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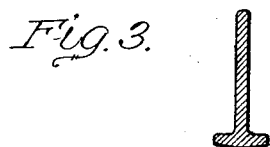
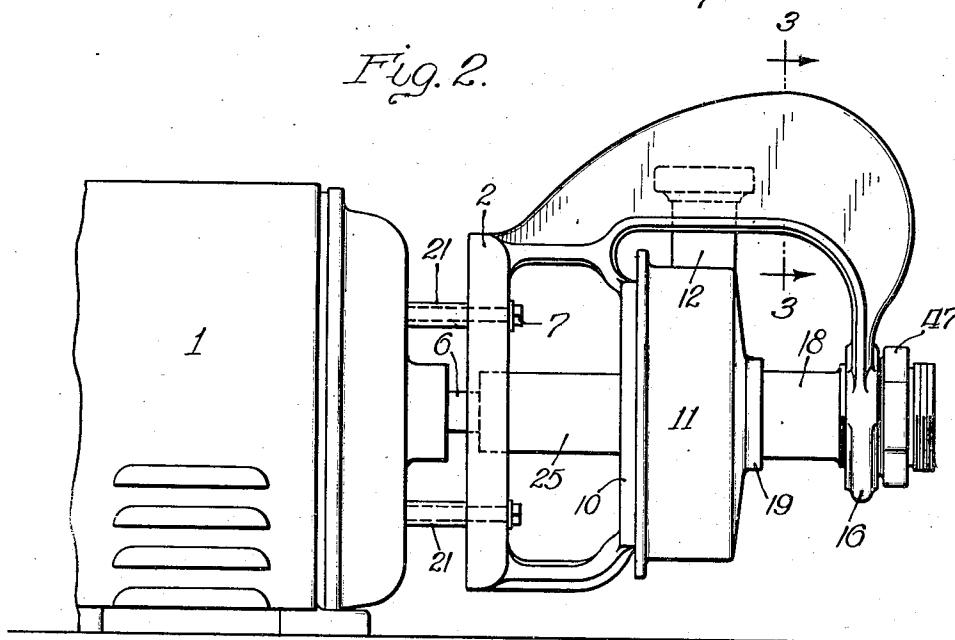
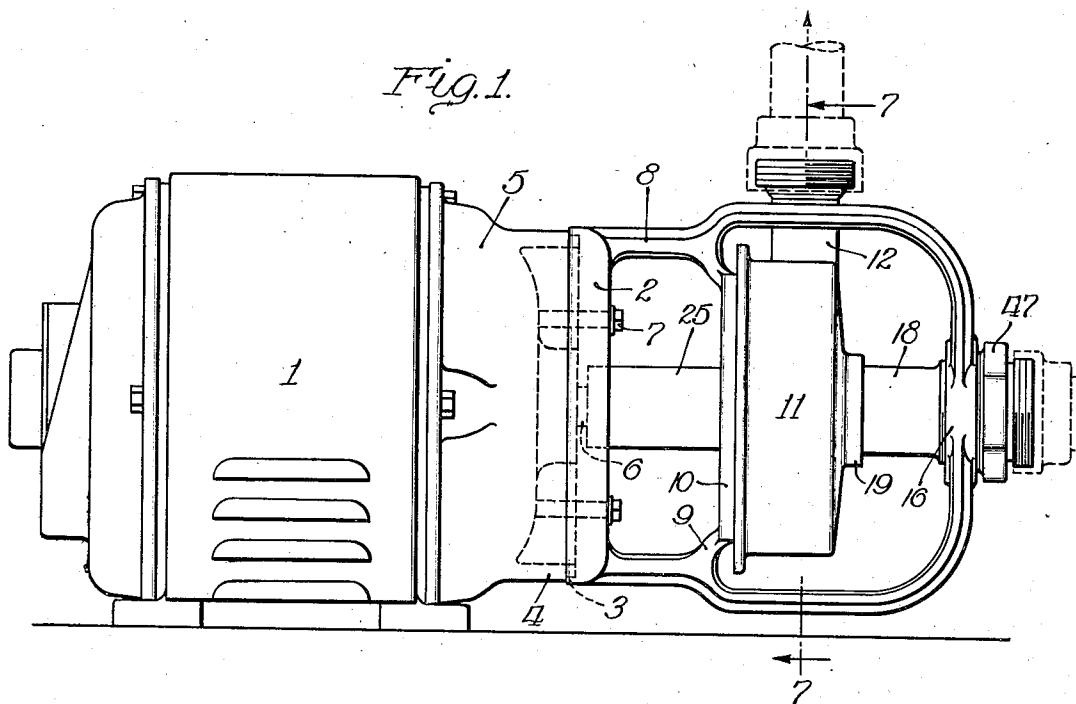
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2,291,797

CENTRIFUGAL PUMP

Filed Oct. 24, 1938

3 Sheets-Sheet 1



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Fig. 5.

