June 9, 1953 J. W. HOUSTON 2,641,283

PUMPING DEVICE

Filed Oct. 13, 1947

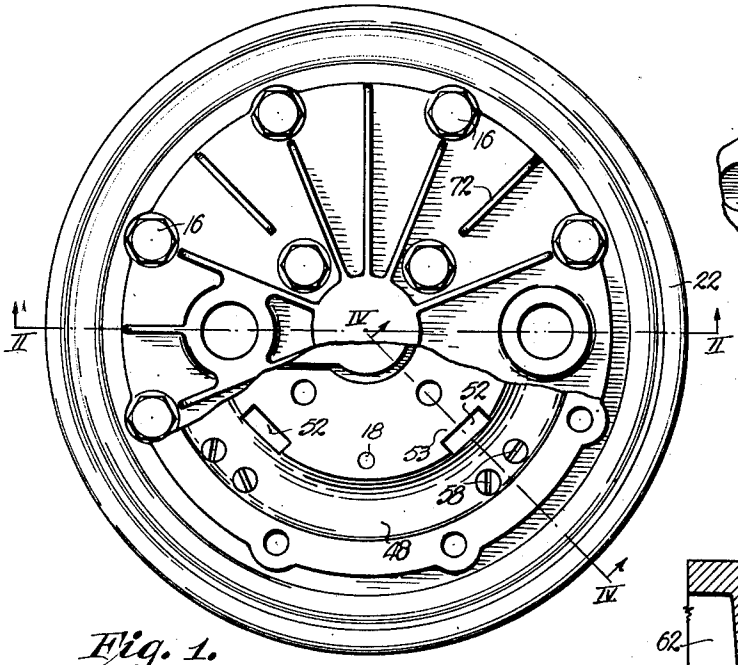


Fig. 1.

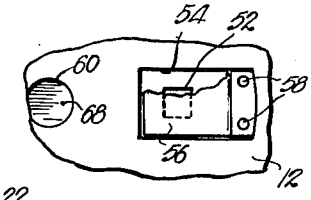


Fig. 6.

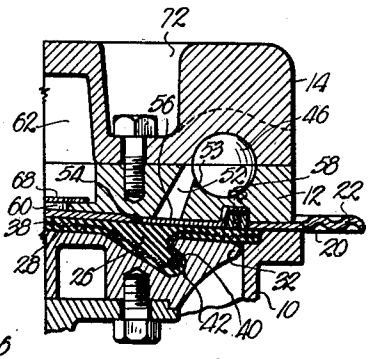


Fig. 4.

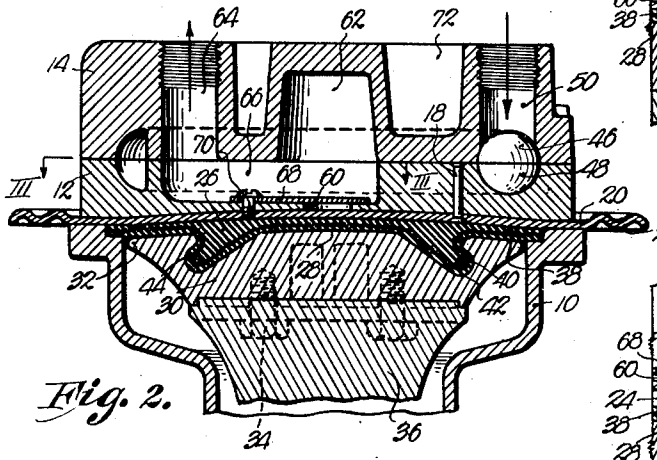


Fig. 2.

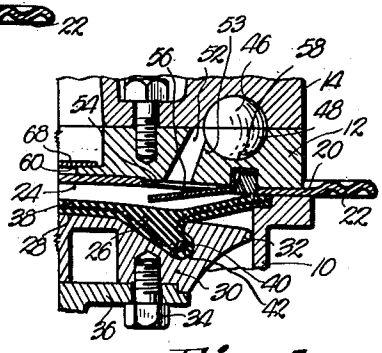


Fig. 5.

