March 8, 1966 G. CAMAC 3,238,880

PUMPS

Filed March 26, 1964 2 Sheets-Sheet 1

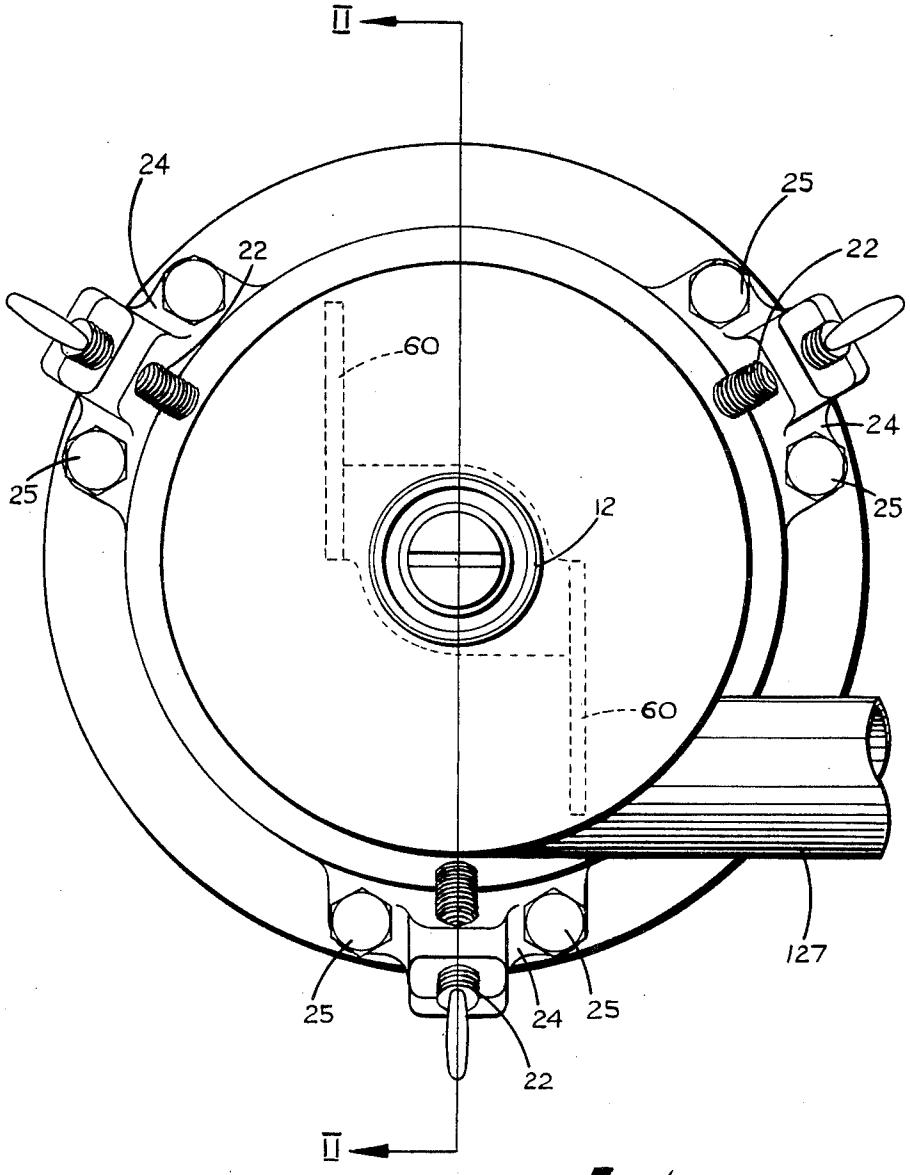


Fig. 1.