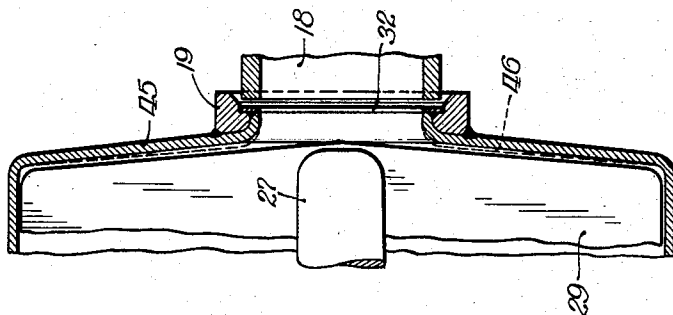
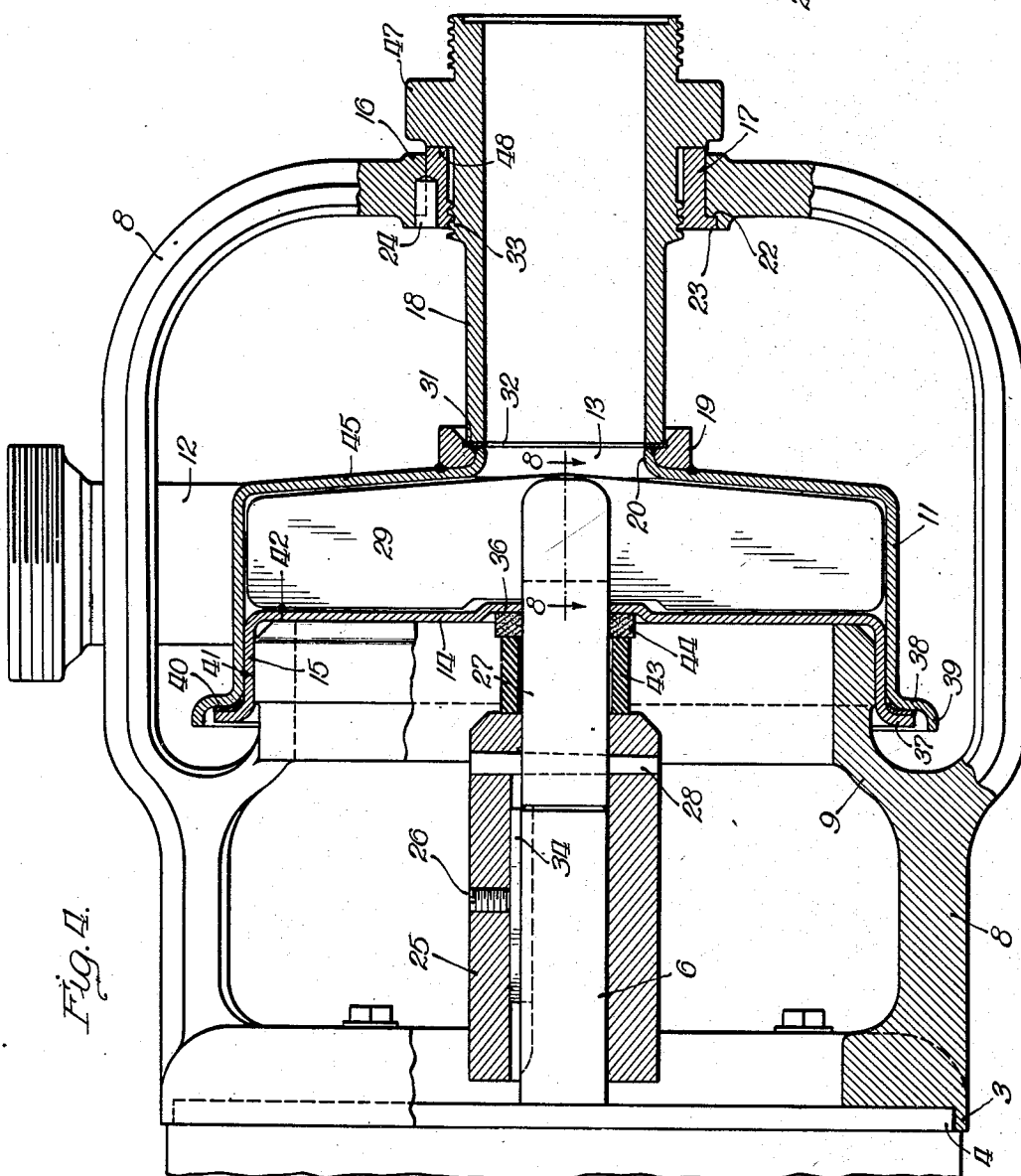