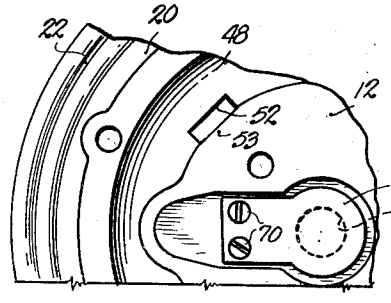


Fig. 3.

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PUMPING DEVICE

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4 Claims. (Cl. 137—788)

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This invention has to do with improvements in pumping apparatus and relates more particularly to a device for pumping and compressing when desired, aeriform fluid such as gas or air and adapted particularly for compressing gaseous fluids for refrigerant purposes.

The pumping apparatus forming the subject matter of this application is of a type having a compression chamber and valve of controlled means for the ingress and egress of aeriform fluid to and from the compression chamber, said chamber having a pair of opposed walls, one stationary and the other reciprocative toward and from the stationary wall combined with means for effecting such reciprocation.

The most important object of this invention is the provision of pumping apparatus in the nature of that forming the subject matter of my copending application, Serial No. 600,489, filed June 20, 1945, now Patent Number 2,605,957, of which this application is a continuation in part, but including a new formation of vital parts thereof capable of effecting a more efficient operation in presenting a device that is not likely to become inoperative or necessitate frequent repairs.

One of the most important objects of this invention is the provision of a pumping apparatus in the nature of that above set forth wherein the reciprocative wall or piston is provided with a specially formed head having a resilient disc or plate member thereon to the end that such disc-like member will bear snugly and tightly against the stationary wall to which it will conform in shape thereby excluding from the compressor chamber substantially all of the aeriform fluid.

Another important object of this invention is the provision of a pumping apparatus having a piston head provided with a continuous annular under-cut groove for receiving a lateral angularly extending flange formed on the resilient disc or plate therefor; said flange extending in the said under-cut portion of the groove whereby the possibility of breaking loose is positively eliminated during normal use.

A further object of this invention is the provision of a pumping apparatus having a resilient member of the aforesaid character mounted upon a piston head and provided with a reinforcement of fabric material along with a retaining ring, all embedded within the material from which the member is made; said fabric partially enclosing the ring and extending along with said ring into the above mentioned under-cut groove of the piston head.

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Other objects of this invention include the manner in which the piston head and its resilient disc member are mounted not only to prevent displacement thereof but to define a line of bend that is distinct and not likely to extend inwardly toward the central portion of the member; and the way in which the inlet and outlet openings of the device are modified to present a pumping apparatus that is more efficient in operation than that disclosed in my aforesaid copending application.

Many additional objects will be made clear during the course of the following specification, wherein:

Fig. 1 is a top plan view of a pumping device made in accordance with my present invention, parts being broken away to reveal details of construction.

Fig. 2 is a fragmentary substantially central cross sectional view taken on line II—II of Fig. 1.

Fig. 3 is a fragmentary cross sectional view taken on line III—III of Fig. 2, looking in the direction of the arrows.

Fig. 4 is a fragmentary cross sectional view taken on line IV—IV of Fig. 1, showing the piston head and resilient disc thereon at the uppermost end of their paths of travel.

Fig. 5 is a fragmentary cross sectional view similar to that shown in Fig. 4 illustrating the piston head and parts thereof at the opposite end of their paths of travel; and

Fig. 6 is a fragmentary detailed view showing a bottom plan view of one of the inlet valves when the same is in a closed position, parts being broken away for clearness.

Similar characters of reference designate similar parts in the different views.

My improved pumping apparatus is provided with what may be termed a casing comprising the following described parts.

The numeral 10 designates the upper end portion of the body of a pump cylinder, which forms the lower member of the casing, and upon which is disposed the intermediate member 12 upon which is mounted the upper casing member 14. The members 10, 12 and 14 are circular in plan and are held clamped together by vertical bolts 16 which extend through aligned holes in the members 12 and 14, and have their lower threaded ends fitted in threaded holes in the upper side of the member 10.