INVENTOR.
GEORGE CAMAC
By

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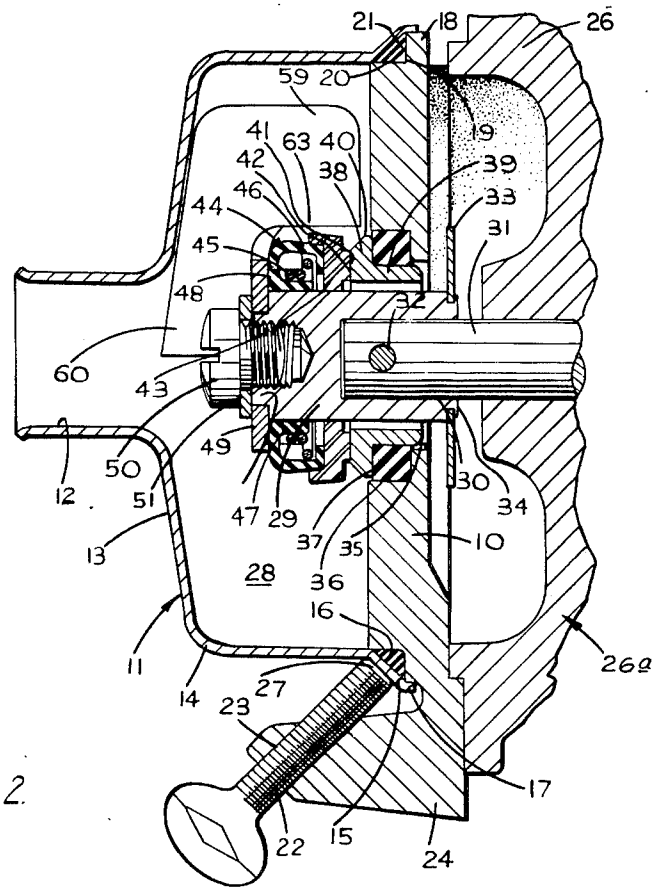


Fig. 2.

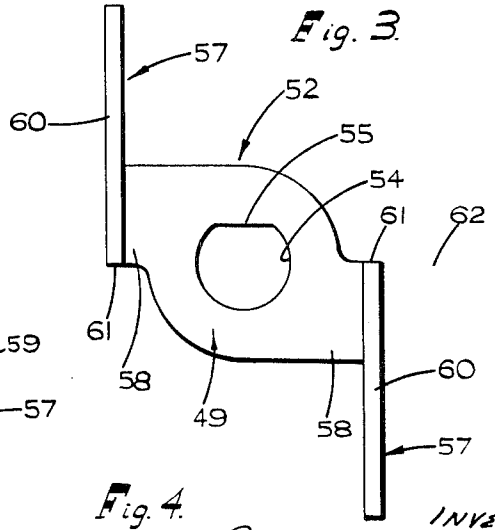


Fig. 3.

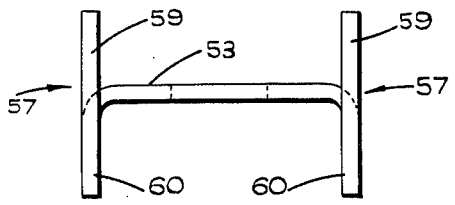


Fig. 4.

INVENTOR.
GEORGE CAMAC
By Kurt Kelman AGENT

United States Patent Office 3,238,880 Patented Mar. 8, 1966

3,238,880

PUMPS

George Camac, Weston-super-Mare, England, assignor to Speedwell Research Limited, Birmingham, England, a British company

Filed Mar. 26, 1964, Ser. No. 354,883
Claims priority, application Great Britain, Nov. 14, 1963, 44,947/63; Feb. 19, 1964, 6,878/64
4 Claims. (Cl. 103—103)

This invention relates to pumps. The invention has been developed in connection with sanitary centrifugal pumps suitable for pumping milk and chemical solutions and which have to be so constructed that they can be easily cleaned.

In centrifugal pumps it is necessary to provide a gland to provide a running joint between the impeller shaft and the casing.

When pumping certain chemical solutions, crystals tend to form in any interstices within the pump casing where no liquid flows or where the flow is comparatively slow. In conventional pumps, crystals tend to form around the gland and to interfere with the proper operation thereof. One method which has been proposed for overcoming this disadvantage is to provide two glands spaced axially along the impeller shaft and to supply the space between the glands with clean flushing liquid which flushes out the space and prevents the formation of crystals. While this system is satisfactory, it is necessary to provide two glands and to provide a source of flushing liquid to be supplied to the space between the glands. The construction of a pump incorporating two such glands is complicated and is expensive.

Moreover, when pumping perishable liquid such as milk, it is essential not to provide dead spaces where the milk will be stagnant and which will provide breeding grounds for bacteria.

Various sanitary pumps have been previously proposed but, due to the means used to locate the gland, dead spaces have been provided in which, e.g. milk can become stagnant during pumping. Such pumps have also been difficult to clean since the back plate has had to be removed to clean the gland.

