Aug. 26, 1958 A. H. WAKEMAN 2,848,952

PUMP CONSTRUCTION

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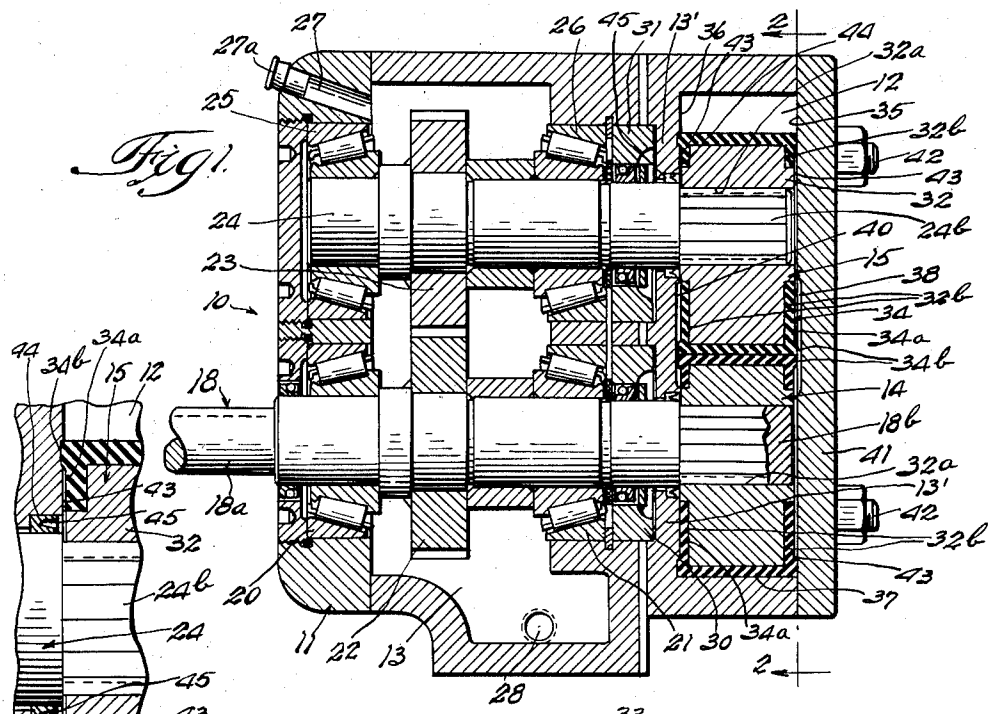

Fig. 1.

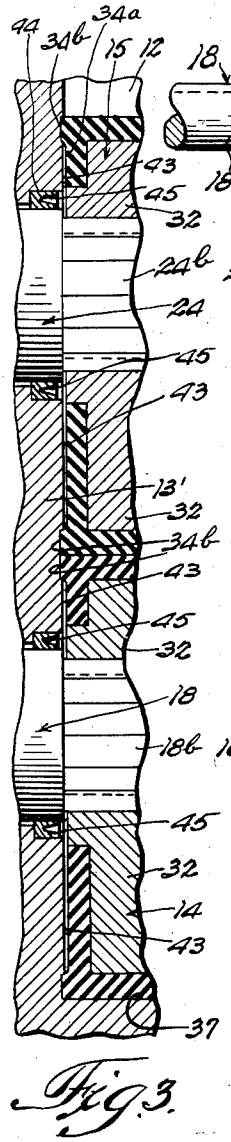

Fig. 3.

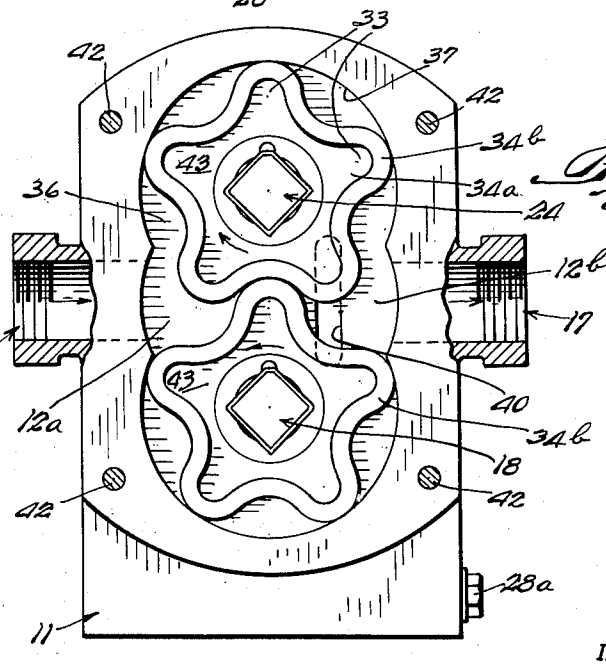

Fig. 2.

