

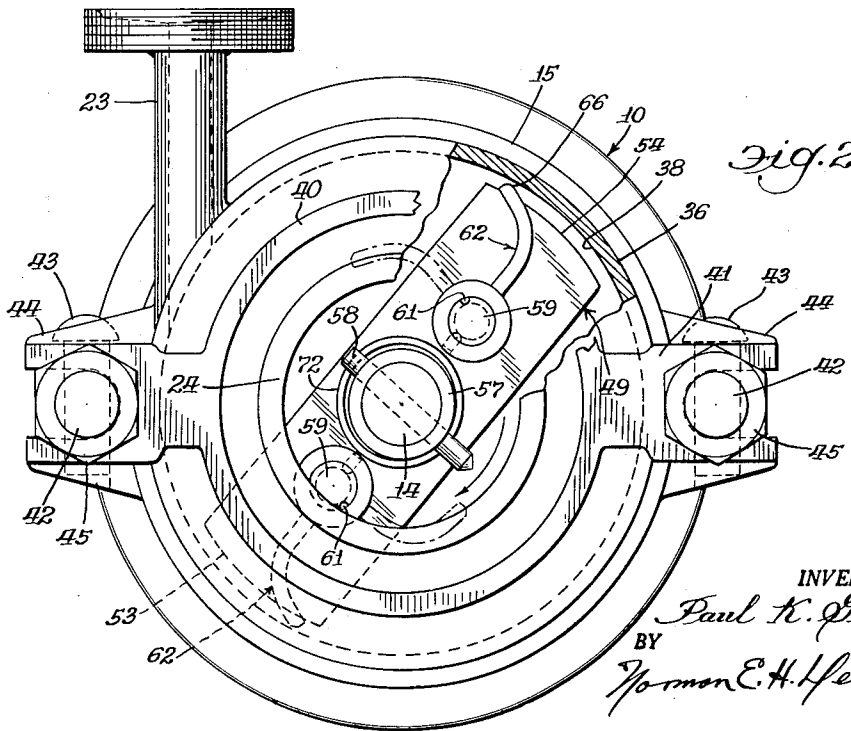
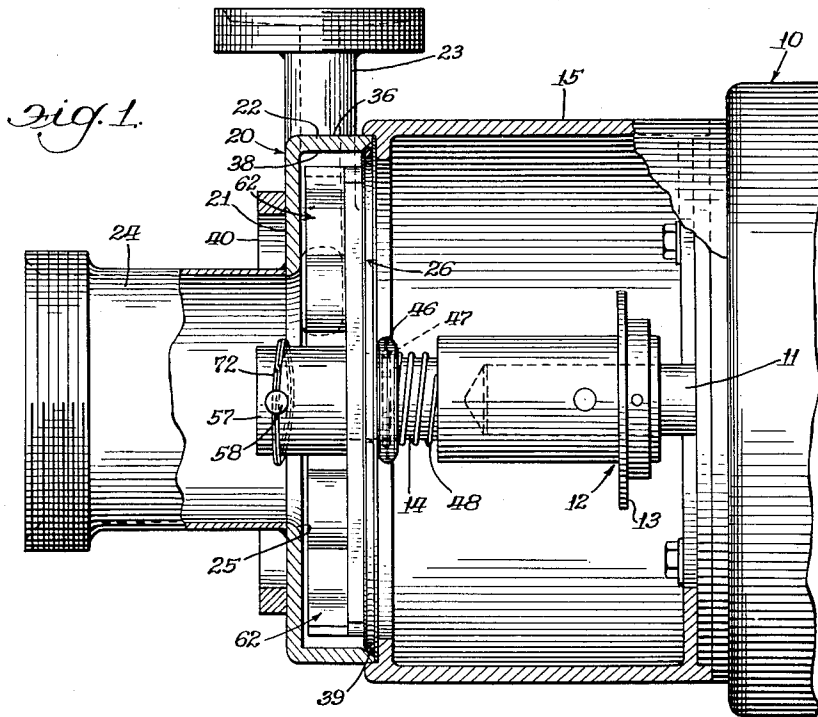
May 8, 1962