It is an object of the invention to provide a pump in which only a single gland is used but which is so disposed in the pump casing that the formation of dead spaces or crystals is prevented. This is obtained by arranging that the seal faces of the gland are disposed within the pump casing and have their outer peripheral edges exposed to the fluid being pumped through the chamber. The peripheral edges of the seal faces are conveniently flushed by means of blade portions of an open type, i.e., an unshrouded impeller, the blade portions being arranged so that they sweep out a path surrounding the outer peripheral edges of the seal faces.

The invention will now be described in detail by way of example with reference to the accompanying drawings in which like reference numerals indicate like parts and in which:

FIGURE 1 is a front elevation of a centrifugal pump embodying the invention;

FIGURE 2 is a cross section of the pump of FIGURE 1 on the line II—II thereof;

FIGURE 3 is a front elevation of the impeller of the pump of FIGURES 1 and 2; and

FIGURE 4 is an end elevation of the impeller of FIGURE 3.

Referring now to the drawings, the pump shown therein is a centrifugal pump having an open-type i.e. unshrouded impeller. Such impellers have no shrouds at either face and there is therefore no hinderance to liquid

flowing between the blades in directions parallel to the axis of rotation of the impeller. The pump comprises a first casing component 10 which in the form of a generally flat back plate of the pump and a second casing component 11 which is of generally dished form and which provides a hollow spigot or pump inlet 12. The component 11 provides an end wall 13 of the casing and has a peripheral flange 14 which has a first portion forming a peripheral wall extending between the end wall 13 and the back plate 10 when the components are held in assembled relation. The peripheral flange 14 terminates remote from the end wall 13 in a second portion or extension 15 which has a frusto-conical internal surface 16. The extension 15 merges into a short cylindrical third flange portion 17.

The first component 10 has a sealing flange 18 around the periphery thereof. The flange lying in the general plane of the component 10 and being of less thickness than the main portion of the component. The flange 18 forms a step around the periphery of the back plate 10 and this step is defined by walls 19 and 20 which are parallel to and perpendicular to the general plane of the component 10 respectively. A sealing gasket 21 is received on the step and, when the pump casing is assembled, is compressed and substantially fills the peripheral cavity formed between the walls 19 and 20 on the component 10 and the frusto-conical internal surface 16 of the extension 15 of the second casing component 11.

The casing components are releasably held in assembled relationship by means of three thumb screws 22 which are threadedly received in threaded bores 23 in lugs 24 formed integrally with the casing component 10. Three such lugs are provided and are equiangularly spaced around the periphery of the casing component 10 as is clearly shown in FIGURE 1.

Each lug 24 is drilled to receive two pins 25 which pass through corresponding apertures, not shown, in the flange 26 of an electric motor part of which is shown at 26*a*. The casing component 10 is thus bolted to the motor flange with the pins 25.

The inner ends 27 of the thumb screws 22 abut against the outer surface of the extension 15 of the casing component 11, so that tightening of the thumb screws compresses the gasket 21 between the walls 19 and 20 and the internal surface 16 thus providing a seal between the casing components. The casing component 11 is provided with a tangential outlet pipe 127 as shown in FIGURE 2. An impeller is mounted within the pump chamber 28 defined by the casing components in a manner which will hereinafter be described and serves to accelerate liquid entering the inlet 12 and to discharge it from the outlet pipe 127.

The impeller shaft of the pump comprises a sleeve 29 which is provided with a bore 30 at one end to receive the shaft 31 of the electric motor 26*a*. The sleeve 29 and the shaft 31 are pinned together by means of a taper pin 32 which passes through aligned apertures in the shaft and sleeve. At the end of the sleeve 29 adjacent to the motor 26*a* it is provided with a thrower disc 33 which is mounted on a shoulder at the end of the sleeve and is retained in position by the end 34 of the sleeve being peened over the inner peripheral portion of the thrower disc 33.

The casing component 10 is provided with a central aperture 35 and in the face of the casing component exposed to the chamber 28 there is formed a recess 36. Mounted in the recess 36 is a rubber sealing ring 37 which in turn supports a flanged collar 38, the spigot 39 of the collar being within the ring 37 and the flange 40 of the collar being within the chamber 28. As will be seen from FIGURE 2, the sleeve 29 passes with clearance

through the flanged collar **38**. The flange **40** of the collar provides a seal face **41** which is proud of the immediately surrounding inner face of the component **10**, and this seal face engages a corresponding seal face **42** on a graphite ring **43**. The ring **43** embraces the sleeve **29** and engages a rubber sealing ring **44**. The sealing ring is of generally U-shaped formation and is provided with an internal spring **45**. The spring is so arranged that it forces one limb **46** of the ring against the peripheral wall of a recess in the graphite ring **43** and urges the opposite limb **47** of the rubber ring against the peripheral surface of the sleeve **29**. The base **48** of the "U" is engaged by the hub portion **49** of an impeller which will hereinafter be described. The sleeve is drilled and tapped to receive a fixing screw **50** which, together with a washer **51**, secures the impeller in position on the end of the sleeve **29**.

