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FOOT VALVE FOR PUMP SUCTION LINES

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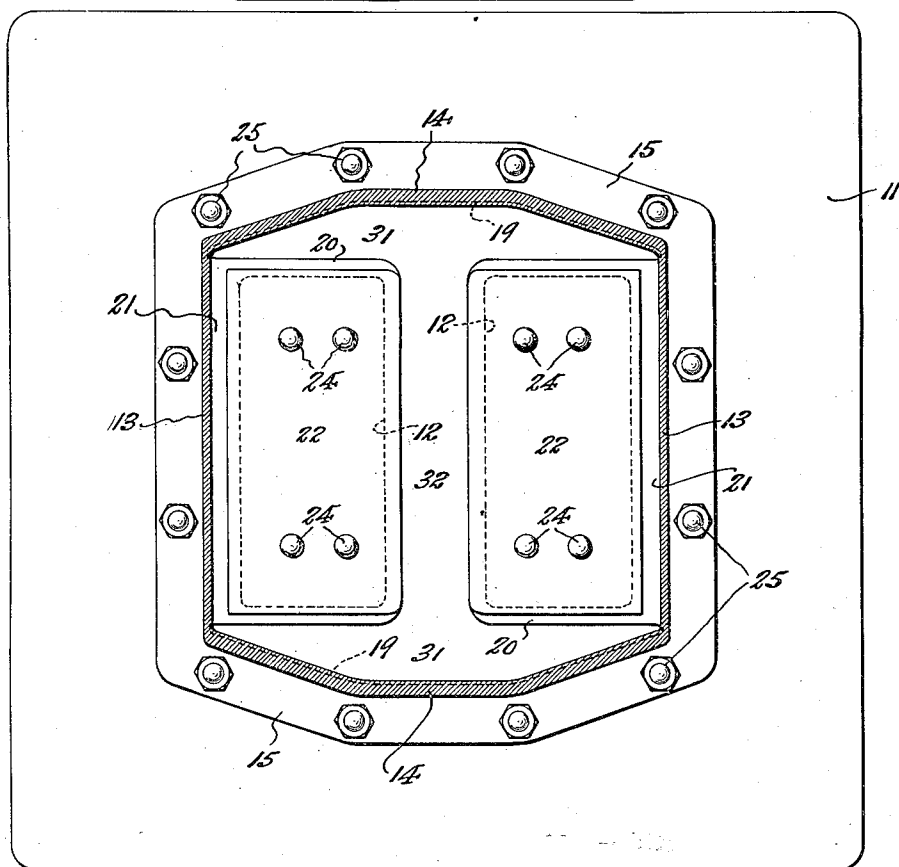
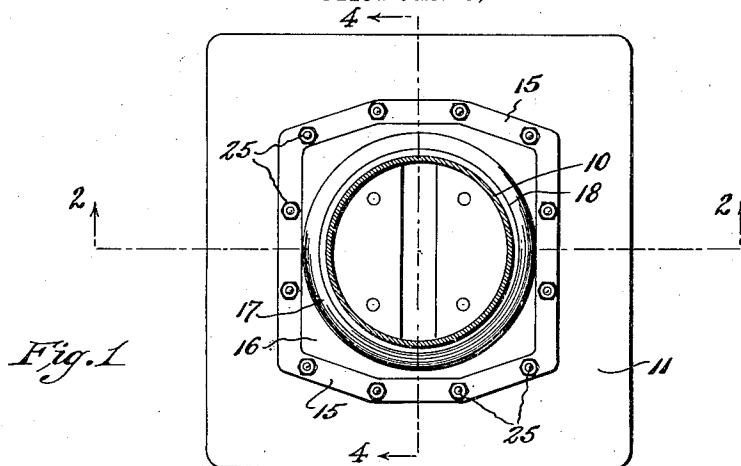


Fig. 3

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FOOT VALVE FOR PUMP SUCTION LINES

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5 Claims. (Cl. 277-60)

This invention relates to improvements in foot valves for pump suction lines.

The invention has for an object to provide a foot valve structure of maximum capacity in relation to a given size thereof; the same being equipped with a novel construction and arrangement of check valve means and check valve chamber or housing therefor, whereby restriction of fluid movement under pump suction is reduced to a minimum so that substantially unimpeded movement of fluid to the suction line at maximum volume is assured.

Another object of the invention is to provide a combined foot valve and strainer structure wherein the strainer possesses an open area exceeding many times the suction area of the valve.

Another object of the invention is to provide a check valve means comprising flexibility hinged valve flap means of rectangular form adapted to provide a maximum extent of hinging length and consequently of greater durability and longer serviceable life; the valve flap construction and arrangement being such that the flap means is cut from a single sheet of flexible and elastic material, such as rubber, whereby outlying portions of said sheet may be utilized as a gasket between the foot valve housing and strainer section of the device.