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PUMP CONSTRUCTION

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2 Claims. (Cl. 103—126)

This invention relates to a pump and more particularly to a positive pump wherein it is important that the interior thereof be free from any deleterious substance which might contaminate a product while being pumped therethrough.

The problem of sealing the periphery of the shaft of the impeller in a pump of this type against substances such as air, oil and the like being drawn into the suction side of the interior of the pump housing and contaminating the product being pumped, has not heretofore been successfully overcome by use of the packing materials which are presently available. Various attempts have heretofore been made to overcome this problem, but because of the cost, complexity, and bulkiness of construction and the inefficient operation of the resultant pumps, such attempts have met with only partial success.

It is one of the objects, therefore, of this invention to provide a pump wherein the possibility of a deleterious substance being drawn into the interior of the pump casing from around the periphery of the rotating impeller shaft has been completely eliminated.

It is a further object of this invention to provide a pump wherein the product being pumped, while under high discharge pressure, functions as the sealing means as well as the lubricant for the impeller shaft seal and the impeller itself.

It is a further object of this invention to provide a pump which is simple and compact in construction, efficient in operation, and minimizes service and maintenance costs.

Further and additional objects will appear from the description, accompanying drawing, and appended claims.

In accordance with one embodiment of this invention, a pump is provided comprising a hollow casing having an inlet port and an outlet port, and a pair of impellers rotatably mounted within said casing and disposed intermediate said inlet and outlet ports. The periphery of each impeller is deformed and has portions thereof in contact with the interior of the casing and the other impeller. The side surfaces of the casing interior cooperate with the adjacent end faces of each impeller to form a cavity which encompasses the axis of the impeller and is disposed intermediate said axis and the periphery of said impeller. The encompassing cavity communicates with the outlet port of said hollow casing to permit a portion of the product being pumped under high pressure to completely fill such cavity.

For a more complete understanding of this invention reference should now be made to the drawing wherein:

Figure 1 is a vertical sectional view of the pump;

Fig. 2 is a right side elevational view of the pump taken along line 2—2 of Fig. 1; and

Fig. 3 is an enlarged fragmentary sectional view of the cavities formed between the end faces of the impellers and the adjacent side surface of the compartment.

Referring now to the drawings and more particularly to Fig. 1, a positive pump 10 is shown for use in instances where it is important that the product being

pumped through the pump housing 11 be free from any deleterious substance which might find its way into the interior of said housing and contaminate the product. The pump housing 11 comprises two compartments, 12 and 13, formed in the interior thereof which are separated from one another by an apertured partition 13'. Disposed within compartment 12 is a pair of rotatably mounted impellers 14 and 15. The product to be pumped is introduced into compartment 12 through an intake port 16 formed in one side of the compartment and is discharged through outlet port 17 formed in the opposite side of the compartment, see Fig. 2. In this instance, impeller 14 is the driven impeller and has the shaft 18 thereof, which extends through an aperture formed in partition 13', rotatably supported within the housing 11 by a pair of anti-friction bearings 20 and 21 arranged in axially spaced relation. One end 18*a* of shaft 18 projects outward from housing 11 through a suitable opening and is adapted to be driven by some external source of power, not shown. Keyed to shaft 18 and disposed within compartment 13 is a spur gear 22 which is adapted to mesh with a like spur gear 23, the latter being keyed to shaft 24 for impeller 15, to effect simultaneous rotation of the two impellers. Shaft 24 likewise extends through a second opening formed in partition 13' and is enclosed entirely within housing 11 and is supported by a pair of axially spaced anti-friction bearings 25 and 26. Compartment 13 is normally filled or partially filled with a lubricant which may be introduced into the compartment through a conduit, not shown, formed in the side thereof and drained therefrom through a port 28 formed adjacent the bottom of the compartment. The port 28 is normally capped or closed off by a plug 28*a*. An air vent 27 is formed adjacent the upper side of compartment 13. Both shafts 18 and 24 are surrounded by sealing rings 30 and 31, respectively, which are disposed between anti-friction bearings 21 and 26 and the partition 13', see Fig. 1.