Fig. 4.



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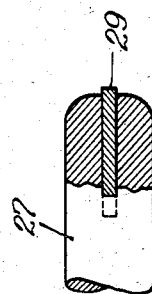
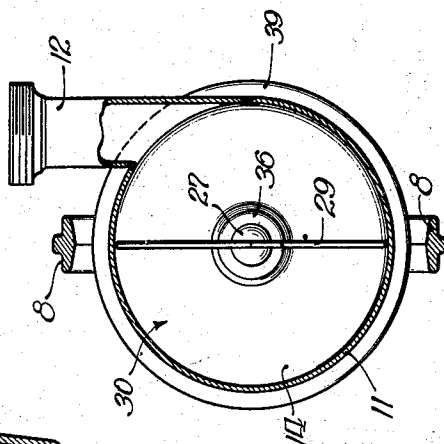
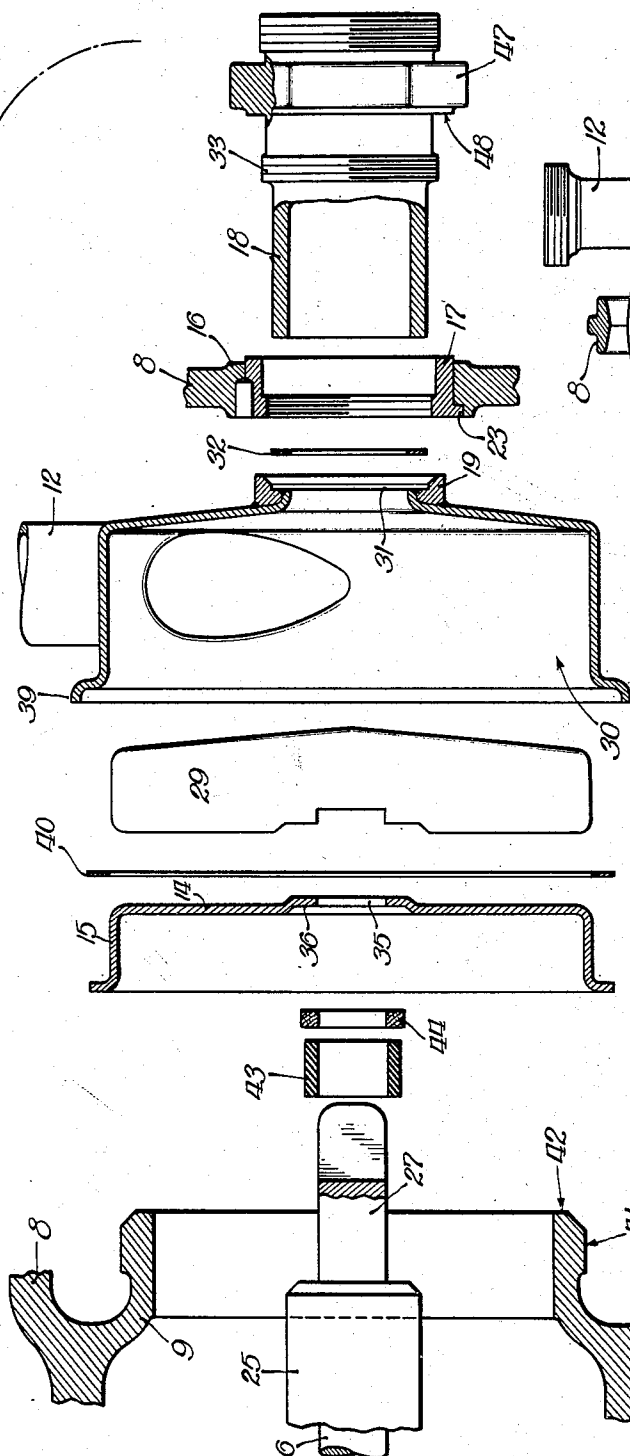
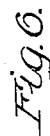
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UNITED STATES PATENT OFFICE

