March 12, 1957 C. A. NAMUR 2,784,673

CENTRIFUGAL PUMP

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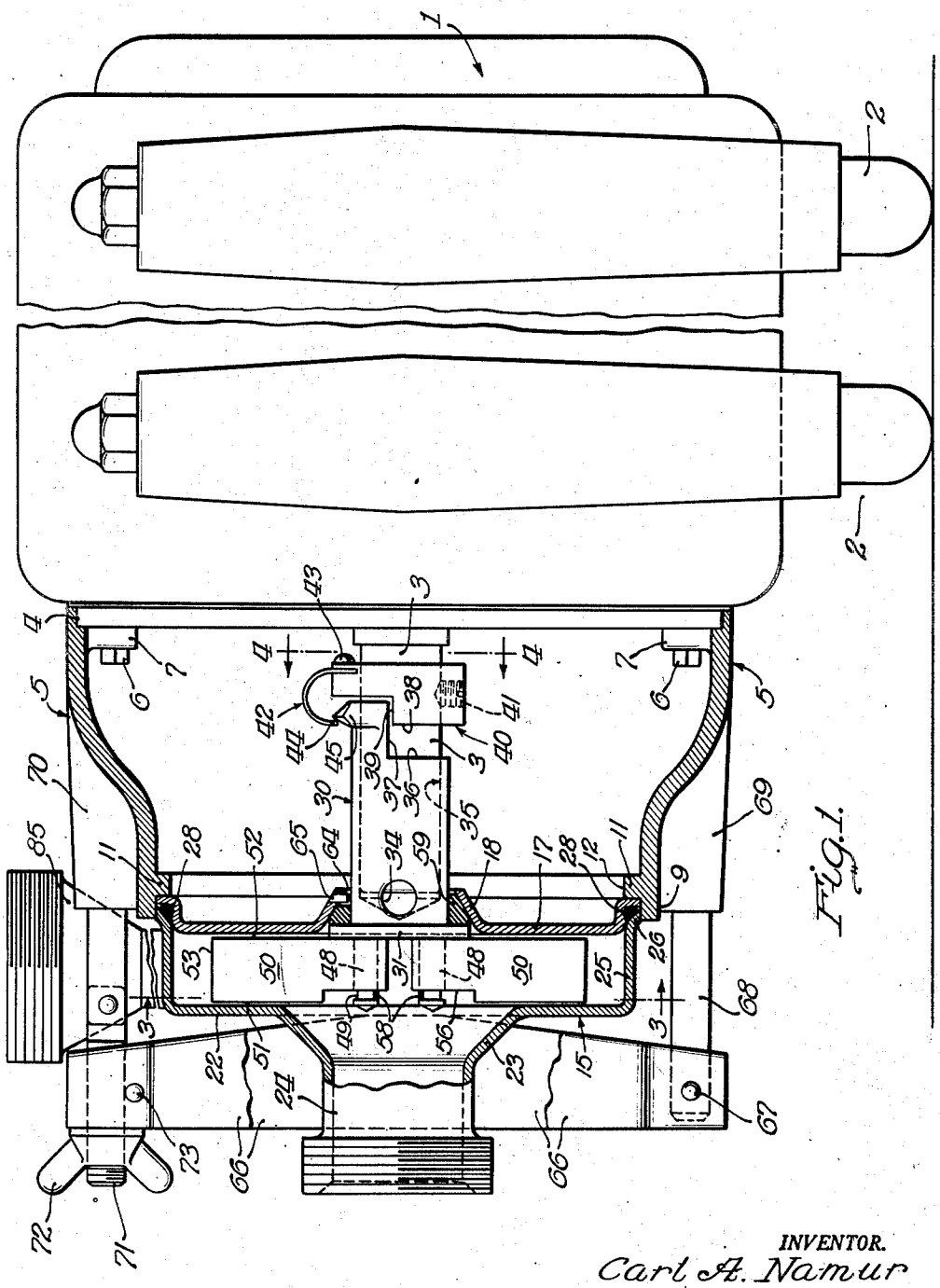

Fig. 1.

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Fig. 2.