Each of the impellers 14 and 15 is of like construction and comprises a metallic hub or core 32 which has the outer periphery thereof shaped so as to form a plurality of symmetrically arranged radially extending nubs 33 which are adapted to mesh with one another and impel the product from the low pressure side 12*a* to the high pressure side 12*b* of the compartment. The number and shape of the nubs may vary without departing from the scope of the invention. The core 32 is provided with a center bore 32*a* which is internally splined and adapted to receive the splined end 18*b* or 24*b* of the shaft 18 or 24, respectively. Encompassing the outer periphery of core 32, including the end faces 32*b* thereof except for a portion surrounding the center bore, is a plastic covering 34 of preferably rubber or latex material which is not corroded by or does not contaminate the product being pumped and likewise is possessed with good wearing qualities. The nubs 33 of the core 32 with the covering 34 thereon are of such dimension that the outer ends thereof contact the annular peripheral surface 37 of the compartment 12, as seen more clearly in Fig. 2. The portions 34*a* of the coating 34 which substantially cover the end faces 32*b* of core 32 are provided with a marginal boss 34*b* which, in this instance, conforms substantially to the perimeter of nubs 33. The marginal boss 34*b* is adapted to slidably engage the opposing side surfaces 35 and 36 of the compartment 12 when the impellers are being rotated. The area delimited by the boss on each of the end faces 32*b* of the impellers forms a cavity 43 which is adapted to encompass the periphery of shaft 18 or 24.

Formed within each of the side surfaces 35 and 36 of compartment 12 are elongated grooves 38 and 40, respectively, which are disposed within the high pres-

sure side 12*b* of the compartment 12. The ends of each groove 38 and 40 are adapted to communicate with the cavity 43 formed in each of the end faces of the impellers 14 and 15. A portion of each groove 38 and 40, disposed intermediate the ends thereof, is adapted to communicate with the high pressure side 12*b* of the compartment 12. The purpose of grooves 38 and 40 is to allow a portion of the product, being pumped through compartment 12, to find its way into the cavities 43 and surround the peripheries of the impeller shafts 18 and 24 with the product under high pressure. It will be noted in Fig. 1 that an annular recess 44 is formed in the side surface 36 of compartment 12 and is adapted to encircle the periphery of the impeller shaft 18 or 24. Disposed within each of the recesses 44 is an annular sealing piece 45 which is substantially V-shaped in cross-section. The open side of the sealing piece 45 is adjacent the end face of impeller 14 or 15 and is adapted to communicate with the cavity 43 formed between the end face of the impeller and the side surface 36 of the compartment. Upon the high pressure product becoming entrapped within the cavity, the product will cause the annular sealing piece 45 to expand a certain amount, thereby causing the piece 45 to function more effectively as a seal for the impeller shaft. By reason of the fact that the product under high pressure is disposed within the cavities adjacent each of the end faces of the impeller, an effective seal is provided which prevents any foreign or deleterious substance such as oil, air and the like, being drawn into the suction side 12*a* of the compartment around the periphery of each of the shafts. Furthermore, the product disposed within each of the cavities 43 acts as a lubricant between the end faces of the impellers and the corresponding side surfaces 35 and 36 of the compartment 12. The compartment 12 has one side 41 thereof removable to facilitate assembly of the impellers within the compartment 12. The cover 41 is secured to the housing or casing 11 by nut and bolt assemblies 42.

It is to be understood, of course, that the peripheral shape of each of the impellers may be varied without departing from the scope of this invention and that the marginal boss 34*b* may be of any shape so long as it encompasses the impeller shaft and is spaced therefrom and in addition is disposed entirely within the periphery of the impeller. Furthermore, if so desired, the end faces of the impellers may be flat and a boss, corresponding to the marginal boss 34*b*, be formed instead on the side surfaces 35 and 36 of the compartment. In this latter instance, however, the bosses would have to be of such a shape that they would be disposed at all times within the outer periphery of the impellers and spaced from the periphery of the impeller shaft. Thus, each side surface of the compartment would have formed thereon a boss for each impeller. The area delimited by the boss would communicate with the high pressure side 12*b* of the compartment 12 through a groove or any other suitable conduit. While the pump in this instance is directed to a unit containing two impellers, it is not to be limited thereto, as the novel construction may be incorporated in a pump having one or more impellers as well as single or multi stages.