P. K. GIRTON
PUMP HOUSING

3,033,121

Original Filed Oct. 26, 1960

2 Sheets-Sheet 1



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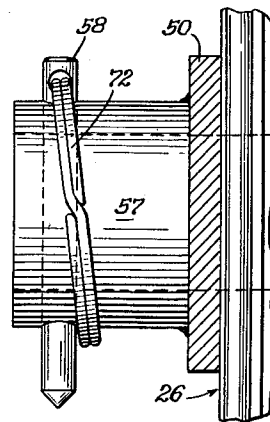
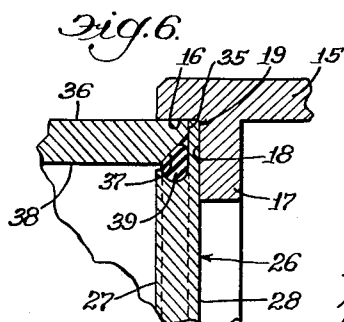
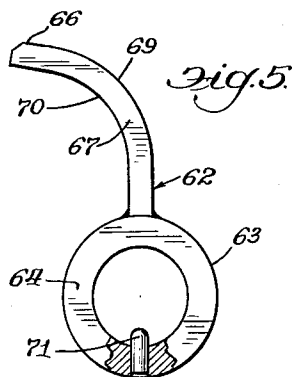
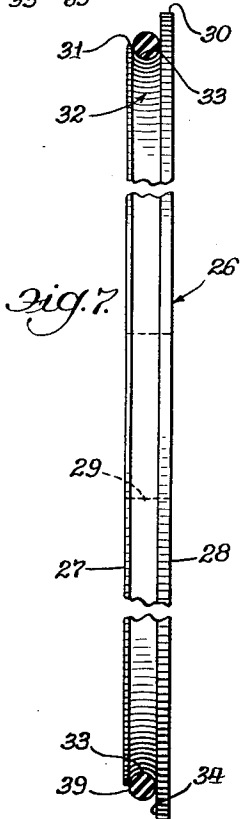
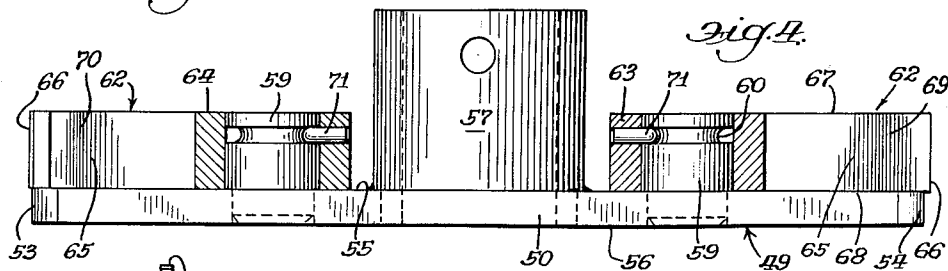
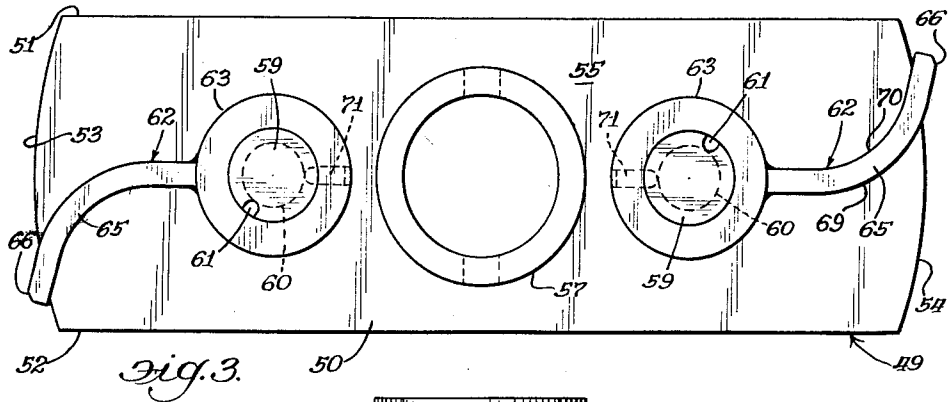
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P. K. GIRTON
PUMP HOUSING

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2 Sheets-Sheet 2



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3,033,121

PUMP HOUSING

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Original application Oct. 26, 1960, Ser. No. 65,195. Divided and this application Mar. 7, 1961, Ser. No. 94,649

7 Claims. (Cl. 103-103)

This invention pertains to improvements in housings for pumps. More specifically stated, this invention relates to improvements in compact housings for centrifugal pumps of the so-called sanitary type wherein the housing is comprised of a plurality of readily separable sections.