The lower side of the member 12 is provided with a heat conductive lining comprising preferably a metal plate of high heat conductivity, as copper, fastened in any suitable manner, as by

rivets 18 to the under side of and mostly covering such under side of the member 12. The lining plate which is designated by 20, is circular and projects from the periphery of the member 12 a substantial distance, said projecting portion having circular corrugations 22 for radiating the heat to the atmosphere.

The underside of the member 12 with its lining plate 20 comprises the stationary wall of a compression chamber, and is concavely arcuate, said chamber being designated by the numeral 24.

Directly below the lining plate 20 is the vertically reciprocative wall of the compression chamber 24 which comprises a circular flexible resilient and compressible disc member 26, a peripheral portion of which is held tightly clamped between the member 10 and the lining plate 20. The disc member 26 is composed of a suitable material having flexibility, resilience and compressibility, and which is positively resistant to cold, heat, refrigerant gases and other fluids such as those encountered in normal commercial operation. Certain types of synthetic rubber have been found satisfactory.

For operatively reciprocating upwardly and downwardly the disc member 26, its larger central circular portion is thicker than its outer circular peripheral portion, which central portion is fitted in and secured to the upper side of a circular central recessed convexly arcuate portion 28 of a circular piston head 30 vertically reciprocative in the upper enlarged portion of the cylinder member 10. The peripheral portion of the piston head, outside the portion 28 has its upper side curved to conform to the under-side of the lining plate 20 immediately above. Such peripheral portion of the piston head 30 is designated by 32. Fastened by screws 34 to the under side of the piston head 30 is the piston rod 36.

Any suitable means, not shown, may be employed for imparting vertical reciprocation to the piston rod 36 and the piston head 30, the length of stroke required, which is relatively short.

That portion of the disc member 26 which is between the portion secured tightly to the central portion of the piston head designated by 28 and the peripheral portion held clamped between the member 10 and the lining plate 20, is free to swing when the piston head reciprocates. When the piston head moves upwardly on its compression stroke, its peripheral portion 32 engages the under side of the free swinging portion of the disc member 26, and at the upper end of its stroke presses the free swinging portion tightly against and conforming to the lining plate 20, while the central portion is tightly compressed against the lining plate 20.

The rubber-like member 26 is preferably molded into the shape illustrated and when so formed, a fabric reinforcing 38 is embedded thereinto. This reinforcement 38 extends entirely through the member 26 and partially encircles a wire ring 40 also molded into the member 26.

An annular recess 42 is formed in the head 30, circumscribing the portion 28 thereof when head 30 is cast or otherwise manufactured and the lowermost face of the member 26 has a laterally extending continuous flange 44 that is fitted into the recess or groove 42 of head 30.

It is notable that the groove 42 is slightly under-cut near its innermost end and that the flange 44 is beveled outwardly and formed to conform to and completely fill the groove 42. The ring 40 is mounted near the periphery of flange 44 within the fabric 38, and when completely assembled, this ring 40 is disposed near the innermost end of annular groove 42 beneath the under-cut portion thereof. Suitable adhesive, capable of securing member 26 to the metallic head 30, not only along the portion 28 thereof but within groove 42, is preferably used.

Thus, it is seen that a positive and extremely effective mounting is provided for the member 26 that cannot possibly become damaged or loosened under normal use. Further, the point of flexing or line of bend of the member 26, as the head 30 reciprocates, is adjacent the innermost edge of portion 32 of head 30 or along one outermost edge of the groove 42. To this extent, the member 26 and head 30 are far superior to that shown in my aforesaid pending application. There is no chance in the present structure for member 26 to break away from the head 30 at portion 28 thereof or elsewhere, and the fabric reinforcement 38 prevents breakage along the aforesaid line of bend.