2,291,797

CENTRIFUGAL PUMP

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Application October 24, 1938, Serial No. 236,654

16 Claims. (Cl. 103—96)

This invention relates to pumps for conveying fluids and more particularly to sanitary, centrifugal pumps, such as milk pumps, of simple compact construction, the parts of which cooperate to aid in the rapid assembly and dismantling of the pump, which parts when dismantled may be easily cleaned; and to the support and driving means for the pump which facilitate its rapid assembly and satisfactory operation; and to the method of constructing pump casings.

In pumps of the sanitary type, such as are used in the handling of foodstuffs, particularly milk, it is essential that the pump be easily dismantled in a minimum of time for the reason that these operations must of necessity be repeated frequently in connection with the sterilization of the equipment. Such pumps must also be so constructed as to require no delicate adjustment to assure their satisfactory operation, and to use the least possible number of working parts. The accompanying drawings illustrate the invention in a pump of this kind. However, the invention is not to be limited to the specific embodiment disclosed.

The objects of this invention are to provide a sanitary pump in which the fluid contacting elements can be quickly dismantled and reassembled, in which the pump casing support and sectional casing elements are arranged in self-aligning position, in which the inlet passage member adjustably mounted in a fixed yoke can also be used to apply uniformly distributed sealing and retaining pressure to the pump casing, as well as support the weight of connecting conduits, thereby avoiding the possibility of eccentric loading the pump casing, and also to provide a pump casing, preferably of sheet metal stampings, a portion of which is slightly bowed, which bowed portion, when deflected due to the application of sealing pressure, assumes the predetermined, desired operative position, assures the application of the desired sealing pressure to all gasket elements, and secures the proper alignment and positioning of the casing sections on the pump support.

A further object of the invention is to provide a support, together with a compression member for a sheet metal pump casing, which prevents the deflection of the faces of the pump casing by the weight of the connecting conduits.

Another object of the invention is to provide a pump and pump support which may be easily dismantled, in which there are no bearings for rotary shafts in the pump casing, in which the impeller is operatively supported by an extension

of the shaft of the driving motor, in which the port in the rear face of the pump casing through which the impeller shaft passes is sealed by a removable sanitary rotary seal, and in which the support for the pump casing and connecting conduits may be easily attached to the base of the driving motor of standard design using the framework of the motor to support the pumping unit.

As one important feature of the present invention, the supporting brackets for the pump casing and connecting fluid conduits are mounted on the framework of the driving motor, thereby permitting the use of an extension of the motor shaft as the pump impeller shaft, as well as permitting use of the motor bearings to carry the load of the pump impeller, thereby avoiding the incorporation of unsanitary bearings in the pump casing.

As an additional important feature of this invention, the inlet coupling supported by a fixed bail or yoke is provided with a positive positioning flange, which, when drawn tightly into position against the yoke, will enable the coupling to carry the entire load of connecting conduits thus avoiding the usual application of eccentric loading to the faces of the pump casing, as well as to permit the application of uniformly distributed sealing and casing positioning pressure to the pump casing by means of an inlet coupling which also acts as the pressure applying means to seal the pump casing.

Other important features of the invention will be apparent upon examination of the details of construction and arrangement of the pump unit parts and their combination with the supporting brackets, including the flanges and gasket seats in the pump casing, which cooperate in a novel manner with the pump casing support to insure proper sealing of the pump casing and proper alignment and positioning of the sections of the pump casing with respect to each other, as well as a balanced rotor or impeller removably held in place on the impeller shaft by the pump casing, all of which will be first fully described and then be specifically pointed out in the appended claims, reference being made to the accompanying drawings in which:

Figure 1 is a side illustration of a centrifugal pump constructed in accordance with the invention, directly connected to an electrical motor and supported thereon by a special end bell or head;

Figure 2 is a view like Figure 1 showing a modified construction of the yoke supporting the in-

let coupling to the pump, and also showing a pump support mounted directly on the bell or head of a standard design electrical motor;

Figure 3 is a sectional view of the yoke supporting the inlet coupling to the pump taken along the line 3—3 of Figure 2;

Figure 4 is a central vertical longitudinal section of the pump embodying the invention;

Figure 5 is a view like Figure 4, showing only a segmental or partial section of the inlet coupling, pump impeller and the deflectable portion of the pump casing, in their relative position when the inlet coupling is not pressed against the pump casing and when the pump casing is not deflected;

Figure 6 illustrates the various main parts of the pump, support, rotary seal and inlet coupling in their relative positions of assembly;

Figure 7 is a sectional view taken on line 7—7 of Figure 1;

Figure 8 is a sectional view taken on line 8—8 of Figure 4.