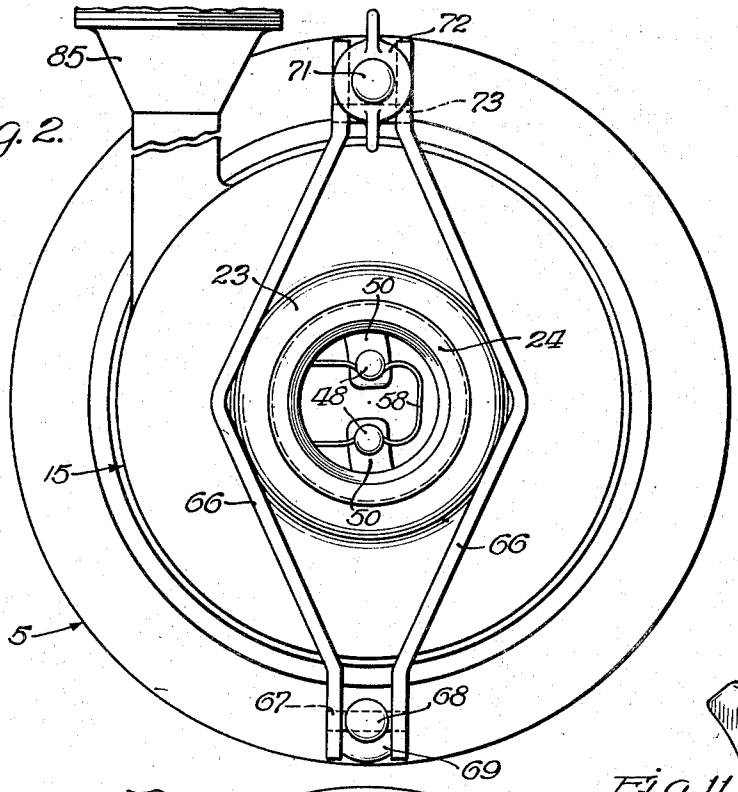

Fig. 3.

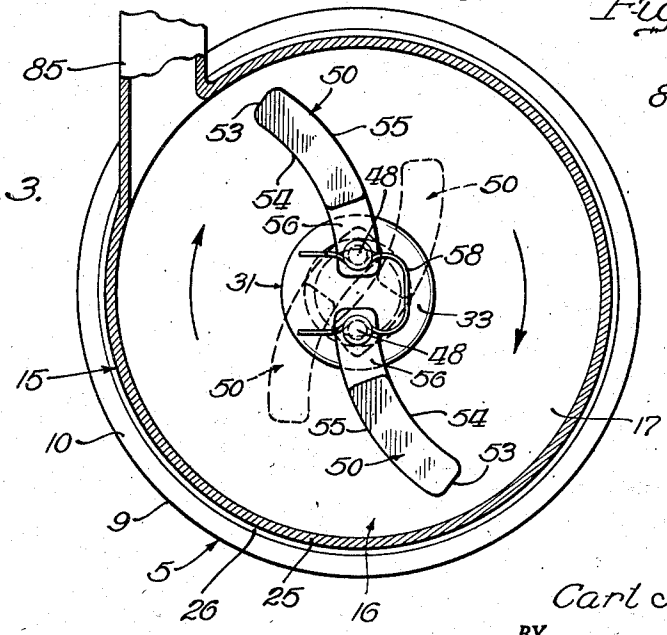

Fig. 11.

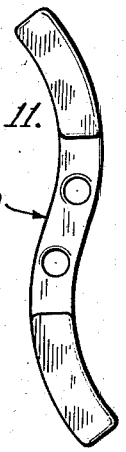

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Fig. 4.

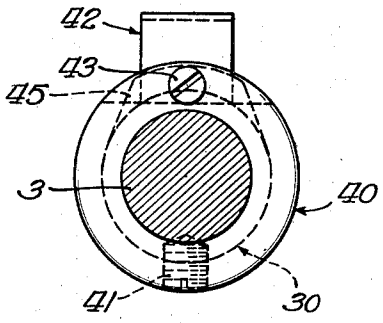


Fig. 8.

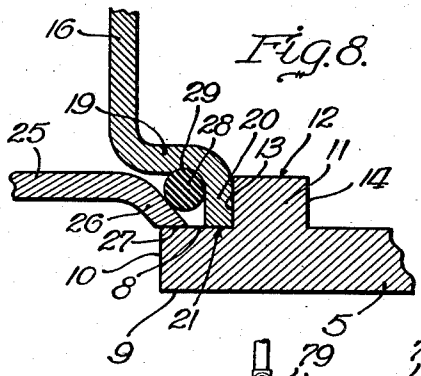


Fig. 5.

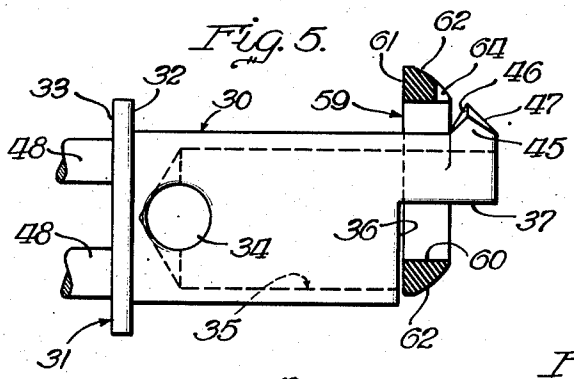


Fig. 10.

