Nov. 1, 1927. 1,647,823

A. B. ANTISELL

VALVE

Filed Aug. 31, 1926 2 Sheets-Sheet 1

Fig. 1.

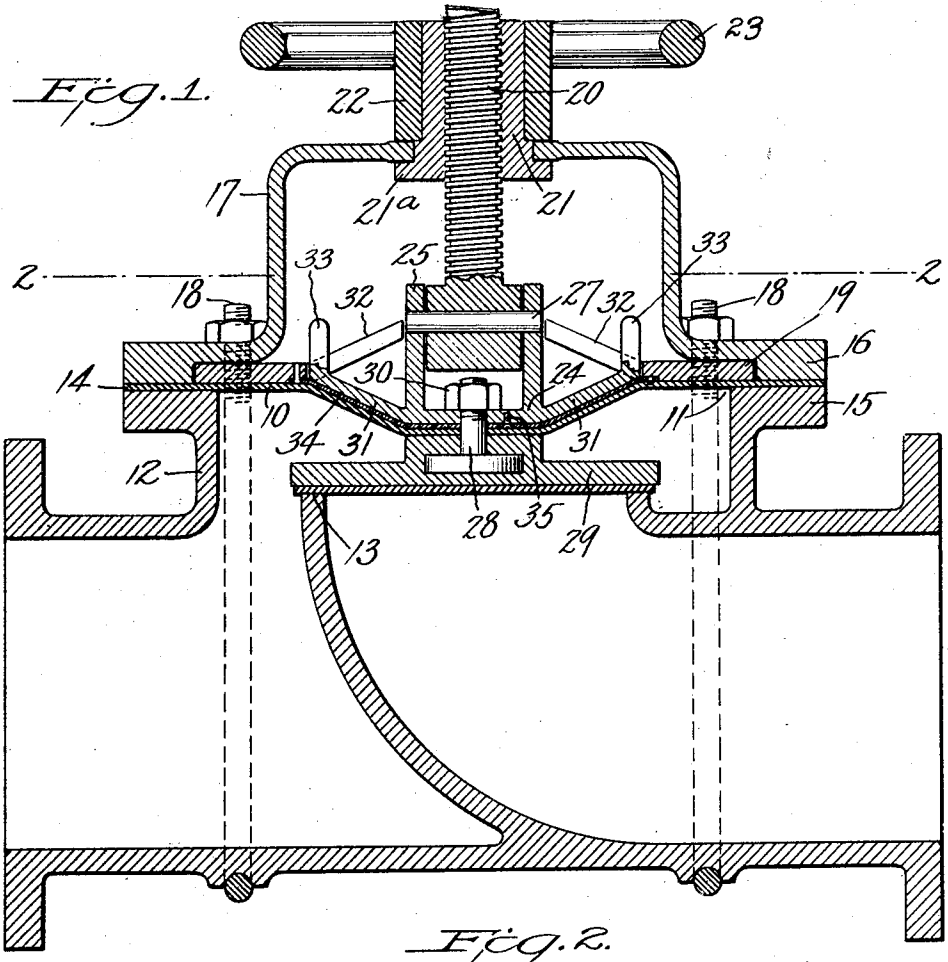
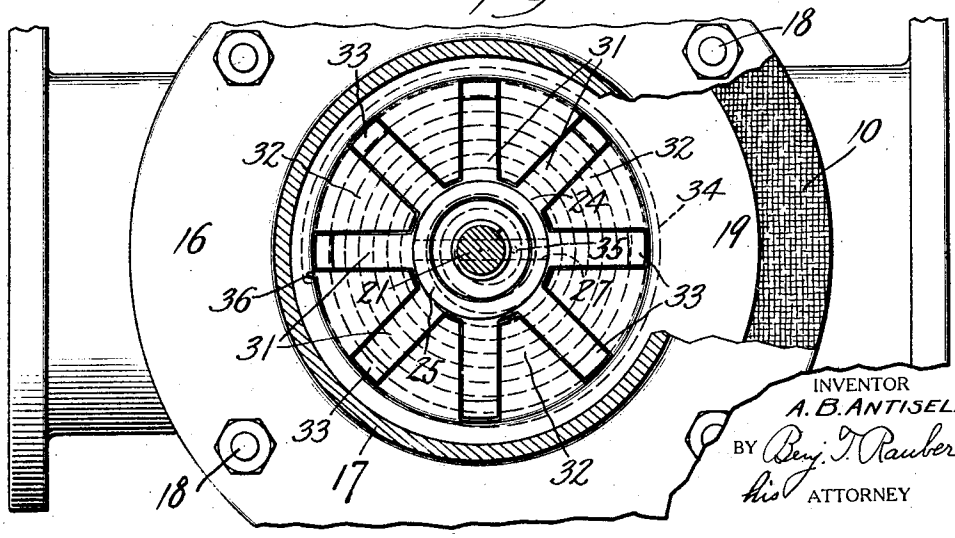