Referring to the preferred illustrations embodying the invention, the improved pump unit is mounted on an electric motor 1 by means of a centrally ported disk-like bracket base 2, provided with a peripheral annular flange 3 telescopically fitted over the outer edge of an annular outwardly extended boss 4, concentrically positioned with respect to the motor shaft 6, and carried by special end plate 5 of the motor 1, which boss supports the bracket base 2 in spaced relation to the frame of the motor 1. Bracket base 2 is detachably held in position on the head of the motor by means of retaining screws 7 extending into the frame of the motor 1. The bail or yoke 8, carried by the base 2 extending away from the rotor 1 in substantial alignment with the axis of the motor, carries the bracket 3, which supports a ring-like pump base 10 concentrically arranged with a motor shaft 6. A cylindrical pump casing 11 has a threaded tangential discharge connection 12, a central inlet passage 13 in its front face 45 and is provided with a flanged end plate 14, with flanges 15 telescopically fitted or interfitted into the extended cylindrical walls of the casing 11, and in turn telescoped over and carried by the base 10 in a concentric alignment therewith as clearly shown by Figure 4. The cross arm of the bail or yoke 8 is provided with a ring-like center portion 16, arranged concentrically with a motor shaft 6 and provided with a threaded bushing 17 to engage a threaded inlet coupling 18, supporting it in concentric alignment with the inlet port 13 of casing 11 and in sealing engagement with the seat in the ring-like member 19 telescoped or interfitted over and welded to the outwardly turned flange 20 of the inlet port 13.

Figure 2 illustrates in modified form the yoke or bail 8 in which only one arm of the yoke is extended to support the ring 16 and in which modification the ported bracket base 2 is detachably mounted directly on the head of a standard electric motor and concentrically aligned with the shaft thereof, and held in spaced relation thereto by the spacing elements 21 and the retaining screws 7.

The ring 16 is accurately machined on its inner face making the same concentric with the axis of shaft 6, and is also provided with an inner shoulder 22 at right angles to the axis of shaft 6. The bushing 17 is provided with end faces at right angles to the axis of the bushing and is also provided with a flange 23 to engage the

shoulder 22 of the ring 16, into which ring the bushing 17 is closely and precisely fitted and prevented from rotation by a dowel pin 24.

The centrifugal pump casing 11, provided with an impeller chamber 30 containing a bladed impeller 29, has a tangential discharge connection 12 welded thereto, and a central inlet passage 13 in its front face surrounded and defined by an outwardly turned flange 20, to which is welded a ring-like member 19 having a gasket seat 31 to receive a paper or other suitable gasket 32, to sealingly engage the flat inner end of coupling 18 supported in the bushing 17.

The coupling 18 as shown is provided with screw threads 33 on its outer surface intermediate its ends to engage the threaded inner face of bushing 17. The coupling 18 is also provided intermediate the threads 33 and the end farthest removed from the pump casing with a flange 47 having any desired number of faces on its outer periphery constituting gripping means and a shoulder 48 on its inner face perpendicular to the axis of the coupling to engage the complementary face of the bushing 17, thereby securing accurate alignment of the axis of the coupling 18 with the axis of the motor shaft 6 and to limit the possible axial motion of the coupling 18 inwardly toward the pump casing.

The impeller 29 as shown consists of a flat blade or plate removably seated in a diametrical slot in the end of an impeller shaft 27 extending into the casing through a central aperture 35 defined by a gasket seat 36 depressed inwardly into the rear face 14 of the pump casing 11, so that when the casing is opened the impeller can be quickly removed by pulling it out of the slot in the end of the impeller shaft.

The impeller blade 29 is notched on the inner edge, as specifically shown in Figure 6, to receive a portion of the shaft 27 at the closed end of the slot in the shaft which extends into the impeller chamber, and also to receive the ridge formed by the impression of the gasket seat into the rear pump face 14 whereby radial displacement of the impeller blade 29 is prevented.