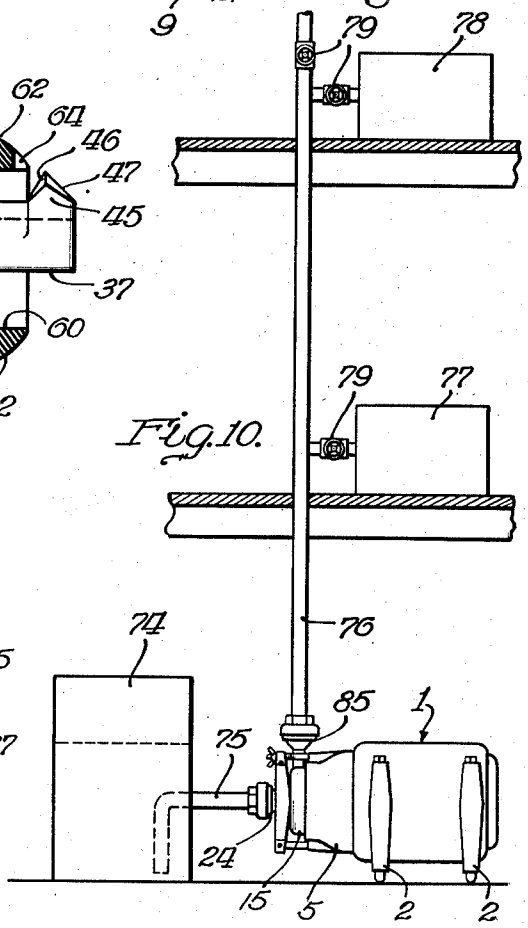
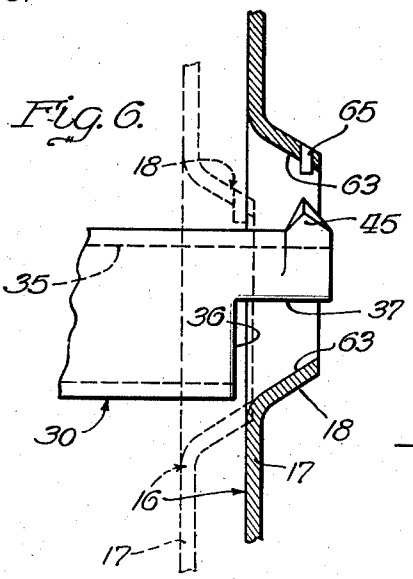


Fig. 6.



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Filed Sept. 22, 1952 4 Sheets-Sheet 4

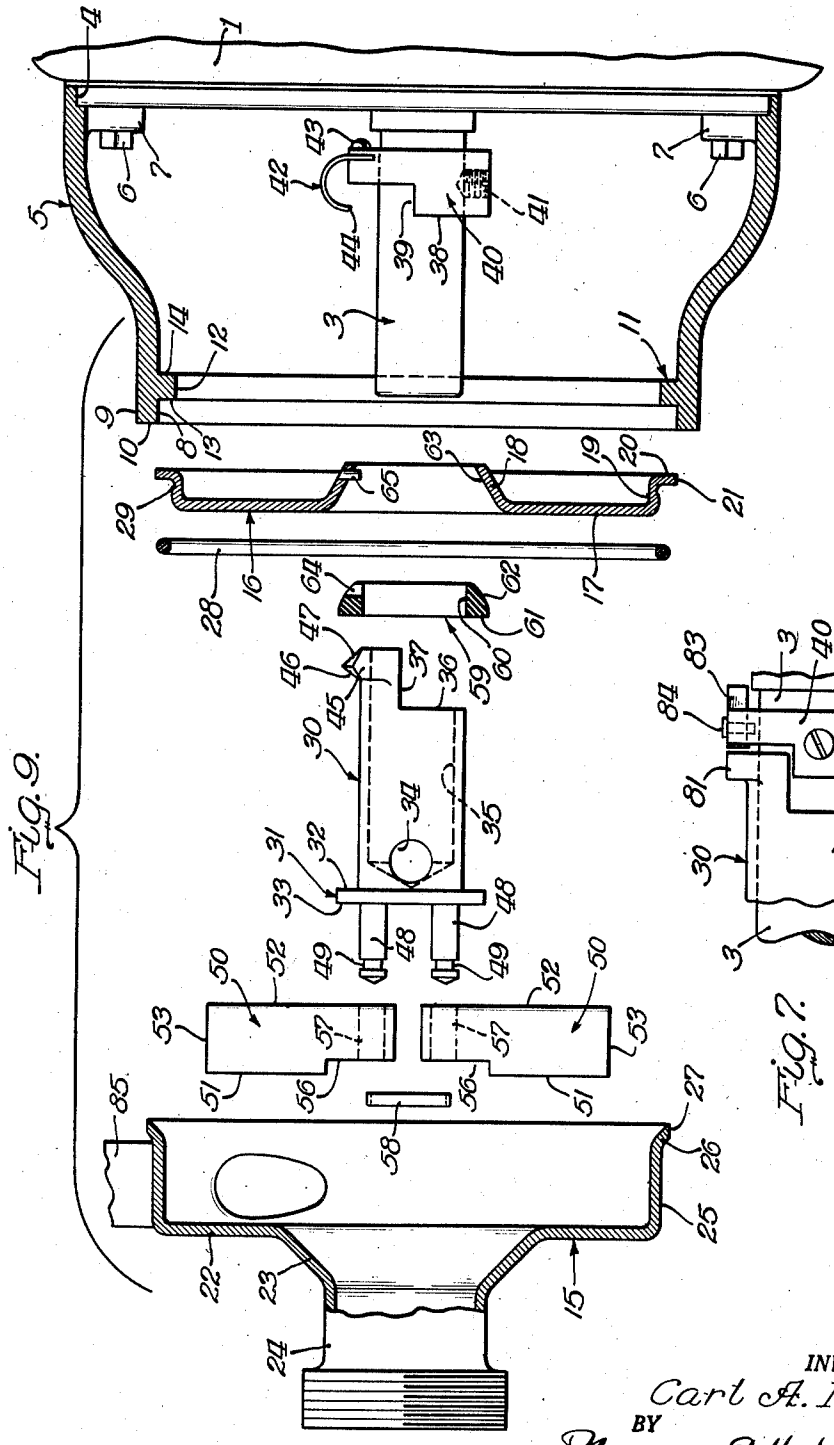

Fig. 9.