Fig. 2.



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Filed Aug. 31, 1926 2 Sheets-Sheet 2

Fig. 3.

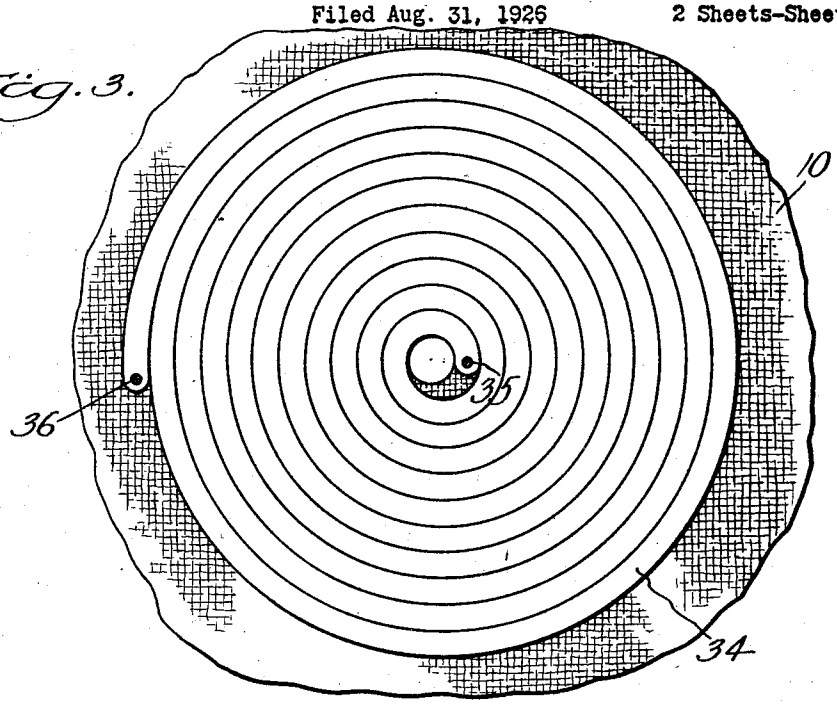
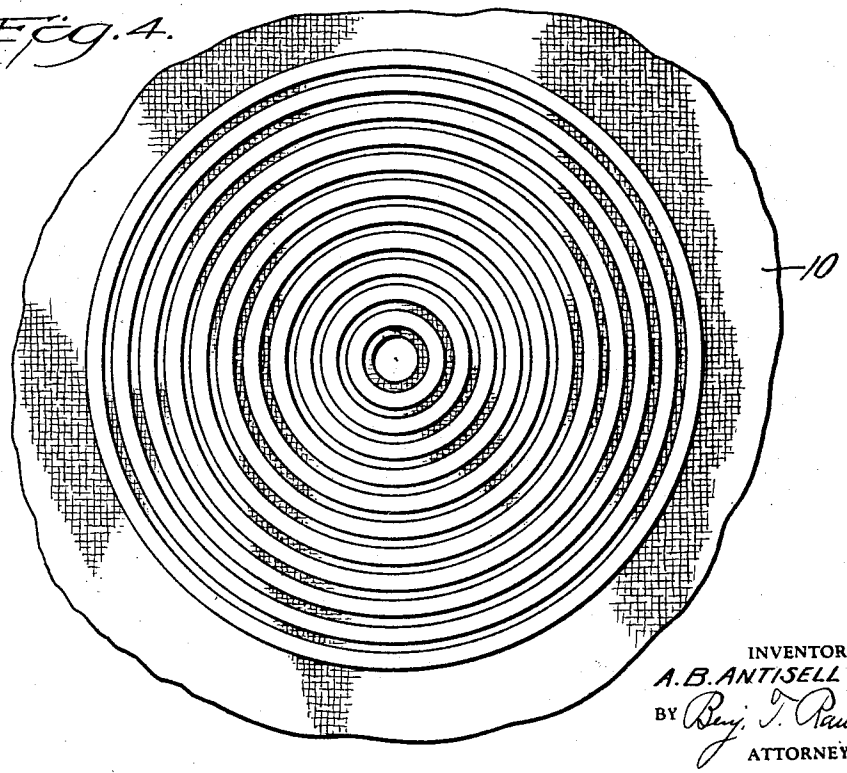