More particularly stated, this invention pertains to sanitary and operative improvements in the housing and support arrangement for pumps, whereby to incorporate in the pump such constructional features and arrangement of parts as to render the improved pump housing easy to maintain in sanitary condition and to enable the easy and rapid assembly, disassembly, inspection and cleaning of the pump housing.

This invention also pertains to improvements in the arrangement for demountably supporting the several sections of the improved pump housing, whereby to enable the easy and quick dismantling of the pump housing from its support and whereby to utilize the support for accurately and independently positioning and centering the several sections of the pump housing with respect to one another and with respect to the drive mechanism of the pump.

This application is a division of my pending application Serial No. 65,195, filed October 26, 1960, and entitled "Centrifugal Pump."

Centrifugal pumps of the type contemplated by this invention are frequently used in the handling of readily perishable food products, necessitating the frequent disassembly, cleaning and reassembly of the pump. In food processing establishments and in similar establishments, pumps of the type contemplated by this invention are frequently shifted from one flow system to another flow system, requiring easy adjustment of the position of the discharge connection of such pump. In some instances the weight of the adjacent ends of connecting piping is supported directly upon the one or another section of a conventional pump housing, tending to distort or displace such section with the resulting adverse effect upon the operation of the pump.

It is therefore an object of this invention to provide an improved and relatively simple sectional pump housing wherein all of the surfaces of the disassembled housing parts may be easily inspected and cleaned without the necessity of using any special tools or cleaning devices.

A further object of this invention is to provide an improved sectional pump housing and an improved support arrangement for supporting such pump housing; so that at least one of the sections of the pump housing is independently and adjustably supported and automatically centered and aligned with the impeller mechanism; so that the sections of the improved housing are sealed one to another by an improved seal arrangement, whereby to automatically preclude the failure of such seal irrespective of the operation of the improved pump under superatmospheric pressure or under subatmospheric pressure; and so that the rotary seal, through which the drive shaft enters the pump housing through an aperture in an end face of the improved housing, is protected during the operation of the pump.

A still further object of the present invention is to

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provide an improved pump housing particularly well adapted for use in centrifugal pumps; wherein the housing, when operatively assembled upon its support, is relatively rigid and adapted to support the weight of connecting piping; wherein the housing section which includes the discharge connection may be adjusted to any desired angular position in the plane of the assembled housing, and wherein the housing is comprised of a minimum of parts which are relatively easy and relatively inexpensive to produce, and wherein any loading applied to any section of the improved housing is directly transferred to the housing support without the transfer of any of such loading to any other section of the improved pump housing.

An improved pump embodying the various new, novel and useful features of this invention, whereby to attain the foregoing objectives, possesses the advantages of: compactness, simplicity of construction, ease and rapidity of assembly and disassembly, ease of cleaning and inspection, independent support and automatic alignment and centering of the sections of the improved pump housing, ready adjustability of the pump discharge connection, rupture proof housing seal, ability to readily support the weight of connecting piping without distorting any portion of the pump housing, and a minimum number of relatively inexpensive parts.

The foregoing and other objectives, important new, novel and useful features and advantages of this invention will become more apparent and be more easily understood upon examination of the following description thereof and the accompanying drawings and appended claims. It should, however, be remembered that, without desire of limitation, the invention will be described and illustrated as the preferred embodiment of the invention in an improved housing for a centrifugal pump. Certain changes and variations in the invention may, upon review of this application, suggest themselves to those skilled in the pertinent arts, which changes may, however, not depart from the spirit of this invention and may come within the scope of the appended claims.

In the accompanying drawings:

FIGURE 1 is a side elevational view, partially in broken away vertical section, of the improved centrifugal pump embodying the present invention;

FIGURE 2 is a left hand or front elevational view of the improved pump as shown in FIGURE 1, partially in broken away section, showing the automatically adjustable impeller vanes in expanded operative position and also schematically illustrating a depressed position of the automatically adjustable impeller vanes;

FIGURE 3 is a plan view of the impeller subassembly;

FIGURE 4 is a side elevational view, partially in broken away vertical section, of the impeller subassembly shown in FIGURE 3;

FIGURE 5 is a plan view of one of the automatically adjustable impeller vanes;

FIGURE 6 is an enlarged vertical fragmentary view, partially in section, showing the interrelation of the edge portions of the front pump head and the rear pump head and the casing seal and the casing support frame at the locus of coaction of those elements;

FIGURE 7 is a side view of the rear head of the housing of the improved pump showing the resilient seal for the housing sections in transverse section; and

FIGURE 8 is an elevational view illustrating the arrangement for drivingly connecting and locking the hub of the improved impeller mechanism to the drive shaft.