Fig. 7.

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United States Patent Office 2,784,673 Patented Mar. 12, 1957

2,784,673

CENTRIFUGAL PUMP

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Application September 22, 1952, Serial No. 310,837

11 Claims. (Cl. 103—103)

This invention relates to centrifugal pumps and the use thereof. More particularly this invention relates to improvements in centrifugal pumps whereby they are adapted particularly well for uses wherein the pumps must frequently be disassembled and reassembled incidental to the cleaning thereof, and wherein they are frequently operated under greatly varying conditions of discharge pressures, and wherein they are frequently used to pump products of appreciably different viscosities.

The improved impeller is disclosed and claimed in the divisional application Serial No. 346,971, filed April 6, 1953 and entitled, Centrifugal Pump Impeller.

Some of the primary objects of this invention are to provide a sanitary type, centrifugal pump, which may be easily and quickly assembled and disassembled, which is comprised of relatively few operating parts, which is of symmetrical design, which is provided with a self regulating feathering type impeller, and which is provided with a self adjusting, sanitary rotary seal for sealing the aperture in the pump housing through which the impeller shaft extends into the pump housing.

A further object of this invention is to provide an improved method for the non-turbulous pumping of fluid, such as milk, against changeable conditions of discharge pressure head by the use of constant speed centrifugal pumps provided with self feathering type impellers.

An important object of this invention is to provide an improved support structure for a sectional casing for a pump.

Other objectives and important aspects and advantages of this invention may be more readily determined from a consideration of the following description of the invention when read in connection with the accompanying drawings in which:

Figure 1 is a side elevational view, partially in section, showing the improved pump unit;

Figure 2 is a front elevational view of the pump shown in Figure 1 of the drawings;

Figure 3 is a sectional view taken along line 3—3 of Figure 1 of the drawings, together with a superimposed dotted line illustration of the maximum radial contraction of the blades of the impeller of the improved pump;

Figure 4 is a sectional view taken along line 4—4 of Figure 1 of the drawings;

Figure 5 is a side elevational view, partially in section of a portion of the pump impeller shaft and impeller shaft operative seal ring, illustrating the manner of removal of the seal ring from the impeller shaft;

Figure 6 is a side elevational view, partially in section, of a portion of the impeller shaft and the apertured portion of the rear wall of the pump housing, illustrating the manner of disassembling the pump impeller shaft from the pump housing;

Figure 7 is a side elevational view of a modified arrangement of a portion of the pump impeller shaft and a portion of the driving motor shaft illustrating the use of permanent magnets to urge the impeller shaft axially along the motor shaft toward the jaw clutch collar on the motor shaft;

Figure 8 is an enlarged sectional view of the complementary flanged edges of the sections of the pump casing seated in the pump casing support;

Figure 9 is a view, partially in section, illustrating the relative position of assembly of elements of the improved pump;

Figure 10 is a diagrammatic view illustrating a manner of use of the improved pump in pumping material against different pressure heads; and

Figure 11 is a view of a modified impeller of rigid construction usable in the improved pump.

Referring to the preferred embodiment of the invention as illustrated in the drawings, in which like elements are identified by like numerals, 1 represents a source of driving power, such as an electrical motor of the sanitary type. The motor 1, as clearly illustrated in Figure 1 of the drawings, is provided with ball type feet 2, and is also provided with a central drive shaft 3 extending outwardly from one end of the motor casing, centrally thereof. Shaft 3 is adapted to deliver a uniform driving torque at a constant number of revolutions of the shaft per minute.

An annular shoulder 4 formed on the shaft end of the motor casing, surrounds the shaft 3 and is concentric therewith. Shoulder 4 is utilized in the support of and positioning of an annular yoke 5. One end of yoke 5 is snugly fitted over the shoulder 4 and rigidly secured to the frame of the motor 1 in concentric arrangement with the axis of the drive shaft 3 by bolts 6 which extend through lugs 7 formed on the inside of yoke 5 and then extend into the frame of motor 1 to which they are secured.

The end of yoke 5 farthest removed from the motor 1 is provided with an annular end having parallel inner and outer, longitudinally extending, peripheral portions 8 and 9 respectively. The peripheral portions 8 and 9 are parallel to and concentric with the axis of the drive shaft 3 and are spaced approximately opposite the adjacent end of the shaft 3. The annular end face 10 of the yoke 5 intermediate the peripheral portions 8 and 9 is also concentric with the drive shaft 3 and lies in a plane perpendicular to the axis of the shaft 3 and the surfaces 8 and 9. An inwardly extending, annular flange 11, of rectangular cross section, is formed on the inner surface of the yoke 5 contiguous with the inner peripheral portion 8. Flange 11 has an inner annular peripheral surface 12 concentric with and parallel to the axis of shaft 3. Flange 11 also has opposed, parallel, transversely extending, annular side walls 13 and 14 concentric with the axis of shaft 3 and parallel to the end face 10 of yoke 5. The contiguous, concentric surfaces or shoulders 8 and 13 form between themselves an annular groove on the inside of the end of the yoke 5.

