressure promptly to impart movement to the block 12, and the latter will serve promptly to impart movement to a valve or other device to be operated thereby; but by limiting the amount of relative movement that may take place between any two adjacent rings, the portions of the flexible plates 1 resting upon said adjacent rings will be prevented from being unduly flexed or distorted.

The diaphragm device described is simple in construction, easily manufactured, and is sufficiently strong to withstand and efficiently operate in response to high pressures.

The diaphragm device described may be employed for various purposes, but for exemplification, in the present instance, it is shown as operating a valve, such, for example, as a valve employed for regulating the supply of oil or atomizing steam to a fuel oil burner.

In the present instance, a valve 31 is shown having conical portions 33 and 35 co-operating respectively with seats 37 and 39 in a bushing 41 threaded in a sleeve 43 mounted in the casing 10 referred to. A port 45 in said bushing communicates with a neck 47 projecting from the casing 10 and adapted to be connected with a pipe for conducting oil or steam thereto. A neck 49 projects from the casing 10 at a point conveniently diametrically opposed to the neck 47, and is adapted to be connected to a pipe for conducting the oil or steam to a burner.

The valve 31 may have a stem 51 having an end projecting through the block 12 of the diaphragm device and secured thereto by a nut 53, suitable washers 55 being provided at opposite sides of the diaphragm device.

The construction is such that on flexion of the diaphragm device, the valve will be moved relatively to the valve seats 37 and 39 to regulate the amount of oil or steam fed through the neck 47, the port 45, past the valve seats into the casing 10 and thence out through the neck 49.

In some instances it is desirable to subject the diaphragm device to a counterpressure. To accomplish this, in the present instance, a coil spring 57 may be provided in a head 59 having a flange 61 secured by bolts 63 to a flange 65 projecting outward from the casing 10.

The valve 31 may have a stem 67 adapted to engage a cap 69 confined between the end of said stem and one end of the coil spring 57. An adjusting screw 71 may be threaded into the head 59 and have a cap 73 confined between said screw and the opposite end of the coil spring 57. The construction is such that the screw may be adjusted to vary the tension of the spring to furnish the counterpressure effect desired.

To separate the head 59 containing the spring from the casing 10 and prevent entrance of oil or steam into said head while admitting movement of the valve 31 in response to pressure on the upper diaphragm device, a similar diaphragm device 75 may be connected to the stem 67 and have its margins confined between the flanges 61 and 65 referred to.

The casing 9 may have a port 77 therein tapped to receive a pipe for transmitting steam pressure from a steam generator or other source to the chamber above the diaphragm device in the casing 9.

If the steam pressure rises, the upper diaphragm device will be flexed downward against the resistance of the coil spring 57, thereby moving the valve 31 toward its seats, and on the other hand, if the steam pressure lowers, the coil spring 57 will be effective to move the valve upward away from its seats. Thus, the valve may be automatically operated to regulate the amount of oil, steam or other fluid passing through the casing 11.

It will be understood that the invention is not limited to the specific embodiment shown, and that various deviations may be made therefrom without departing from the spirit and scope of the appended claims.

What is claimed is:—

1. A diaphragm device, comprising, in combination, a pair of spaced flexible plates, a block interposed between said plates, and a plurality of rings encircling said block and interposed between said plates, said rings having circumferential ribs and

grooves, with the ribs freely entered into the grooves to limit the relative movement of the adjacent rings and thereby prevent local bulging of the portions of the plates opposite said rings on flexion of said plates.

2. A diaphragm device comprising, in combination, a pair of spaced flexible plates, means to confine the margins of said plates, a plurality of concentric rings between said plates, and interengaging means between the adjacent rings constructed and arranged to limit the relative movement of the adjacent rings axially in either direction, and thereby prevent local bulging of the portions of the plates opposite said rings on flexion of said plates.

3. A diaphragm device, comprising, in combination, a pair of spaced flexible plates, means to confine the margins of said plates, a spacing ring interposed between said margins, a central member between said plates, and a plurality of rings intermediate said spacing ring and member and interposed between said plates, said spacing ring, member and rings having jointed connections for limiting relative movements thereof axially in either direction.

4. A diaphragm device, comprising in combination, a pair of spaced flexible plates, means to confine the margins of said plates, a plurality of concentric rings between said plates, and means for connecting each ring to the concentric ring surrounding it and adapted to limit the relative axial movement of the rings on flexion of the plates in either direction.

5. A diaphragm device, comprising, in combination, a pair of spaced flexible plates having confined margins, a central member interposed between said plates, and a plurality of concentric rings encircling said member, and having interengaging ribs and grooves for limiting relative movement of said rings, the innermost ring having jointed connection with the central member.

6. A diaphragm device, comprising, in combination, a pair of flexible plates, a central member interposed between said plates, a spacing ring interposed between the margins of said plates, a plurality of intermediate rings interposed between said central member and spacing ring, said spacing ring and the outermost intermediate ring having opposed grooves therein, and a member mounted in said grooves to limit the movement of said outermost intermediate ring with respect to said spacing ring.

7. A diaphragm device, comprising, in combination, a pair of flexible plates having confined margins, a spacing ring interposed between said margins, a central member interposed between said plates, a plurality of intermediate rings between said central member and spacing ring, said central member and intermediate rings having circumferential ribs and grooves for inter-engagement to allow limited relative movement thereof, the outermost intermediate ring and the spacing ring having opposed grooves therein, and an element mounted in said opposed grooves to allow relative movement of the outermost intermediate ring with respect to the spacing ring.

8. A diaphragm device, comprising, in combination, a pair of flexible plates, a central member mounted between said plates, a plurality of rings between said plates encircling said member, said rings and member having provision for limiting relative movement thereof, and means connected to said central member adapted to impart movement to a device to be controlled thereby.

9. A diaphragm device, comprising in combination, a pair of spaced flexible plates having confined margins, a central member interposed between said plates, a plurality of concentric rings encircling said member and having interengaging ribs and grooves for limiting the relative movement of adjacent rings, means for limiting the movement of the innermost ring relative to the central member, and means for limiting the movement of the outermost ring relative to said confined margins.

10. A device of the character described, comprising, in combination, a pair of spaced diaphragms, means to confine the margins of said diaphragms, and a plurality of members interposed between said diaphragms having provision to limit relative movement of said members on flexion of the diaphragms in either direction.

In testimony whereof, I have signed my name to this specification.

MILTON A. FESLER.