Referring to the drawings, in which like elements are identified by like numerals, 10 represents a driving unit, such as an electrical motor, enclosed in a housing and having a central rotary power shaft 11 extending from one end thereof and mounted in suitable bearings (not

shown) adapted to support the shaft 11 against radial and axial thrust. Shaft coupling 12 is coaxially and drivingly mounted on shaft 11 in telescopic arrangement and is provided with an oil guard ring 13 on its end adjacent drive 10. Coupling 12 drivingly carries a pump drive shaft 14, coaxially arranged with the motor shaft 11 for rotation by shaft 11. A cylindrical support frame or element 15, for supporting a pump housing is coaxially mounted in fixed position on the end of the driving unit 10 and surrounds the shaft 11 and the coupling 12 and the inner end of the pump shaft 14. The end of the frame or support 15 farthest removed from the motor 10 is in a plane perpendicular to the axis of pump shaft 14 and that end of the substantially cylindrical frame 15 is provided with a cylindrical inner face 16 coaxially arranged with respect to pump shaft 14. An annular flange 17 extends inwardly from face 16 and is provided with a flat face 18 perpendicular to the cylindrical face 16 and the axis of shaft 14. Face 18 together with face 16 forms an outwardly or forwardly opening right angle groove 19 having concentric annular faces 16 and 18.

A sectional pump casing or housing is supported on the free end of frame 15 and is formed of front housing section 20 which is substantially cup-shaped and generally cylindrical and is formed of a substantially flat and centrally apertured front head portion 21 and a substantially cylindrical side wall portion 22 which is perpendicular to front head portion 21. Side wall 22 is provided with a substantially tangential discharge connection 23. Side wall 22 is coaxial with frame 15 and shaft 14 and has an outer diameter slightly less than the inner diameter of face 16 of groove 19 whereby to permit the relatively snug telescoping of the free end of side wall 22 into the groove 19 in the forward end of frame 15 with the outer surface of wall 22 in centered or coaxial engagement with face 16. Front head 20 is perpendicular to the axis of pump shaft 14 and is provided with a cylindrical inlet connection 24 coaxial with shaft 14 and communicating with and defining the inner edge of the central and circular aperture 25 in front head 20. As thus supported, front housing section 20 may be rotated within frame 15 about the axis of shaft 14 so as to dispose the outlet connection 23 at any desired angle.

Rear housing section or rear pump head 26 comprises a substantially flat and circular disc having parallel front and rear flat side surfaces 27 and 28 respectively and having a central circular aperture 29 telescoped over and coaxial with pump shaft 14. The rear pump head 26 is supported perpendicular to pump shaft 14 and is parallel to front pump head 21 and is parallel to face 18 of groove 19. The cylindrical outer edge surface 30 of rear head 26 defines the outer edge of rear face 28 of head 26 and is coaxial with and of a diameter slightly less than the cylindrical face 16 of groove 19 into which the rear head 26 is telescopically seated inwardly of the side wall 22 of housing section 20 with the edge surface 30 in coaxial and centering engagement with face 16 and with the outer portions of the circular rear face 28 of head 26 parallel to and in seating or abutting engagement with the complementary surface 18 of groove 19.

The circular inner or front surface 27 of rear casing head 26 is defined at its outer periphery by a cylindrical edge surface 31. The parallel and axially spaced cylindrical edge surfaces 30 and 31 are coaxial with shaft 14 and are positioned intermediate the parallel planes of the flat surfaces 27 and 28 of the rear head 26. Edge surface 30 is of greater diameter than edge surface 31 and the adjacent edges of surfaces 30 and 31 are joined by a circular and uniformly curved groove or seal seat 32, the inner portion of which groove 32 is defined by a re-entrant circular surface 33 which is coaxial with groove face 16 and which at its upper edge joins the surface 31 and extends generally rearwardly from surface 31 to an annular and flat surface 34 which is parallel to the rear face 28 and extends inwardly from the coaxial cylindrical

surface 30 to join in the lower edge of the re-entrant surface 33.