A pump housing consisting of interfitted, substantially circular, centrally apertured, front and rear housing sections 15 and 16 respectively, is releasably supported on the yoke 5 in concentric arrangement with the axis of the shaft 3.

The rear, cup shaped, housing section or rear end face 16 of the pump casing is formed primarily of a flat plate like portion 17, substantially flat on both sides thereof, which sides are parallel one to another and to the end face 10 of yoke 5 and are also perpendicular to the axis of the shaft 3. The rear end face 16 is centrally ported and is provided with a rearwardly extending and outwardly converging annular flange 18. The flange 18 is in the form of the outer inclined surface of a frustum of a cone and is concentric with the axis of the drive shaft 3 and defines the central aperture in the end face 16. A laterally or longitudinally extending flange 19, formed

integrally with the flat portion 17 extends rearwardly from the outer periphery of the flat portion 17 of the end face 16 and is perpendicular to the flat portion 17 and is also concentric with the axis of the shaft 3 and is also parallel to the inner peripheral portion 8 of the yoke 5 but spaced from the portion 8. An annular, transversely extending flange 20 formed integrally with the longitudinal flange 19 extends radially from the rear edge of flange 19 parallel to the flat portion 17 of the end face 16 and concentric with the inner yoke flange 11 and overlappingly abutting and parallel to the front face 13 of flange 11. The free, outer annular edge 21 of flange 20 is concentric with, parallel to, and abuts against the inner peripheral portion 8 of the yoke 5.

The front, cup shaped, pump casing or housing section 15 has its front face formed primarily of a flat plate-like portion 22 substantially flat on both sides thereof which sides are parallel one to another and to the flat sides 17 of the rear pump face 16 and to the end face 10 of yoke 5 and are also perpendicular to the axis of the drive shaft 3. The front end face 15 is centrally ported and is provided with a forwardly extending and outwardly converging inlet throat portion 23 which defines the aperture in the front face 15. The wall of the throat portion 23 is in the shape of the outer inclined surface of a frustum of a cone and is concentric with the axis of the shaft 3 and terminates at its outer end in a juncture with a conventional cylindrical pipe connection 24. A laterally or longitudinally extending flange 25 formed integrally with the flat portion 22 of front face 15 extends rearwardly from the outer periphery of the flat portion 22 of the front end face 15 and is perpendicular to the flat portion 22 and is also concentric with the axis of the shaft 3 and parallel to and concentric with flange 19 of the rear end face 16 and is also parallel to and concentric but spaced from the inner peripheral portion 8 of the yoke 5. An annular, transversely extending flange 26 formed integrally with the longitudinally extending flange 25, extends outwardly and rearwardly at an angle to the flange 25 from the rear edge of the flange 25 and is concentric with the axis of the shaft 3 and the peripheral portion 8 of yoke 5 and is generally of the configuration of the inclined surface of a frustum of a cone and generally overlaps the front of the flange 20 but preferably out of contact therewith. The free outer annular edge 27 of flange 26 is concentric with, parallel to and abuts against the inner peripheral portion 8 of the yoke 5. A tangential discharge connection 85 communicates with the interior of the pump housing through an aperture in the flange 25.

To seal the sections 15 and 16 of the pump housing or casing one to another an annular gasket 28, preferably of circular cross sections is mounted on the rear section or end face 16 and seated in the annular groove 29 in the outer face of the flange 19 immediately adjacent the flange 20. Gasket 28 is of such a cross section dimension that it will be sealingly compressed between the juxtaposed flanges 19, 20, and 26 when the casing sections 15 and 16 and the gasket 28 are assembled in the manner described.

Telescoped snugly over the drive shaft 3 is a circular centrally bored impeller shaft 30 the faces of which are concentric with, and supported against radial displacement by the drive shaft 3. The cylindrical impeller shaft 30, centrally bored partially through the length thereof, is telescoped over the cylindrical drive shaft 3, over which drive shaft it fits snugly in coaxial arrangement and with the end of the bore in the impeller shaft 30 immediately adjacent the end of the shaft 3. The free end of the impeller shaft 30 extends into the pump housing through the central aperture in the rear end face 16 of the pump housing, out of contact with the flange 18 but concentric with the axis thereof. The end of the impeller shaft 30 which extends into the pump casing is provided with a transverse, peripheral, annular flange 31 having parallel

rear and front side walls or shoulders 32 and 33 which are perpendicular to the axis of the drive shaft 3 and parallel to the flat face portions 17 and 22 of the pump casing rear and front sections 16 and 15 respectively and also parallel to and concentric with the annular end face 10 of the yoke 5.

To facilitate ready escape of air in assembly and to facilitate cleaning, a diametrical transverse hole 34 intersecting the end of the axial bore is provided in shaft 30, thus permitting ready assembly of shaft 30 on shaft 3 with the inner surface 35 defining the bore in shaft 30 closely fitted on to the outer cylindrical surface of drive shaft 3.

The rear end of the impeller shaft 30 is provided with a jaw clutch arrangement consisting of the transverse and axial shoulders 36 and 37 respectively formed in the rear end portion of the impeller shaft 30 for driving engagement with the complementary shoulders 38 and 39 respectively on the collar 40 secured to the drive shaft 3 by key bolt 41. In normal operation the driving torque is transferred from shoulder 39 to shoulder 37 and the thrust shoulders 36 and 38 do not engage one another for reasons which will become more apparent hereinafter.