Referring now to FIGURES 4 and 5, the impeller indicated generally **52** is made from a single sheet of metal which has been cut and bent to the shape shown in the drawing. The hub portion **49** has a planar seating face **53** which is provided with an aperture **54** which is part-circular and part defined by a chord **55** of the circle. The sleeve **29** is provided with a boss **56** which is shaped so as to be complementary to the aperture **54** so that when the impeller is mounted on the boss it cannot rotate relative to the sleeve **29**. When the impeller is mounted on the shaft, the seating face **53** extends generally normal to the rotary axis of the sleeve **29**.

The impeller comprises two blades **57** carried by the hub portion at the end of short spokes **58**. The blades extend out of the plane of the seating face in two opposite directions as is clearly shown in FIGURE 4. Thus, referring to that figure, the portions **59** of the blades which extend upwardly in FIGURE 4 overlap the sleeve **29** and the seal when the pump is assembled. The other portions **60**, which extend downwardly in FIGURE 4, face the inlet **12**. The inner edges **61** of the portions **60** lie on a diametral plane **62** of the sleeve **29**. The inner edges **63** of the portions **59** overlap the gland as is clearly shown in FIGURE 2 and the blade portions extend to a position adjacent to the back wall formed by the casing component **10**. It will be seen that the blade portions **59** sweep out a path which surrounds the seal faces **41** and **42** of the gland parts.

The blade portions **60** are parallel and are spaced apart by a perpendicular distance which is greater than the diameter of the inlet **12**. This is clearly shown in FIGURE 1.

Operation of the pump is obtained by rotating the sleeve **29** and thus the impeller **52**. Liquid is drawn in through the inlet **12** and can enter the eye of the impeller since the latter is unobstructed due to the spacing of the blade portion **60**. The liquid then begins to flow outwardly within the casing and is then accelerated by the blade portions **60**. As the liquid gets nearer to the periphery of the casing, it is caused to flow toward the casing component **10** and is then accelerated by the blade portions **59** being finally discharged from the pump casing through the outlet pipe **127**. The sleeve **29** is sealed to the casing component **10** by the gland previously described, the flanged collar **38** remaining stationary within the casing component **10** and the graphite ring **43** rotating with the sleeve **29**. Should the seal be defective and leak, any liquid which passes between the seal faces **41** and **42** will be caught by the thrower **33** and will be flung out of a peripheral space which is provided between the casing **10** and the motor **26***a*.

The outer peripheral edges of the seal faces **41** and **42** lie adjacent to the path which is swept out by the inner edges **63** of the blade portions **59** and therefore the liquid flow around the peripheral edges will be at a substantial speed and crystals will not be able to form 'round the seal faces thus impairing their efficiency.

When it is desired to disassemble the pump for cleaning, the thumb screws **22** are slackened until the casing component **11** can be disengaged from the casing component **10**. After the casing component **11** has been withdrawn, the screw **50** can be slackened and removed from the sleeve **29** and then the impeller can be withdrawn off the end of the sleeve. After the impeller has been withdrawn, the rubber ring **44** and the graphite ring **43** may be slid together off the end of the sleeve **29**. The various parts may thus be flushed and cleaned easily before reassembling the pump by carrying out the above steps in the reverse order.

It will be seen that the invention provides a centrifugal pump which may easily be assembled and disassembled for cleaning purposes and which has its gland so arranged as to prevent the formation of crystals around the gland when liquid having a tendency to form crystals is being pumped. Moreover, the particular type of impeller used in the pump has an unobstructed eye which gives improved suction performance.

For a pump to be used in the food industry, the casing components can conveniently be made of stainless steel as can the impeller, the sleeve **29** and the screw **50**. The flanged collar **38** can also be made of stainless steel. Alternatively, depending on the services for which the pump is intended, the parts may be made of titanium. Instead of flanged collar **38** being made of metal it may be made of ceramic or any suitable plastic material.