The following described means are employed for introducing the aeriform fluid that is to be pumped into the compression chamber 24 and for equally distributing it therein.

The under side of the member 14 is provided with a horizontal circular channel 46, semi-circular in cross section, which registers with a corresponding semi-circular channel 48 in the top of the member 12 and forms therewith a circular channel, circular in cross section.

In the member 14 is provided an intake passage 50 having its lower end communicating with the channel 46, and having its upper end adapted to be connected with the aeriform fluid which is to be compressed. The circular channel 46—48 forms a manifold having four equally spaced apart ducts 52 extending from its inner side through the members 14 and 12 and the lining plate 20 thus forming four intake ducts leading to the compression chamber 24.

The zone of interconnection between ducts 52 and channels 46 and 48 is above the bottom of the channel and prevents the flow of any liquid refrigerant, that may collect in the bottom of channel 48, into ducts 52. A fin or baffle 53 insures this trapping action and is a part of the section 12. The fin 53 is in reality one side of the circular channel 48 in section 12 and, therefore, any condensed refrigerant collecting therein is in close proximity to the compression chamber and subject to heat generated during normal operation. Thus, the collected condensed refrigerant is always evaporated and returned to the system as useful gas.

Normally respectively closing the lower ends of the ducts 52 are for flat resilient plates forming intake valves respectively located in four rectangular openings 54 through the lining plate 20. Each intake valve is designated by 56 and is fastened by two screws 58, adjacent to its outer end to the under side of the member 12. The tension of the valve plates 56 normally holds them against the member 12 respectively closing the lower ends of the intake ducts 52.

The casing member 12 has through it a circular outlet opening 60, the lower end of which registers with an opening in plate 20, which in turn communicates with the compression chamber 24.

Formed in the sections 12 and 14 of the casing 10 directly above the outlet opening 60 in section 12 and communicating therewith, is a cavity 62 serving as a receiving chamber for

compressed fluid from chamber **24** and this chamber **62** in turn communicates with an outlet opening **64** formed in member **14** through a port **66** within members **12** and **14**.

A flat resilient plate **68** serving as an egress valve overlies the opening **60** and lies flatly within the cavity **62** and port **66**. This plate **68** is held in place by screws or the like **70** threaded into the member **12**.

For aiding in cooling the heated parts, the upper side of the casing member **14** is provided with a plurality of radial integral fins **72**, Figs. 1 and 2.

In operation, when the piston head **30** and its piston rod **36** move downwardly with the central portion of the disc member **26**, from the uppermost position, shown in Figs. 1 and 4, the aeriform fluid to be compressed or pumped is forced downwardly through the intake passage **50** into the manifold **46—48**, from which it divides equally and passes through the ducts **52**, forcing the intake valves **56** downwardly to the open positions as shown in Fig. 5.

When the piston head **30** and the central portion of the disc member **26** fastened thereto, have reached the lower end of the intake stroke, the peripheral portion of the disc member **26** will have cleared the peripheral portions **32** of the piston head, the egress valve **68** in the meantime, remaining closed.

When the piston head starts on its upward compression stroke, the intake valves **56** will close and compression of the aeriform fluid will begin in the compression chamber **26**, and the egress valve **68** will open and rise from the opening **60** and the fluid will pass through the outlet opening **60**, port **66** and opening **64**.

As the piston head **10** moves upwardly, the free to swing peripheral portion of the disc member **26** will gradually seat upon the peripheral portion **32** of the piston head, so that by the end of the up stroke, it will be fully supported by the portion **32** and the disc member **26** will be held tightly compressed against the upper stationary wall of the compression chamber **24** and the intake valves **56**, whereby a substantially complete elimination of the aeriform fluid will have been effected, thus affording a maximum of efficiency.

During the compressing operation, heat will be produced, a large amount of which will be absorbed by the lining plate **20** and conducted to the outer peripheral portion **22** where it will be disseminated to the atmosphere, a certain amount of the heat also being disseminated to the atmosphere by the fins **72** and the casing members **10**, **12** and **14**.