A U-shaped spring clip 42 is rigidly seated at one end in a slot in the collar 40 and secured thereto by screw 43. The free end 44 of the spring clip 42 is in the form of a cam follower and overlaps the end of impeller shaft 30 opposite the shoulder 37 and under tension engages the peripheral cam 45 on the extreme rear portion of the outer periphery of the impeller shaft 30 and when the follower 44 is normally in contact with the upwardly and rearwardly inclined cam face 46 the impeller shaft 30 is urged rearwardly on the drive shaft 3. In the pump assembly operation the cam follower end 44 of spring clip 42 engages the upwardly and forwardly inclined cam face 47 of cam 45 to aid in seating the follower 44 properly upon the cam face 46.

The end of the impeller shaft 30 which extends into the pump housing is provided with two parallel, forwardly extending, cylindrical studs or hinge pins or pivots 48 which are equally spaced from and parallel to the axis of the shaft 3 and extend forwardly from the front face of the shaft 30 which is flush with the face 33 of the flange 31. The outer edges of the pivots 48 are spaced slightly inwardly of the outer edges of the shaft 30. Each of the pivots 48 are of a length approximately equal to the internal depth of the pump casing between the flat surfaces 17 and 22, and each of the pivots 48 is provided adjacent its free end with a peripheral groove 49.

In the preferred embodiment of the invention the improved pump includes two rigid impeller blades 50 having substantially flat front and rear parallel faces 51 and 52 respectively which are parallel to and spaced slightly from the flat faces 17 and 22 of the pump housing sections 15 and 16 and lie in parallel planes perpendicular to the axis of the shaft 3. The outer end 53 of each of the blades 50 is perpendicular to the front and rear faces 51 and 52 and parallel to the axis of the shaft 3 and spaced from the flange 25 of the housing section 15. The curved or bowed side walls 54 and 55 of the impeller blades 50 are parallel and arcuate and are perpendicular to the planes of the flat portions 17 and 22 of the pump sections 15 and 16. In operation the impeller blades 50 are rotated clockwise as viewed in Figure 3 of the drawings with the convex surface 55 of the blades 50 comprising the leading surface and the concave surface 54 comprising the following surface. Each of the blades 50 is formed with an offset inner end portion having a flat front surface 56 parallel to the front face 51 of the blade 50, and which offset portion is slightly narrower than the width of the blades intermediate the parallel front and rear faces 51 and 52. A pivot or hinge pin receiving cylindrical bearing opening 57 is provided immediately adjacent the inner end of

the blades 50 through which the pivot pins or studs 48 extend in bearing contact therewith. The blades 50 are releasably secured in hinged operative position upon the pivot pins 48 by means of the engagement of the branches of the hairpin-like, outwardly, expandable, spring clip 58 in the grooves 49 of the studs 48. The clip pin 58 is releasably locked in groove 49 due to the spring tension of the pin 58, and also due to the effect of centrifugal force upon the branches of the pin 58 when the impeller shaft 30 is rotated. The width of the inner end portions of each of the blades 50 through which the pivots 48 extend is substantially equal to the length of the studs 48 intermediate to the groove 49 and the front end of the impeller shaft 30.

A seal ring 59 is provided to seal the aperture in the rear section 16 of the pump casing about the impeller shaft 30. The seal ring 59 is formed of any suitable anti-friction material such as for example, Bakelite, hard rubber, nylon or other suitable material, and has a cylindrical inner periphery 60 of a diameter slightly larger than the outer diameter of the impeller shaft 30. The seal ring 59 is provided with a flat front face 61 which is perpendicular to the axis of the shaft 3 and parallel to and abutting in sealing contact against the rear surface 32 of the flange 31 on the shaft 30. The width of the annular sealing surface or face 61 of the ring 59 is such that the outer edge thereof is flush with the outer edge of the sealing face 32 of the flange 31. The seal ring 59 is provided with an annular outer peripheral surface 62 which joins the front face 61 of the seal ring 59 with the rear face of the seal ring. The surface 62 converges inwardly from the front face of the ring 59 toward the rear face of the ring 59 so as to provide a seal ring wherein a lateral cross section as illustrated in Figures 5 and 9 of the drawings thereof would be provided with a convex surface 62. The ring 59 is seated within the flange 18 by the sealing engagment of the convex surface 62 of the ring 59 with the inner conical surface 63 of the flange 18.

In the operation of the improved pump the sealing engagement between the seal face 61 of the ring 59 and the seal face 32 of the flange 31 is maintained, at least in part, by the spring 42 which, through engagement with the cam face 46 urges the impeller shaft 30 rearwardly whereby the flange 31 compresses the conical surface 62 of the ring 59 sealingly against the surface 63 of the flange 18 while simultaneously urging the seal face 32 of flange 31 into sealing engagement with the face 61 of ring 59.

In the normal operation of the pumps the seal ring 59 is prevented from rotating within the flange 18 by virtue of the inter fitting relation between the slot 64 in the rear edge of the seal ring 59 and the complementary key 65 within the flange 18.