Fig. 4.



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UNITED STATES PATENT OFFICE.

ALFRED B. ANTISELL, OF NEW YORK, N. Y.

VALVE.

Application filed August 31, 1926. Serial No. 132,662.

My present invention relates to valves, particularly to valves having a hermetic seal about the valve stem in the form of a flexible diaphragm secured to the valve chamber walls and to the valve stem, and flexing as the valve and valve stem move to and from the valve port. In valves of this type, the flexing portion of the diaphragm is subjected on one side to the full pressure of the fluid confined in the valve chamber, and on the opposite side is subjected merely to atmospheric pressure. As the diaphragm must be made of thin, flexible material, this pressure imposes a relatively severe strain on the material of which the diaphragm is constructed.

An object of my present invention is to provide a rigid supporting means for the diaphragm on the outer side thereof without interfering with or limiting the free movement of the diaphragm.

In the attainment of this end, a number of spaced supporting arms are provided to extend from the fixed peripheral portion of the diaphragm towards the center, and having inclined surfaces against which the outer face of the diaphragm rests and is supported, when flexed to its outermost position. When the diaphragm is pushed inwardly by the valve stem, its outer face is supported by spaced arms carried on the valve stem and extending between the stationary arms, the supporting surface of these valve stem arms being inclined to the same angle as the diaphragm when it is flexed inwardly. The diaphragm in its intermediate positions is supported partly by one and partly by the other set of arms. In all positions of the diaphragm the portions spanning the spaces between the arms remain unsupported.

A further object of my invention is therefore to provide a reinforcement or support for the diaphragm in the areas between the supporting arms.

Another object of the invention is to provide a valve construction for valves of the above type in which the flexing area of the diaphragm may be independent of and of smaller periphery than the area of the valve plate or valve seat.

Other objects and features of the invention are to provide a valve of the type described having circular, concentric supports for the diaphragm in all of its positions and, in turn, supported by the supporting and guiding arms.

With these and other objects in view, the invention comprises the valve described and set forth in the following specification and claims.

The various features of the invention are illustrated in the accompanying drawing, in which:

Fig. 1 is a section taken longitudinally of the axes of the valve and valve stem of a valve embodying my invention.

Fig. 2 is a section of the valve taken on line 2—2 of Fig. 1, the parts being broken away to more clearly show the structure of portions of the valve.

Fig. 3 is a plan view of a diaphragm supporting spiral forming a part of the invention.

Fig. 4 is a plan view of a modified form of diaphragm supporting means.

In my present invention a valve chamber is provided with an opening spaced from the valve seat, and this opening is closed by a flexible diaphragm having a valve secured to it on its inner side, and movable to and from the valve seat as the diaphragm is flexed inwardly or outwardly. In all of its flexed positions the outer surface of the diaphragm is supported by reinforcing or supporting means of a circular, concentric structure, such as a series of concentric rings or a spiral that permits bending on radial lines, but which is rigid transversely of the radii of the flexing areas. The concentric, circular diaphragm supports are supported in all their positions by stationary arms extending towards the axis of movement of the diaphragm, or by arms secured to the outer side of the diaphragm and extending between the stationary arms. The interspersed stationary and moving arms are inclined from their respective outer and inner supports so that when the diaphragm is flexed outwardly, the support of the reinforcing elements is taken up by the stationary arms, and when flexed inwardly, it is assumed by the movable diaphragm arms. This reinforcing structure may, of course, be used where the diaphragm is flexed by an outwardly applied force, as in closing a valve, or in cases where pressure is used to transmit movement through the diaphragm. As

the valve is secured to the diaphragm it may be made larger or smaller than the flexing area of the diaphragm and, accordingly, the area of the diaphragm subjected to pressure may be made independent of the area of the valve port.