Many modifications of my invention, within the scope of the appended claims may be made without departing from the spirit of my invention.

Having thus described my invention, what I claim as new and desire to be secured by Letters Patent is:

1. In a pumping apparatus of the character specified, a hollow casing; a reciprocable piston in said casing having a head on one end thereof provided with a dome-shaped face; a flexible, resilient, compressible disc-like member having an outer peripheral portion clamped within said casing, said member being imperforate and having a central portion tightly fastened to, bearing flatly against, and reciprocative with a central portion of said face of the piston head, said member having a circular portion intermediate its central and peripheral portions free to flex during reciprocation of said piston head, said piston head having a continuous annular groove formed in said face thereof and surrounding said central portion of said face; a continuous, annular flange integral with said member, surrounding said central portion of the member, and extending into said groove of the piston head, said flange projecting outwardly from one face of the member proximal to said face of the piston head.

2. In a pumping apparatus of the character specified, a hollow casing; a reciprocable piston in said casing having a head on one end thereof provided with a dome-shaped face; a flexible, resilient, compressible disc-like member having an outer peripheral portion clamped within said casing, said member being imperforate and having a central portion tightly fastened to, bearing flatly against, and reciprocative with a central portion of said face of the piston head, said member having a circular portion intermediate its central and peripheral portions free to flex during reciprocation of said piston head, said piston head having a continuous annular groove formed in said face thereof and surrounding said central portion of said face; and a continuous, annular flange integral with said member, surrounding said central portion of the member, and extending into said groove of the piston head, said flange projecting outwardly from one face of the member proximal to said face of the piston head, said groove having an undercut portion receiving said flange on the member.

3. In a pumping apparatus of the character specified, a hollow casing; a reciprocable piston in said casing having a head on one end thereof provided with a dome-shaped face; a flexible, resilient, compressible disc-like member having an outer peripheral portion clamped within said casing, said member being imperforate and having a central portion tightly fastened to, bearing flatly against, and reciprocative with a central portion of said face of the piston head, said member having a circular portion intermediate its central and peripheral portions free to flex during reciprocation of said piston head, said piston head having a continuous annular groove formed in said face thereof and surrounding said central portion of said face; a continuous, annular flange integral with said member, surrounding said central portion of the member, and extending into said groove of the piston head, said flange projecting outwardly from one face of the member proximal to said face of the piston head, said groove having an undercut portion receiving said flange on the member; and a metallic molding ring embedded within that portion of the flange disposed in said undercut portion of the groove.

4. In a pumping apparatus of the character specified, a hollow casing; a reciprocable piston in said casing having a head on one end thereof provided with a dome-shaped face; a flexible, resilient, compressible disc-like member having an outer peripheral portion clamped within said casing, said member being imperforate and having a central portion tightly fastened to, bearing flatly against, and reciprocative with a central portion of said face of the piston head, said member having a circular portion intermediate its central and peripheral portions free to flex during reciprocation of said piston head, said piston head having a continuous annular groove formed in said face thereof and surrounding said

central portion of said face; a continuous, annular flange integral with said member, surrounding said central portion of the member, and extending into said groove of the piston head, said flange projecting outwardly from one face of the member proximal to said face of the piston head, said groove having an undercut portion receiving said flange on the member; a metallic molding ring embedded within that portion of the flange disposed in said undercut portion of the groove; and a fabric reinforcement embedded within said member, said reinforcement extending throughout the area of said member and partially encircling the ring.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
356,997	Gil	Feb. 1, 1887
1,445,844	Mueser	Feb. 2, 1923
1,976,098	Smith	Oct. 9, 1934
2,063,728	DeVille	Dec. 8, 1936
2,229,038	Booth	Jan. 21, 1941
2,241,056	Chilton	May 6, 1941
2,334,119	Mulholland	Nov. 6, 1943
2,368,132	French	Jan. 30, 1945
2,381,544	Jacobsen	Aug. 7, 1945