When the operative elements of the improved pump have been assembled in the arrangement as heretofore set forth, the pump housing is maintained in its operative position on the yoke 5 with the sections 15 and 16 sealed one to another by means of the compressed gasket 28 due to the rearward thrust against the front section 15 of the pump casing by the compression bracket 66. The opposed arms of the compression bracket 66 are hinged at one end by hinge pin 67 to a supporting stud 68 anchored in a lug 69 on the outer periphery of the yoke 5.

An oppositely disposed lug 70 on the yoke 5 is utilized to support a tension screw 71 on the free end of which is threaded a nut 72 which overlappingly engages the free ends of the opposed bracket arms 66 which are rigidly secured together by the cross pin 73. The appropriate adjustment of the nut 72 on the screw 71 brings about the desired compression of the front pump housing head 15 against the gasket 28.

In the operation of a pump embodying the present inventions, the position of the impeller blades 50 is determined in part by the effect of centrifugal force, which would tend to cause the blades 50 to assume a position of maximum radial extension, and is determined in part by the resistance to movement of the material being pumped, either due to viscosity or discharge pressure head, which will tend to cause the blades 50 to assume a position of minimum radial extension as illustrated by the dotted line representations of the blades 50 in Figure 3 of the drawings.

Such self adjustment or automatic feathering of the rigid, but pivoted impeller blades 50 which are eccentrically hinged to the rotary impeller shaft and arranged to rotate concentrically within a cylindrical pump casing at an established speed of rotation, and which impeller has an extreme outer diameter less than the inner diameter of the pump casing, always provides a fluid circulating space between the end of the impeller blade and the cooperating walls of the pump casing. The adjustability of the impeller blades 50 determines the radial depth of the fluid circulating space. In such adjustment of the impeller blade 50 the outer free end thereof is swingable, from its position of maximum radial extension, toward the axis of rotation of the impeller shaft 30, and in being so moved travels through a path of progressively diminishing radial extension. Under these conditions of possible movement of the impeller blade 50 responsive to such conditions as discharge pressure head, the free end of the impeller blade 50 will under low pressure conditions be caused to travel through an outermost orbital circular path radially inwardly of the inner periphery of the casing wall 25, and to travel under conditions of high discharge pressure head along an innermost orbital circular path radially closer to the axis of rotation, and to travel through orbital circular paths intermediate the outermost and innermost paths depending on the conditions of discharge pressure head.

In Figure 10 of the drawings there is illustrated a pumping system utilizing an improved pump according to this invention wherein the fluid is supplied to the pump either under a slight static head or by suction from supply reservoir 74 through the supply pipe 75 to the pump. The pump then delivers the fluid under pressure into the discharge conduit 76. From the conduit 76 the fluid may be discharged under pressure at a low elevation against a low discharge pressure head by opening the lower valve 79 and discharging the fluid into reservoir 77 or the fluid may be discharged at a higher elevation against a higher pressure head by opening the upper valve 79 and discharging the fluid into the reservoir 78. In the use of the improved pump in such a pumping system the working capacity of the pump is automatically adjusted in proportion to the discharge pressure which in turn determines the volume of fluid contained in the pump chamber while the fluid is subject to a given discharge pressure head and that in turn, in an important degree, determines the extent of radial expansion of the eccentrically pivoted impeller blades.

Figure 11 of the drawings illustrates a modified form of pump impeller 80 which is comprised of one rigid bar-like element having generally the configurations of the result of the combining of two impeller blades 50. The modified form of impeller blade 80 is provided with two bearing ports in the mid section thereof to receive the studs 48 of the impeller shaft 30.

Figure 7 of the drawings illustrates an arrangement for urging the impeller shaft 30 rearwardly on the drive shaft 3 to maintain the rotary seal in sealing position in the aperture of the rear face 16 of the pump housing by the use of magnets. To this end the modified form of the impeller shaft 30 is provided with opposed peripheral flange-like elements 81 and 82 immediately adjacent the jaw clutch portions of the shaft 30 and spaced directly opposite and adjacent to magnets 83 secured by screws 84 to the collar 40 on the drive shaft 3.

Having thus described the illustrated and preferred em-

bodiment of this invention in a pump and method of its use, the invention is not to be restricted to the specifically illustrated embodiment thereof as set forth in the accompanying drawings and as hereinbefore described, except in so far as necessary by the prior art and the appended claims.

The invention is hereby claimed as follows:

1. In combination, a support, transversely extending shoulder-like means on said support, longitudinally extending shoulder-like means on said support, and two complementary and opposed sectional housing means supported on said support, one section of said housing means having a transversely extending peripheral portion abutting against said transversely extending shoulder means and the other section of said housing means having a transversely extending peripheral portion abutting against said longitudinally extending shoulder means, and both sections of said housing means each having juxtaposed transversely and longitudinally extending peripheral portions and being so constructed and arranged and each being of such dimensions as to overlap with one another along their outermost peripheral portions both transversely and longitudinally with respect to said housing means.

2. In combination, a wall having an aperture therethrough, axially shiftable rotary power shaft means extending through said aperture, a peripheral shoulder means on said shaft means to one side of said wall, seal means intermediate said shoulder and said wall, rotary drive means supporting and rotating said shaft means in an axially shiftable manner, and thrust applying means engaging said shaft means and urging said peripheral shoulder means sealingly against said seal means and urging said seal means sealingly against said wall to seal the aperture in said wall, said thrust applying means being carried by and mounted upon said rotary drive means and positioned to one side of said wall opposite the side of said wall which is adjacent to said peripheral shoulder means.