Other objects of this invention, not at this time more particularly enumerated, will be understood from the following detailed description of the same.

An illustrative embodiment of this invention is shown in the accompanying drawings, in which:

Fig. 1 is a top end view of a foot valve and strainer device made according to this invention; Fig. 2 is a vertical transverse section through the same, taken on line 2-2 in Fig. 1, but drawn on an enlarged scale; Fig. 3 is a horizontal section, taken on line 3-3 in Fig. 2; and Fig. 4 is a fragmentary vertical section, taken on line 4-4 in Fig. 1, but drawn on an enlarged scale.

Similar characters of reference are employed in the above described views, to indicate corresponding parts.

Referring to the drawings, the reference character 10 indicates a pump suction line or pipe to which the novel foot valve and strainer structure is connected.

The foot valve and strainer structure comprises a horizontal valve port plate 11, which also preferably forms the top end wall of the strainer element. The plate 11 is preferably of rectangular peripheral shape. Opening through the central

portion of said plate are valve port means, preferably comprising two rectangular openings 12, respectively offset on opposite sides of a medial portion of said plate.

Mounted on the upper side of said plate 11 is a check valve housing formed to provide a substantially rectangular chamber above the valve port openings 12, having opposite side walls 13 respectively parallel to the outer long sides of said valve port openings 12, and having outwardly bowed opposite end walls 14 in outwardly spaced relation to the ends of said valve port openings 12. Said housing is provided with an outwardly projecting longitudinal peripheral footing flange 15 extending from the lower margins of said walls 13-14. The upper margins of said walls 13-14 terminate in a top wall 16 which merges in a circular upwardly projecting neck-portion 17, having an integral internally screw-threaded union portion 18 into which is screwed the externally threaded end of the pump suction line or pipe 10, thereby to operatively connect the foot valve and strainer structure therewith.

Overlaid upon the upper side of said plate 11 is a combined valve flap and gasket means made of flexible elastic sheet material, such as sheet rubber of substantial thickness, the same comprising a gasket portion 19 shaped to conform to the bottom peripheral outline of said check valve housing, and in width corresponding substantially to the width of the footing flange 15 of the latter. Integrally formed with and springing from the inner margins of said gasket portion 19 which border the side walls 13 of said check valve housing are rectangular inwardly extending valve flaps 20, the same being somewhat larger in area than the areas of the valve port openings 12, over which they respectively extend in normal closed relation thereto. The portions 21 by which said valve flap 20 join the gasket portion 19 provide said valve with relatively long flexible hinging connections, thereby assuring greater durability and longer serviceable life, as well as greater control and stability of valve flap movements to assure proper and operative registration and alignment of the valve flaps with the valve port openings. The body portions of the valve flaps are preferably maintained in flat plane against curling, buckling or other similar deformation, by providing the same with top and bottom reinforcing and stiffening plates 22 and 23, which are secured thereto by rivets 24 or other suitable fastening means. Preferably the top plates 22 are somewhat larger in area than the areas of the valve port openings 12, while the bottom plates

23 are of smaller area than said valve port opening areas.

The check valve housing, valve port plate 11 and intermediate gasket and valve flap structure are secured together in operative assembled relation by means of bolts and nuts 25 which are engaged through the latter parts and through the footing flange 15 of said check valve housing.

Suitably affixed to the underside of said plate 11, as by welding for example, is a strainer cage 26 of square cross-sectional shape and outwardly offset relative to the vertical axis of said check-valve housing pump suction line to a substantial extent, whereby a maximum of strainer area proportional to the suction area is provided so that the former is many times in excess of the latter. The walls of the strainer cage are perforated by a multiplicity of suitably disposed and preferably vertical slots 27. The lower end of said strainer cage is closed by a bottom plate 28 suitably affixed thereto by welding or other suitable fastening means. Said bottom plate 28 is ordinarily imperforate, especially when the device is to be used resting upon bottom of the area to be drained. If, however, the device is to be used in clear water or elevated from the bottom of the area to be drained, perforations may be provided in said bottom plate 28 to further increase the strainer area relative to suction area of the device.

Depending from the plate 11 downwardly into the interior of the strainer cage, but terminating short of the bottom plate 28, is a suction intake tube 29 which communicates with the valve port openings 12 of said plate 11. Said tube 29 is affixed to plate 11 by welding or any other suitable fastening means.

Affixed to and extending across the underside of said plate 11, intermediate the valve port openings 12, is a reinforcing rib or brace 30, preferably of angular cross-sectional shape, with the free margins of its flanges welded to the plate 11.