The end face 14 of the pump casing 11 is provided with a peripheral annular flange 15 perpendicular to the end face 14, which flange in turn is provided with a peripheral annular outwardly extended flange 37. When the end face 14 with its flange 15 is telescoped or interfitted into the cylindrical pump casing 11, the flange 37 abuts up against a peripheral outwardly extending annular flange 38 provided at the rear edge of the cylindrical wall of the pump casing 11. Flange 38 in turn carries a rearwardly extended flange 39 on its free edge. A gasket 40 is interposed between the flanges 37 and 38 to seal the sections of the pump casing when compressed.

The use of the variously arranged flanges on the embossed sheet metal pump casing sections greatly increases the rigidity, as well as provides gasket seats, and the telescoping or interfitting of one section into the other insures good support of the casing, proper alignment with the axis of the impeller shaft and the avoidance of lateral displacement of the operating elements of the pump. The flange 15 on the rear face of the pump casing is in turn telescoped over the ring-like pump base 10, which is provided with a cylindrical outer face 41 mounted in concentric arrangement with the drive shaft 6, and a front face 42 perpendicular to the axis of the shaft 6 to abut against and accurately position the pump face 14. This arrangement of telescopically

mounting or interfitting the sections of the pump casing on a positioning ring avoids axial and lateral displacement of the pump case relative to the fixed driving mechanism which is individually mounted on the motor shaft.

One end of the impeller shaft passes through a cylindrical port 35 in the rear face 14 of the pump casing, while the opposite end is securely held in a press fit sleeve 25 secured thereto by a taper pin 28. The sleeve 25 is in turn telescoped over the motor shaft 6 and detachably secured thereto by a key 34 held in place by a set screw 26. The positioning of the sleeve 25 on the shaft 6 will determine the relative position of the impeller blade 29 when assembled on the impeller shaft 27 and the pump casing 11.

The rotary seal of the shaft port 35 in the rear face 14 of the pump casing comprises a flexible elastic ring 43 which surrounds the pump shaft 27, intermediate the fixed sleeve 25 and the gasket seat 36, together with a separate sealing ring 44 also surrounding the shaft and held by the elastic sleeve 43 in sealing contact with the gasket seat 36. When the pump casing is pressed tightly against the ring base 10 by the fluid coupling 18, which also acts as a casing compression member, the elastic sleeve is compressed somewhat against the shaft sleeve 25 and in turn presses the sealing ring 44 against the seat 36 around the port 35 in the end wall 14. The elastic body and sealing ring are not fixed on the shaft 27, but with the particular arrangement just described, they tend to rotate with the shaft, the sealing body 44 running in sealing contact with the seat 36. In commercial practice it is desirable to avoid the use of oily seals or sealing rings in sanitary pumps, and, therefore, the use of sealing rings composed of self-lubricating materials, such as lignum-vitae, hard rubber, phenolic resins, and casein compounds is usually preferred.

Assembly and operation

In assembling the pump unit, the bracket 2 and its integral parts, the yoke 8 and pump base 10 are mounted on the head of the driving motor 1 in any of the preferred illustrated methods. The pump shaft 27 fixed in the sleeve 25 is next assembled on the motor shaft 6 and securely keyed thereto by the use of a key 34 and a set screw 36 to insure the proper positioning of the end of the impeller shaft 27 with relation to the pump casing. The elastic ring 43 and the sealing ring 44 are next assembled on the shaft 27, after which the rear pump face 14 is telescoped or interfitted over and seated against the pump base 10. The impeller blade 29 is then placed in the diametrical slot in the inner end of the shaft 27 with the notch in the edge of the impeller blade projected over the part of the part of the impeller shaft extending into chamber 30. A gasket 40 of paper or other suitable material is then slipped over the flange 15 against the flange 37 as a gasket seat, and the casing is then telescoped or interfitted over the flanged edge of the face 14 until the gasket 40 is securely held in position between the outwardly extending abutting flanges 37 and 38 on the two sections of the pump casing. The bushing 17 is now positioned in the ring 16 and locked in place by dowel pin 24. A gasket 32 of any suitable material, such as paper or rubber, is placed in the gasket seat 31 around the central inlet opening in the front face of the pump casing. The threaded coupling 18 is next inserted into the bushing 17 and after engaging 75

the threads therein is then tightened to apply pressure to the sealing gaskets 32 and 40 and to compress the elastic element 43 of the rotary seal, as well as complete the positioning of the pump casing 11 on the flanged edge of the base 14, pressing the assembled casing securely against the supporting ring 10 until the front face 45 of the casing is deflected to the desired operative position, as shown by the dotted line 46 of Figure 5.