What I claim is:

1. A centrifugal pump comprising first and second casing components defining a pump chamber, the first casing component having a generally flat face presented inwardly to the chamber, the face having a central aperture therein, the second casing component being formed in sheet metal to a dished configuration having a base and a peripheral wall, releasable means to hold the components in assembled relation with said base opposite said face and said peripheral wall extending between the base and the face, complementary circular sealing formations on the peripheral wall and around the outer periphery of said face, the formations defining a peripheral cavity extending from the pump chamber when the components are in assembled relation, a sealing gasket received in and substantially filling said cavity, an impeller shaft extending into the chamber through said aperture, an unshrouded impeller on said shaft, the impeller having a hub and the external diameter of said impeller being less than the diameter of the circle defined by the sealing formations, whereby the casing components can be assembled together and disassembled with the impeller on the shaft, releasable means engaging the hub portion of the shaft to secure the impeller to the shaft, a non-rotatable seal face in sealing relation with the first component, said seal face surrounding the aperture and standing proud of said flat face, a seal member surrounding the impeller shaft within the chamber and providing a seal face in contact with said stationary seal face, said seal member being located against axial movement on the shaft between said stationary seal face and the hub and being in gripping sealing engagement with the shaft whereby the seal face of the seal member rotates with the shaft, resilient means of the seal member urging the seal faces into contact and blades on the impeller having portions which sweep out a path surrounding the outer edges of the seal faces to provide a positive flow of liquid around said edges during operation of the pump.

2. A centrifugal pump according to claim **1** wherein said non-rotatable seal face is provided by the flange of a flanged collar in said aperture, a rubber ring being interposed between the collar and the first casing component to hold the collar in sealing relation with said component.

3. A centrifugal pump according to claim **1** wherein the seal member comprises a resilient ring and a rigid ring, the latter having the seal face thereon, said resilient

ring being compressed between the rigid ring and the hub of the impeller and serving to urge the seal faces together.

4. A centrifugal pump comprising first and second casing components defining a pump chamber, the first casing component having a generally flat face presented inwardly to the chamber, the face having a central aperture therein, the second casing component being formed in sheet metal to a dished configuration having a base and a peripheral wall, releasable means to hold the components in assembled relation with said base opposite said face and said peripheral wall extending between the base and the face, complementary circular sealing formations on the peripheral wall and around the outer periphery of said face, the formations defining a peripheral cavity extending from the pump chamber when the components are in assembled relation, a sealing gasket received in and substantially filling said cavity, an impeller shaft extending into the chamber through said aperture, an unshrouded impeller on said shaft, the impeller having a hub and the external diameter of said impeller being less than the diameter of the circle defined by the sealing formations, whereby the casing components can be assembled together and disassembled with the impeller on the shaft, complementary driving formations on the impeller and the shaft, a threaded bore in the end of the impeller shaft, a headed fixing screw engaged in the bore to hold the driving formations engaged, a sealing washer between the head of the screw and the end of the shaft for preventing ingress of liquid into the bore, a non-rotatable seal face in sealing relation with the first component, said seal face surrounding the aperture and standing proud of said flat face, a seal member surrounding the impeller shaft within the chamber and connected to rotate therewith

and providing a seal face in contact with said stationary seal face, said seal member being in sealing relation with the impeller shaft, resilient means urging the seal faces into contact, and blades upon the impeller having portions which sweep out a path surrounding the outer edges of the seal faces to provide a positive flow of liquid around said edges during operation of the pump.

References Cited by the Examiner

UNITED STATES PATENTS

29,262	6/1860	Fitzpatrick	230—134
1,498,790	6/1924	Field	230—134
1,809,526	6/1931	Namur	103—1.3
1,827,316	10/1931	Haynsworth	230—134
1,967,316	7/1934	Meeker	103—111
2,262,695	11/1941	Moeller	230—134
2,291,797	8/1942	Dalzell	103—111
2,352,127	6/1944	Sheldon	103—111
2,459,036	1/1949	Lipe et al.	103—87
2,461,624	2/1949	Bakewell	103—111
2,613,786	10/1952	Emrick	230—134
2,836,124	5/1958	Lung	103—111
2,842,063	7/1958	Kishline et al.	103—111
2,963,978	12/1960	Namur	103—111
2,986,095	5/1961	Namur	103—111
3.130.679	5/1964	Sence	103—115

FOREIGN PATENTS

583,417	10/1958	Italy.

SAMUEL LEVINE, *Primary Examiner.*

HENRY F. RADUAZO, *Examiner.*