Referring more particularly to the accompanying drawing, a diaphragm 10 is mounted to span and close an opening 11 in a valve chamber 12 directly opposite and slightly spaced from a valve seat 13. The outer edge portion 14 of the diaphragm 10 is secured between a flange 15 on the casing 12, and a flange 16 extending outwardly from a bonnet 17, tightly clamped to the flange 15 by means of a pair of U-shaped bolts 18. The diaphragm is further supported on its outer side over an area radially inwardly of the edge of the opening 11, by means of an annular plate 19 mounted in a recess in the flange 16 and projecting past the edge of the opening 11. The portion of the diaphragm 10, within the inner periphery of this plate 19 is therefore free to be flexed inwardly against the pressure acting on the inner face of the diaphragm. In the embodiment shown, the diaphragm is flexed inwardly and outwardly by means of a valve stem 20 threaded into a rotatable sleeve 21, retained in its vertical position in an opening in the upper part of the bonnet 17. The sleeve 21 is rotatably secured to the bonnet 17 by means of a flange 21a resting against the inner face of the top wall of the bonnet 17, and by a ring 22 secured to the sleeve 21 and resting against the upper edge of the wall of the bonnet 17. The ring 22 is provided with a hand wheel 23 for turning the sleeve.

To the lower end of the stem 20 a head 24 is secured by means of a cylinder, and a pin 27 passing therethrough and through the end of the stem 20, providing a flexible or rocking connection between the stem and the head. The stem 20 and said cylinder constitutes a sectional valve stem. The head 24 is secured to the central portion of the diaphragm 10, by means of a short bolt 28, the lower end of which is enclosed and anchored in a valve plate 29, having a boss covering that portion of the face of the diaphragm opposite the bottom of the head 24. The bolt 28 is secured in the head 24 by means of a nut 30, or other suitable connection.

As the hand wheel 23 is turned in one direction or the other while the valve stem 20 is kept from turning, the diaphragm 10 is flexed inwardly and outwardly, and the valve plate 29 is moved to or from the valve seat 13, and at the same time the flexing portion of the diaphragm 10 is supported by means of a number of arms 31 extending radially outward from the head 24, and meshing with a number of converging radial arms 32, extending from the inner periphery of the plate 19 towards the valve stem. The lower portions of the arms 31 are inclined upwardly and outwardly so that when the head 24 is in its lowermost position these arms will extend from the head 24 to the inner periphery of the plate 19, and therefore be in position to support those portions of the diaphragm which lie beneath these arms. The arms 32 are conversely inclined centrally and upwardly so that when the diaphragm is flexed downwardly or inwardly its surface is free from the lower surface of the arms 32, but when drawn upwardly or outwardly until the lower inner face of the head 24 reaches the upper edge of the lower surfaces of the arms 32, the portions of the diaphragm beneath the arms 32 will rest and be supported by these arms, while those portions of the diaphragm beneath the arms 31 will be unsupported. The arms 31 and 32 being intermeshed, prevent the stem 20 from turning as it is raised and lowered, thereby rendering the use of a key and keyway unnecessary for preventing the stem 20 from turning.

To prevent the arms 31 from being forced downwardly out of engagement with the arms 32, the outer ends of the arms 31 are preferably provided with upwardly projecting lugs 33. It will be apparent that as the valve stem 20 moves inwardly and outwardly, the support of the diaphragm 10 on its outer side is assumed in turn by the arms 31 and 32, and that when the support of a certain part of the diaphragm is taken by the arms 31, the spaces between the arms 31 and below the arms 32 are unsupported, and that when the support of the diaphragm is formed by the arms 32, the spaces between the arms 32 are left unsupported. To support the diaphragm throughout its entire area, a number of rings as shown in Fig. 4 or a single spiral 34 as shown in Fig. 3 are positioned on the diaphragm concentrically with the axis of the valve stem 20. The rings or spiral of wire 34 span the distances or spaces between the arms 31 and 32, respectively, and support or reinforce all the parts of the diaphragm. The rings or spiral 34 permit the diaphragm to bend freely on radial lines and, therefore, do not interfere in any way with its flexibility.