The annular surface 34 of rear head 26 is parallel to and abuts against a complementary and parallel annular flat edge surface 35 which defines the radially outer portion of the inner end of side wall 22 of the front pump head 20. The inner end of the outer cylindrical surface 36 of side wall 22 terminates in the outer edge of surface 35. The inner edge of the annular surface 35 is joined, by an inwardly diverging or beveled and annular surface 37 concentric with surface 16, with the inner terminal end of the inner cylindrical surface 38 of side wall 22.

The front housing section 20 and the complementary and interfitted rear housing section 26 being thus concentrically and independently supported radially in groove 19 and being thus coactively supported against axial displacement by flange 17, the outer peripheral portions of the housing sections 20 and 26 are sealed one to another by an annular and resilient seal ring 39, of circular cross section, snugly fitted in sealing engagement with and seated in the groove or seal seat 32 of the rear head 26. The circular radial cross section of seal ring 39 is sufficiently great that the outer surface of the seal ring 39 sealingly engages the beveled surface 37 of the end of the inner side of the side wall 22. Due to the re-entrant curvature of groove wall 33, any pressure within the pump chamber will tend to force the seal gasket 39 into a more compressed and more tightly engaging or sealing position. The thus supported and sealed pump housing sections 20 and 26 are locked in such operative position on frame 15 by a circular compression yoke 40 which surrounds the inlet connection 24 and compressively engages the outer front surface of the front housing section 20.

Yoke 40 is provided with two oppositely positioned and bifurcated peripheral lugs 41, receiving tension bolts 42 hingedly supported by hinge pins 43 on similarly positioned lugs 44 formed on the outer surface of the frame 15. Compression nuts 45 threaded onto the free ends of bolts 42, when tightened into compressive engagement with lugs 41, produce a compressive biasing of yoke 40 toward frame 15, thereby locking the sections 20 and 26 of the housing in sealed and rigidly supported arrangement in groove 19 of frame 15, and coaxially arranged with pump shaft 14.

The aperture 29 in rear housing section 26 is sealed by a rotary seal comprised of an antifriction annular seal element 46 telescoped over pump shaft 14 and slidingly and sealingly engaging the rear surface 28 of housing section 26. Seal element 46 is sealed to drive shaft 14 by gasket element 47 sealingly fitted into seal ring 46 and sealingly engaging the outer periphery of shaft 14. Seal ring 46 is maintained in sealing engagement by the compressed coil spring 48 telescoped over shaft 14 intermediate coupling collar 12 and seal ring 46, which two elements are compressively engaged by the opposite ends of the compressed spring 48.

The compound pump impeller subassembly 49, housed within the pump chamber formed of housing sections 20 and 26, includes an elongated, flat and substantially rectangular and centrally apertured and rigid and rotatable impeller element or blade 50, having straight and parallel side edge surfaces 51 and 52 and having curved ends 53 and 54. The curved ends 53 and 54 are both of the same radius and are parallel to and are spaced slightly inwardly from the inner cylindrical surface 38 of the housing side wall 22. Impeller element 50 also has parallel front and rear flat faces 55 and 56 respectively. Faces 55 and 56 of impeller element 50 are perpendicular to the side edge surfaces 51 and 52 and are also parallel to the front and rear pump housing heads 21 and 26. Impeller element or blade 50 is positioned within the pump housing so that the rear face 56 of impeller element 50 is positioned very close to the parallel front sur-

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face or face 27 of rear pump head 26, and so that the front face 55 of the impeller element 50 is positioned a substantial distance from the front pump head 21.

A central cylindrical hub 57 is permanently fixed at one end thereof in the central aperture in impeller element or blade 50, thereby dividing blade 50 into two oppositely directed rigid impeller arms. Hub 57 is coaxially telescoped over the free end of pump drive shaft 14 and extends from blade 50 coaxially into the pump inlet connection 24. A key or driving pin 58 extends through aligned apertures in hub 57 and shaft 14 to releasably lock impeller element 50 onto shaft 14 against axial motion and to drivingly connect impeller element 50 for rotation with shaft 14.