When the pressure is applied by coupling 18 to the front face 45 of casing 11 shown in its undeflected condition in Figure 5, it will be deflected from its normal contour and relative position with respect to the impeller 29 to the position shown by the dotted line 46, which represents the desired operative position of the compressed pump casing.

In the normal use of the pump herein described, it is of course only necessary to remove the inlet fitting, the gaskets, the pump casing sections, the impeller and the rotary seal elements to enable the cleansing of the pump. It is of course evident that the yoke element and shaft extensions need not be removed after once being assembled.

The threaded free end of the coupling 18 and the discharge connection 12 are then connected to any desired conduits forming a part of the fluid circulating system, and the pump is now ready for use.

It will, of course, be readily understood that the herein described pump unit is particularly adapted for sanitary use in which it must be frequently cleaned; however, it is also well adapted for use in pumping other liquids. The improved unit is simple in construction. It involves the use of no parts which cannot be easily cleaned when disassembled, and is maintained in perfect alignment and operative condition by the unique assembly and mounting on its supports. With this particular arrangement of parts, all shaft bearings have been eliminated from the pump and the motor bearings utilized for that purpose, and perfect sealing alignment is maintained without the use of special means. All unsanitary seals common in pumps and the usual pump case compression mechanism have been eliminated. It has also been possible to eliminate the usual objection in pump construction in which the weight of the fluid connecting conduits is largely supported by the pump casing. This has been eliminated by securely mounting the coupling 18 in a part of the framework supporting the weight of the fluid conduits on the coupling 18.

It will, of course, be understood that various changes in materials, details and arrangements of the elements of the pump and its support, which have here been described and illustrated to explain the invention, may be made by those skilled in the art within the scope of the invention as set forth in the appended claims.

I claim as my invention:

1. A pump of the sanitary type, comprising a support including an apertured portion, a sectional casing disposed against said apertured portion of said support and having an annular flange extending outwardly from a face thereof and surrounding said apertured portion of said support in contact therewith, and releasable means forming a part of the fluid circulating system carried by an element of said support and engaging said casing for pressing the casing against said apertured portion of said support and the sections of the casing together.

2. A centrifugal pump of the sanitary type, comprising an apertured support, a cylindrical sectional impeller casing disposed against said support and having an annular flange extending outwardly from a face thereof and surrounding said support, releasable means forming a part of the circulating system carried by said support and engaging said casing for pressing the casing against said support and the sections of the casing together, an aperture in an end face of said casing aligned with the aperture in said support, an impeller in said casing and having an operating shaft extending outwardly through said apertures and out of contact therewith, a power shaft to which said operating shaft is rigidly fixed for supporting said operating shaft and acting as a radial and end thrust bearing for said operating shaft, a shoulder on said operating shaft outside of said casing, and elastic means disposed about said operating shaft enclosing the same intermediate said shoulder and said casing and having its ends engaging said shoulder and said casing for sealing the casing aperture.

3. In a pump unit, a support, a pump housing having an aperture in an end wall thereof and mounted on said support, and a releasable tubular coupling and clamping element carried on said support in alignment with said aperture and abutting against said housing for clamping said housing against said support and for communicating with the interior of said housing through said aperture.

4. In a pump unit, the combination of a motor having a shaft mounted in bearings, a bracket disengageably supporting a sectional cylindrical pump casing centrally apertured in at least one face thereof, said central aperture being in alignment with the axis of said shaft, an impeller in said casing an impeller shaft rigidly fixed to said motor shaft and extending through said aperture into said casing to engage and support said impeller and impart a driving torque from said motor shaft to said impeller, and a rotary sealing means carried by said impeller shaft to seal the aperture in said casing and being removable from said impeller shaft when said casing is disengaged from said support, said motor shaft supporting said impeller shaft in spaced axial and lateral relation to said pump casing and acting as a radial and end thrust bearing support for said impeller and impeller shaft.

5. In a rotary pump, the combination of a support, a ported pump casing mounted on said support, and a fluid coupling in communication with the port in said casing, said coupling being independently carried by said support.