3. In combination, a wall having an aperture therethrough, rotary shaft means extending through said aperture, rotary drive means driving said shaft means and supporting it in an axially slidable manner against radial displacement, and thrust applying means engaging said shaft means and stabilizing said shaft means against axial displacement with respect to said drive means, said thrust applying means being carried by and mounted upon said rotary drive means.

4. A pump of the sanitary type comprising, in combination, a support for sectional housing elements, a complementary pair of juxtaposed sectional and circular housing engaging elements having overlapping edges and forming a pump housing, a seal element intermediate said housing elements, said support having contiguous shoulders forming an annular groove at one end of said support releasably receiving said overlapping edges and centeringly engaging the peripheral circular edge of each of said housing elements and supportingly engaging the outer face of one of said housing elements, and compression means secured to said support and urging one of said housing elements relatively toward the other element and compressing said seal element intermediate said housing element and securely locking said overlapping edges within said groove to form thereby a sealed housing.

5. A pump unit comprising, in combination, a driving motor having a central shaft, a pump housing support mounted on said motor, a pump housing having a central shaft aperture in one face thereof and mounted on said support with the aperture arranged co-axially with the shaft of said driving motor, an impeller shaft carried by said motor shaft at one end thereof and extending into said housing through said aperture out of contact with said housing, said impeller shaft being axially slidable on said central shaft of said motor, a shoulder on said impeller shaft within said housing, a seal element intermediate said shoulder and the adjacent surface of said apertured face surrounding said aperture and in sealing contact with said shoulder and said face, and resilient means carried by the central shaft of said motor outwardly of said housing and engaging said impeller shaft for urging said shoulder toward the adjacent surface of said apertured face and for stabilizing said impeller shaft against axial displacement with respect to said central shaft of said motor.

6. In combination, a pump housing support, transversely extending circular shoulder-like means on said support, longitudinally extending circular shoulder-like means on said support, a pair of complementary sectional pump housing means having overlapping circular edges and releasably supported by said support, the circular edge one section of said pump housing means abutting against said transversely extending shoulder means and the circular edge of the other section of said pump housing means abutting against said longitudinally extending shoulder means, and releasable compression means secured to said support and overlapping said pump housing means and urging the sections of said sectional pump housing means relatively one toward another intermediate said support and said compression means and toward said support.

7. A device according to claim 6, wherein said shoulder-like means are annular and perpendicular one to another, and wherein said housing sections are of general circular outer peripheral configuration and have substantially flat opposed side faces.

8. A device of the type described comprising, in combination, a juxtaposed pair of sectional housing elements having overlapping and laterally extending and complementary and annular flanged edges, one of said flanged edges having formed therein an annular seal seat for a seal element, said complementary annular flanged edges being so constructed and arranged that the innermost and outermost portions of the flanged edge having the seal seat formed therein is closer to the adjacent surface of the other complementary flanged edge than is the midportion of the said annular seal seat, an annular seal element intermediate said complementary annular flanged edges, an annular housing support having contiguous shoulders forming an annular groove at one end of said support receiving the overlapping flanged edges, said flanged edge having the seal seat formed therein engaging both said contiguous shoulders of said housing support, the other flanged edge engaging one of said contiguous shoulders of said housing support, and compression means carried by said support and urging one of said housing elements toward the other housing element and urging both housing elements toward said support and compressing said seal element intermediate said housing elements to form thereby a seal between said overlapping flanged edges.

9. A device according to claim 8, wherein both said flanged edges engage one of said contiguous shoulders throughout the entire extent of their outermost peripheries.

10. A pump comprising, a driving motor provided with a central rotary drive shaft, an annular pump support arranged coaxially with said drive shaft and mounted on said motor, a sectional pump housing having a central shaft aperture in one face thereof and mounted on said support with said aperture arranged coaxially with the drive shaft of said driving motor, an impeller, an impeller shaft carried by the drive shaft of said motor and extending into said housing through said aperture and out of contact with said housing and supported coaxially with the drive shaft of said motor and axially slidable upon the drive shaft of said motor, a shoulder on said impeller shaft within said housing, annual seal means relatively rotatable with respect to said shoulder and positioned intermediate said shoulder and the adjacent surface of said apertured face surrounding said aperture and in sealing contact with said shoulder and said face, and resilient means carried by the drive shaft of said motor and engaging said impeller shaft and urging said shoulder

toward the adjacent surface of said apertured face thereby establishing and maintaining sealing engagement between said shoulder and said seal means and between said seal means and said apertured face about the aperture in said face.

11. In combination, a support, transversely extending shoulder-like means on said support, longitudinally extending shoulder-like means on said support, and two complementary and opposed sectional housing means supported on said support, both of said sectional housing means each including a longitudinally extending peripheral portion carrying a transversely and outwardly extending peripheral portion, said longitudinally extending and transversely extending peripheral portions of one of said sectional housing means being arranged in juxtaposition with respect to and respectively overlapping said longitudinally extending and transversely extending peripheral portions of the other of said sectional housing means, one section of said sectional housing means abutting against said transversely extending shoulder means and the other section of said sectional housing means abutting against said longitudinally extending shoulder means.

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