Cylindrical and parallel pivot pins 59 extend perpendicularly from face 55 of impeller element or blade 50 toward the front pump head 21 and have their respective central axis positioned on the longitudinal center line of blade 50 with the respective central axis of the pivots 59 spaced radially from the axis of shaft 14 by a distance slightly less than the inner radius of the housing inlet 24. Each pivot 59 is provided with an annular, peripheral groove 60 which is parallel to the adjacent flat forward face 55 of the rigid impeller blade 50, and is also provided with a straight, peripheral, longitudinally extending groove 61 which is parallel to the central axis of the respective pivot 59 and extends from the forward end of that respective pivot 59 rearwardly into the associated annular groove 60. Groove 61 is located in the semicircular surface segment of pivot pin 59 farthest removed from hub 57 and is of the same radial depth as groove 60.

Each of the pivots 59 is provided with or pivotally carries an automatic feathering or automatic adjusting, rigid, impeller vane element 62 which is hingedly or pivotally mounted upon the pivot 59. In the operation of the improved pump, when operating at maximum pumping efficiency, vanes 59 have their free ends extended radially outwardly from the axis of shaft 14 and from the path of orbiting of the pivots 59. Such outward extension of the hinged impeller vanes 62 upon the rotation of impeller element 50 results from the centrifugal force developed within the respective vanes 62 whose respective center of gravity is always positioned or located laterally or to the side of a straight line extending from the axis of shaft 14 to the axis of the associated pivot 59 upon which the vane in question is pivotally mounted.

In operation, the direction of rotation of the fixed impeller blade or pivoted impeller carrying element 50, and the direction of orbiting of the hinged impeller vanes 62, is clockwise as viewed in FIGURES 2 and 3. Each impeller vane 62 consists of a substantially cylindrical and hollow pivot hub section 63 of substantially the same length as the associated pivot 59 and is telescoped in axial alignment over that pivot 59 with the flat forward end 64 of hub section 63 aligned with the flat forward end of the associated pivot 59. As viewed in FIGURES 2 and 3, pivot hub 63 is provided with a rigid vane element 65 which is rigidly fixed to hub section 63 and which, under maximum effective pumping conditions, extends radially outwardly from shaft 14 and pivot 59. Each vane portion 65 is of a width substantially equal to the width of the pivot hub 63, which width is slightly less than the distance between the impeller element 50 and the adjacent surface of the front pump head 21. Each vane portion 65 is perpendicular to the face 55 of impeller element 50 and is of a length so that the outer end thereof, when the vane 62 is pivoted to its position of maximum radial extension on pivot 59, will extend substantially as close to the cylindrical surface 38 of casing wall 22 as do the ends 53 and 54 of impeller element 50. The outer end 66 of impeller vane portion 65 is straight and is parallel to the axis of shaft 14 and the forward and rear edges 67 and 68 respectively of vane

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portion 65 are flat and parallel one to another and parallel to the front housing section 21 and the rear housing section 26 and the impeller element 50, and edges 67 and 68 are spaced one from another a distance slightly less than the distance between the front pump head 21 and the impeller element 50.

As viewed in FIGURES 2 and 3, the hinged impeller vane elements or portions 65 are curved and extend outwardly from their respective pivots 59 and also extend rearwardly with respect to the path and direction of orbiting thereof. Each vane portion 65 is provided with a radially convex leading surface 69 parallel to a radially concave trailing surface 70 as viewed in a plane parallel to the plane of orbiting of elements 65. The convex surface 69 and the concave surface 70 are both perpendicular to the flat front face 55 of impeller and impeller carrier element 50.

To pivotally lock the hinged impeller element 62 on its pivot 59, there is provided an inwardly extending key 71 anchored in pivot hub 63. Key 71 has its inner end extending into groove 60, thus permitting the free pivoting of the hinged impeller section 62 upon pivot 59 until either of the sides 69 or 70 of vane 65 engage hub 57 to limit the pivotal motion of impeller section 62. To remove vane 62 from pivot 59, after impeller subassembly 49 has been removed it is only necessary to rotate vane 62 clockwise on pivot 59, as viewed in FIGURE 3, until key 71 is aligned with groove 61, whereupon hub 63 may be lifted from pivot 59. Such alignment of the inner end of key 71 and groove 61 is attainable, due to the particular positioning of groove 61 on pivot 59, only when the impeller vane 62 is pivoted from a position of maximum radial extension forwardly with respect to its direction of orbiting during operation until the convex surface of the vane portion 65 is relatively close to the hub 57. Due to the combined effects of the before mentioned curvature of vane portion 65 and the centrifugal force developed by impeller 62 during operation, such forward pivoting of vane portion 65 from a position of maximum extension to a position of alignment of key 71 and groove 61, could not take place. The normal hinging action of impeller 62, during operation of the pump, is in the opposite direction and such pivoting in such opposite direction cannot be sufficient to bring key 71 into alignment with groove 61.