Thus, a pump has been provided which is simple and compact in construction, durable and efficient in operation, and eliminates completely the possibility of foreign or deleterious substances finding their way into the interior of the pump casing from around the periphery of the impeller shaft and contaminating the product being pumped. Furthermore, a pump has been provided which utilizes the product being pumped to provide a seal for the impeller shaft and to provide a lubricant for the end faces of the impeller.

While several embodiments of this invention have heretofore been described, it will be understood, of course, that the invention is not to be limited thereto, since many modifications may be made, and it is contemplated, therefore, by the appended claims, to cover any such modifications as fall within the true spirit and scope of this invention.

I claim:

1. A pump for circulating a liquid product, comprising a casing provided with a chamber, an inlet port through which such product enters said chamber, and an outlet port through which such product leaves said chamber at a higher relative pressure; an impeller rotatably mounted within said chamber and disposed intermediate said inlet and outlet ports, said impeller having a peripheral configuration formed by a non-uniform radius about the rotary axis of said impeller and portions of said periphery being in slidable contact with said chamber surface to impel such product from said inlet port to said outlet port, an end face of said impeller being provided with a resilient peripheral boss conforming to the contour of said impeller periphery and in substantially continuous slidable engagement with the adjacent chamber surface and forming a cavity encompassing the rotary axis of said impeller and occupying a substantial portion of the area of said impeller end face; conduit means provided on said casing and communicating with the outlet port of said casing and said cavity and effecting entrapment within said cavity of a portion of the discharged product, the entrapped product being at a substantially uniform pressure throughout said cavity and effecting lubrication between said end face and the adjacent chamber surface; a drive shaft for said impeller protruding from said end face and extending through a suitable bore formed in said chamber surface, the end of said bore adjacent said chamber surface being provided with a counterbore in partial overlapping and communicating relation with said cavity; and a liquid pressure-responsive, shaft-encompassing element engaging the periphery of said shaft and disposed within said counterbore and being deformable by the liquid pressure within said cavity to effect a liquid seal between said shaft and said bore.

2. A pump for circulating a liquid product, comprising a casing provided with a chamber, an intake port through which such product enters said chamber and a relatively spaced outlet port through which such product leaves said chamber at a higher relative pressure; a pair of impellers mounted within said chamber intermediate said inlet and outlet ports for rotation about substantially parallel relatively spaced shafts, each shaft extending axially from the corresponding end face of said impeller and through one of a pair of relatively spaced bores formed in the adjacent chamber surface, the end of at least one of said bores adjacent said chamber surface being provided with a counterbore, the peripheral configuration of each of said impellers being formed by a non-uniform radius about the impeller rotary axis, portions of said impeller peripheries contacting one another and the chamber surface, when said impellers rotate, to effect impelling the product from the inlet port to the outlet port, the end face of said impeller adjacent the counterbore being provided with a resilient marginal boss conforming substantially to the contour of said impeller periphery, said peripheral boss being in substantially continuous slidable contact with the adjacent chamber surface upon rotation of said impellers and forming a cavity encompassing the rotary axis of said impeller, said counterbore being in partial overlapping and communicating relation with said cavity, conduit means provided on said casing and communicating with said outlet port and said cavity and effecting entrapment in said cavity of a portion of the discharged product at substantially a uniform pressure throughout said cavity and effecting lubrication by the entrapped product between said end face and the adjacent chamber surface, the cavity-forming segment of said impeller end

face constituting a substantial portion of the area of said impeller end face; and a liquid pressure-responsive shaft-encompassing element disposed within said counterbore and being deformable by the liquid pressure within said cavity to effect a liquid seal between the encompassed shaft and the corresponding casing bore.

References Cited in the file of this patent

UNITED STATES PATENTS

1,096,186	Nesmith	May 12, 1914
1,451,859	Balcker	Apr. 17, 1923
2,258,371	Wernert	Oct. 7, 1941
2,455,194	Rumsey	Nov. 30, 1948
2,460,649	Muller	Feb. 1, 1949
2,460,952	Simer et al.	Feb. 8, 1949
2,471,149	Girz	May 24, 1949
2,492,073	Taylor	Dec. 20, 1949
2,533,399	Sadler et al.	Dec. 12, 1950
2,567,699	Devlin	Sept. 11, 1951
2,644,402	Lehman	July 7, 1953
2,659,313	Carson	Nov. 17, 1953
2,665,641	Lauck	Jan. 12, 1954
2,710,581	Rosaen	June 14, 1955
2,711,136	Arnold	June 21, 1955
2,782,723	Doble et al.	Feb. 26, 1957