When the device is in operation, on the suction stroke of a pump attached to the suction line 10, the valve flaps 20 will swing upward to open positions shown by dotted lines in Fig. 2. By an inspection of Fig. 3 it will be noticed that the construction of the check valve housing chamber provides flow clearance passages 31 offset around the ends of the rectangular valve flaps 20 in addition to the axial flow passage 32 lying intermediate the free sides of said valve flaps. By this novel arrangement a maximum flow by-pass area is provided around the open valves which is calculated to permit substantially unimpeded movement of fluid around the open valve flaps and to the suction line at maximum volume. By the arrangement, as thus devised, about one-half the flow capacity is furnished around the ends of the valve flaps and through the additional flow clearance passages 31, while the other half of the flow capacity is furnished by the axial passage 32 intermediate the free sides of said valve flaps.

By reason of the novel combination of flow clearance passages 31 in conjunction with the axial flow passage 32, it is found that the valve flaps 20 are not required to swing so high, and consequently not only is there less wear and tear stresses and strains applied to the hinging connections of said valve flaps, but it is also possible to reduce the height of the check valve chamber, thus permitting the use of lower chamber castings with consequent economy in material and manufacturing costs in the production of the device.

While I have shown the novel foot valve and strainer structure equipped with a duplex arrangement of check flap valves, it will be appreciated that the principles of construction involved may also be provided in a single check flap valve form, especially in smaller sizes of the structure.

From the above it will be apparent that a sturdy, durable and yet highly efficient foot valve structure is provided by the instant invention, as well as one having a maximum of discharge capacity as sized to accommodate lines of given suction area. I am aware that many changes could be made in the foot valve and strainer structure above described and as shown in the accompanying drawings, and that many apparently widely different embodiments of this invention could be made without departing from the scope thereof as defined by the following claims. It is therefore 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.

I claim:

1. In a foot valve structure for pump suction lines, a valve port plate having a rectangular port, a housing member above said plate having side walls, one of which is adjacently parallel to one side of said port, and interconnecting walls angular to said side walls and respectively outwardly spaced from the respective ends of said port, thereby providing flow clearance passages contiguous to said port ends, said housing member walls merging into an upwardly projecting neck-portion having means to connect the same with the end of a pump suction line, and a unitary valve flap and gasket means having its gasket portion interposed and secured between the housing member and valve port plate and providing a rectangular valve flap exceeding the area of and adapted to overlie said port, the integral connection between said valve flap and gasket portion providing a long hinging portion coextensive with the width of said valve flap and contiguous to the housing member side wall which is adjacently parallel to one side of said port as aforesaid, said unitary valve flap and gasket means being made of elastic sheet material.

2. In a foot valve structure as defined in claim 1, wherein said valve port plate extends substantially outward beyond and around said housing member, a strainer cage depending from the marginal portions of said valve port plate within said strainer cage and communicating with said valve port, and a suction intake tube depending from said valve port plate in alignment with the port thereof and terminating short of the bottom of said cage.

3. In a foot valve structure for pump suction lines, a valve port plate having a pair of spaced rectangular ports, a housing member above said plate having side walls respectively adjacently parallel to the respective outer sides of said ports and interconnecting walls angular to said walls and respectively outwardly spaced from the respective ends of said ports thereby providing flow clearance passages contiguous to said port ends, the area of said housing member interior intermediate said ports providing an axial flow passage with which said flow clearance passages join, said housing member walls merging into an upwardly projecting neck-portion having means to connect the same with the end of a pump suction line, and a unitary valve flap and gasket means having its gasket portion interposed and secured between the housing member and valve

port plate and providing rectangular valve flaps exceeding the areas of and adapted to respectively overlie said ports, the integral connections between said valve flaps and gasket portion providing said valve flaps with long hinging portions coextensive with the widths of said valve flaps and respectively contiguous to the respective housing member side walls which are adjacently parallel to the outer sides of said ports, said unitary valve flap and gasket means being made of elastic sheet material.

4. In a foot valve structure as defined in claim 3, wherein said valve port plate extends substantially outward beyond and around said housing member, a strainer cage depending from the

marginal portions of said valve port plate, and a suction intake tube also depending from said valve port plate within said strainer cage and communicating with said valve ports, said tube terminating short of the bottom of said cage.

5. In a foot valve structure as defined in claim 3, wherein said axial flow passage and said flow clearance passages are so relatively dimensioned that approximately one-half of the flow discharge through the valve ports when the valve flaps open is accommodated by the axial flow passage and the other half of said flow discharge is accommodated by said flow clearance passages.

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