It will be apparent that when the pump is assembled, vane 62 may not be accidentally dislodged from pivot 59 in the event of the possible alignment of key 71 and groove 61 while the pump is at rest, for the reason that the radially outer portion of hub 63 extends radially outwardly a distance greater than the inner periphery of the aperture 25 of the front housing head 21 and for the reason that the spacing of the front end of pivot 59 from front housing head 21 is substantially less than would be required to permit the removal of hub 63 from pivot 59.

To insure the readily releasable retention of drive pin 58 in driving engagement with the hub 57 and shaft 14, through which parts pin 58 extends through aligned apertures, a spring or resilient ring 72, consisting of multiple, closely spaced, turns or coils portions, is telescoped over hub 57 and laced through a transverse aperture in one end of drive pin 58. The inner diameter of spring ring 72 is only slightly greater than the outer diameter of hub 57 and is less than the distance from the aperture in drive pin 58 to the opposite end of drive pin 58. As assembled in operative position, the spring ring 72 passes intermediate the free end of pin 58, which extends out of one side of hub 57, and the impeller element 50. As thus assembled, the inner diameter of spring ring 72 and the length of drive pin 58 are such as to preclude the movement of ring 72 outwardly of the free end of drive pin 58 in any position of adjustment of pin 58.

The improved pump may be readily disassembled by loosening nuts 45, swinging compression bolts 42 out-

wardly to clear lugs 41, removing yoke 40, removing front housing section 20 from frame 15, unlacing resilient spring ring 72 from driving pin 58, removing pin 58 from hub 57 and shaft 14, removing impeller sub-assembly 49 from shaft 14, and then removing the rear pump head 26 from frame 15. Seal 46 and spring 48 may then be removed from shaft 14. The impeller sub-assembly 49 may be disassembled as hereinbefore described. Assembly of the improved pump may be accomplished by the performance, in opposite order, of the described disassembly steps.

The relative dimensions, construction and arrangement of the hinged impeller vanes 62 and the dimensions and positioning of the hub 57 and pivots 59 are such as to insure that the center of gravity of the hinged impeller vanes 62 is always so positioned that upon the rotation of impeller subassembly 49 the vanes 62 will be radially extended solely by centrifugal force with respect to the position of shaft 14 and pivots 59.

In operation the leading convex impelling surface 69 of each of the rigid hinged impellers 62, and the leading or fixed impelling surface portions of the edge surfaces 51 and 52 of the rigid impeller element 50, urge the pumped fluid received from inlet 24 outwardly against the housing wall segment 22 for discharge through outlet 23. At maximum pumping efficiency the hinged impeller elements are extended substantially as shown in full lines in FIGURE 2. Any increase in discharge pressure, as may result from sudden closing of a valve in the discharge line, or increase in the viscosity of the pumped fluid, will cause a responsive proportionate collapse or rearward depression of the hinged impeller elements 62 toward a partially collapsed or depressed position such as is schematically illustrated by the dot and dash representation of hinged vane segments 65 of FIGURE 2. In the illustrated embodiment of the improved compound impeller, the fixed impelling surface portions of the surfaces 51 and 52 of the rigid impeller element 50 are equal to at least twenty-five percent of the total impelling surface of the improved pump, which total also includes the impelling surfaces of the hinged vanes 62, thereby providing an improved pump of great flexibility in operating conditions together with maximum protection against overloading the driving motor.

From the foregoing description of this invention and from the accompanying drawings, it will be apparent that this invention realizes the introductorily enumerated objectives respecting the improved pump housing. It will similarly be apparent that the invention possesses the hereinbefore listed advantages and provides new, novel and useful improvements in a pump housing.

Having thus described and illustrated the preferred embodiment of this invention, the invention is not to be interpreted as being restricted to the specifically illustrated and described embodiment, as set forth in the drawings and as hereinbefore described, except insofar as is necessitated by the appended claims and the disclosures of the prior art.