6. A sheet metal casing for pumps comprising, in combination, a pair of ported metallic plates corrugated with laterally extending interfitting flanges at their outer peripheries, a substantially ring-like casing base interfitting into said flanges and carried by a support and abutting against one of said plates and the flange of said plate, releasable means acting between said support and the other of said plates for pressing the said plates with their interfitting flanges against the ring-like base, and inlet and discharge passages in the casing walls.

7. In a rotary pump unit comprising, in combination, a driving motor having a central shaft, a pump casing base mounted on said motor, a cylindrical pump casing mounted on said base and having a central shaft aperture in one face thereof in axial alignment with the motor shaft, an impeller shaft carried by said motor shaft ex-

tending into said casing through said aperture out of contact with the apertured face, an inlet aperture in said casing, and a fluid coupling and compression member releasably carried by said support for communication with said inlet passage and for compression of said casing against said base.

8. The combination with a cylindrical, sectional casing forming an impeller chamber having an inlet opening in one side and a shaft-receiving aperture on the other side, of a sealing gasket intermediate said sections, a support on which said casing is mounted, and a cylindrical fluid coupling and compression element releasably carried by said support in axial alignment with said casing and in communication with said inlet opening for compressing said casing against said support, whereby the application of uniformly distributed pressure is applied by said coupling to said casing.

9. The combination with a casing forming an impeller chamber having an intake opening on one side and a shaft opening on the other side, of an inwardly extending annular gasket depression on the outer surface of one face of the casing defining the said shaft opening and forming a complementary ridge on the inner side of said face, an impeller shaft extending into said casing through said shaft opening and having a diametrical slot in its end wholly within said casing, and a bladed impeller in said casing mounted in said slot having a stepped notch in its inner edge to receive the portion of the shaft at the inner end of the shaft slot and the said complementary ridge, whereby radial displacement of the bladed impeller is prevented.

10. A pump unit, comprising the combination of a support, a sectional sheet metal casing mounted on said support and having at least one substantially deflectable face, a gasket intermediate the sections of said casing, and releasable means acting between said support and casing for deflecting said deflectable face, whereby pressure is applied to said casing sections to press the sections together and against said support and to deform said deflectable face into the desired shape for pumping operation.

11. A pumping unit comprising, in combination, a driving motor, a bracket secured to the side of said motor comprising arms extending from said motor and an annular pump casing supporting ring at the opposite end of said arms, a sheet metal pump casing comprising an inter-fitted pair of apertured sheet metal cup-like elements carrying outwardly extending flanges on their free edges arranged in nested relation one to another to provide a chamber intermediate the adjacent end faces of said cup-like elements and arranged in interfitted relation with said supporting ring, a bracket arm extending from said supporting ring past the outer periphery of said nested cup-like elements and provided with an aperture at its free end, a fluid coupling element carried in the aperture of said bracket arm and axially aligned with the aperture in the cup-like element adjacent said fluid coupling element, and adjustable means securing said coupling element within said bracket arm, whereby said coupling element may be adjusted to engage said nested cup-like elements to compress the same against said supporting ring.

12. A pumping unit comprising, in combination, a motor, a bracket secured to said motor having axially aligned supporting rings, a pump casing comprised of an interfitted pair of aper-

tured sheet metal cup-like elements supported on one of said rings, and a fluid coupling adjustably supported on the other of said rings, whereby upon the adjustment of said coupling in the direction of said other ring said fluid coupling will be caused to engage the adjacent one of said interfitted pair of cup-like elements to compress the same against their supporting ring.

13. A pump device comprising, in combination, a support, a ported pump casing mounted on said support, and a conduit independently mounted on said support and communicating with the interior of said pump casing through said port.

14. A pump casing having a resilient portion in a wall thereof, a support for said casing, an aperture in the resilient portion of the wall of said casing, and a conduit in sealed communication with the interior of said casing through said aperture, said sealed communication being obtained and maintained by pressing the end of said conduit against said casing, thereby subject-

ing said resilient portion of said casing to a deflecting force sufficient to maintain it in sealing contact with the end of said conduit.

15. A sealed sectional pump casing having at least one resilient section and having gasket means interposed between the sections of said casing, said sealed casing being obtained by subjecting a portion of said resilient section of said casing to a force sufficient to deflect said portion and maintain said portion deflected, thereby urging the sections of said casing one toward another to compress said gasket means and form a sealed pump casing of the desired dimensions.

16. A pump device comprising, in combination, a support, a ported pump casing mounted on said support, and a conduit independently mounted on said support and communicating with the interior of said pump casing through said port and urging said pump casing against said support.

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