The spiral 34 may be conveniently held in its proper position by securing its inner end to the head 24, as at 35, and securing its outer end to the ring 19 as at 36.

Any suitable type of spiral or concentric ring arrangement may be employed. A spiral, preferable from many standpoints, may be made by making a spiral cut in a disc of sheet metal. A spiral reinforcement of this type has the advantage that it supports the flexible diaphragm throughout its

surface without forming any raised rib-like portions. It is also extremely flexible while providing the necessary strength.

It will be apparent from the description given above that the inner periphery of the plate 19 may be made of any desired diameter regardless of the dimensions of the valve plate 29, or valve seat 13. Thus, for a given movement of the valve, the area of the valve plate 29 may be made as large as desired, while maintaining the flexing area of the diaphragm constant, or even diminishing it if the pressures to be confined should render that desirable. It is evident also that the valve chamber 12 might be provided with a flange extending inwardly and narrowing the opening 11 to approximately the same area as the plate 29.

As changes of construction could be made within the scope of my invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

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

1. A valve of the type described which comprises a valve chamber, a flexible diaphragm closing and forming a wall of said chamber, a valve stem secured to said diaphragm, a stationary annular member on the outer side of said diaphragm and having outwardly inclined stationary arms extending towards said valve stem, upwardly inclined arms secured to said stem extending between said stationary arms, and concentric wires on the outer side of and supporting said diaphragm and supported by said arms.

2. A valve of the type described which comprises a valve chamber, a flexible diaphragm closing and forming a wall of said chamber, a valve stem secured to said diaphragm, a stationary annular member on the outer side of said diaphragm and having outwardly inclined stationary arms extending towards said valve stem, upwardly inclined arms secured to said stem and extending between said stationary arms, and reinforcing wires on the outer side of and concentric with the axis of said valve stem and supporting said diaphragm between said arms.

3. A valve of the type described which comprises a valve chamber, a flexible diaphragm closing and forming a wall of said chamber, a valve stem secured to said diaphragm, a stationary annular member on the outer side of said diaphragm and having outwardly inclined stationary arms, arms carried on said valve stem adjacent said diaphragm and extending between said stationary arms, and a valve plate secured to the inner side of said diaphragm and extending beyond the outer ends of said arms.

4. A valve of the type described which comprises a valve chamber, a flexible diaphragm closing and forming a wall of said chamber, a valve stem secured to said diaphragm, an annular diaphragm supporting plate having diaphragm supporting arms extending from its inner periphery towards said valve stem and inclined outwardly from the plane of said plate, said supporting plate being on the outer surface of said diaphragm, and diaphragm supporting arms extending from the central portion of said diaphragm outwardly between said inclined arms, and a valve plate secured to the under surface of said diaphragm and extending outwardly beyond the ends of said supporting arms.

5. A valve of the type described which comprises a valve chamber, a flexible diaphragm closing and forming a wall of said chamber, a valve stem secured to said diaphragm and projecting outwardly therefrom, a stationary member on the outer side of said diaphragm and having surfaces inclined outwardly and converging towards said valve stem, and a valve plate secured to and spaced from the inner face of said diaphragm, the periphery of said valve plate being greater than that of the flexing portion of said diaphragm.

6. A valve of the type described which comprises a valve chamber having a valve stem, a valve plate, a flexible diaphragm between said stem and said plate, a removable plate on the outer side of said diaphragm for supporting said diaphragm having an inner periphery about said valve stem less than the outer periphery of said valve plate, outwardly inclined and intermeshed arms extending radially from said supporting plate and said valve stem, and concentric flexible reinforcements for said diaphragm extending transversely of said arms.

7. In a device of the type described, a flexible diaphragm, means for supporting said diaphragm at its outer portion a valve secured centrally of said diaphragm and a metal spiral centered on the axis of movement of said valve on the face of said diaphragm opposite said valve, and extending to the edge of the flexing area of said diaphragm means securing the inner end of said spiral to said valve, and means securing the outer end of said spiral to said diaphragm supporting means.

8. In a device of the type described, a flexible diaphragm, and a metal spiral of flat sheet metal mounted on said diaphragm and extending from the central portion to the edge portion of the flexing area of said diaphragm.

In testimony whereof I hereunto affix my signature.

ALFRED B. ANTISELL.