The invention is hereby claimed as follows:

1. A centrifugal pump, comprising, in combination, a cylindrical support surface for a pump housing, a pump housing of substantially cylindrical configuration and having a centrally apertured rear head portion and having a centrally apertured front head portion spaced from and parallel to and axially aligned with said centrally apertured rear head portion and also having a side wall portion, said front head portion being substantially flat and substantially circular and said rear head portion being circular and having parallel flat front and rear faces, said side wall portion comprising a cylinder the outer surface of which has a unitary radius equal to the maximum radius of the rear face of said rear head portion, said side wall portion being coaxial with said front head portion and with said rear head portion and forms there-

with a substantially cylindrical pumping chamber wherein said side wall portion and said rear head portion abut one against the other, the outermost periphery of said rear head portion and the outer surface of said side wall portion being aligned axially and being radially supported by a cylindrical support surface, annular seal means sealingly engaging adjacent surfaces of said side wall and said rear head portion and being radially compressed inwardly and outwardly by said last mentioned adjacent surfaces, drive shaft means axially aligned with the aligned apertures in said front head portion and said rear head portion and extending into said pumping chamber through the aperture in said rear head portion, circular inlet means communicating with and axially aligned with the aperture in said front head portion, seal means for sealing the space intermediate said drive shaft means and the adjacent edge of the aperture in said rear head portion, and rotatable and rigid impeller means releasably carried by said drive shaft means within said pumping chamber.

2. A pump according to claim 1, wherein said impeller means is provided with a flat rear surface adjacent to said rear head portion and parallel to the adjacent front flat surface of said rear head portion and completely overlapping the central aperture in said rear head portion.

3. A pump housing, comprising, in combination, a front head portion, a circular rear head portion having a flat front face and having a rear flat face parallel to said front face, a cylindrical side wall portion intermediate said front head portion and said rear head portion and having an inner surface and having an outer surface, said rear head portion having the outer periphery of its rear face defined by a first cylindrical surface spaced axially from and parallel to and concentric with and of a greater diameter than a second cylindrical surface defining the outer periphery of the front face of said rear head portion, a re-entrant annular groove encircling said rear head portion intermediate said first cylindrical surface and said second cylindrical surface and extending axially of said rear head portion from said second cylindrical surface toward said rear face of said rear head portion, a first flat annular surface concentric with said first cylindrical surface and parallel to said rear face of said rear head portion and extending radially inwardly from said first cylindrical surface to said re-entrant annular groove, a resilient and compressible annular seal element snugly seated in said groove and having its outermost peripheral surface when said seal means is not compressed extending radially outwardly of said rear head portion beyond said second cylindrical surface, said cylindrical side wall portion of said pump housing having a flat annular end surface extending radially inwardly from the outer surface of said side wall and being parallel to and abutting against said first flat annular surface on said rear head portion, said first flat annular surface having an outer diameter equal to the outer diameter of said second flat annular end surface, and a conical surface extending from said flat annular end surface to said inner surface of said side wall portion and compressively engaging said seal element.

4. In a pump casing, a flat front head portion parallel to a flat rear head portion, said flat rear head portion having a flat rear face the outer periphery of which is defined by a first cylindrical surface spaced axially from and parallel to and concentric with and of a greater diameter than a second cylindrical surface defining the outer periphery of a flat inner face of said flat rear head portion, a re-entrant annular groove encircling said rear head portion intermediate said first cylindrical surface and said second cylindrical surface and extending axially from said second cylindrical surface toward said flat rear face of said rear head portion, and a flat annular surface concentric with said first cylindrical surface and parallel to said flat rear face of said rear head portion and extending radially inwardly from said first cylindrical

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surface to said re-entrant annular groove, a cylindrical side wall for said pump casing having a flat annular end face complementary to and abutting against and concentric with the outer portion of said annular surface, said flat annular end face having a maximum diameter equal to the diameter of said first cylindrical surface, and annular seal means seated in said annular groove and sealingly engaging said cylindrical side wall and said rear head portion.

5. A supported pump housing, comprising, in combination, a frame adapted to support a sectional and substantially cylindrical housing, said frame having a cylindrical inner support surface at one end thereof and having a flat annular support surface extending radially inwardly from one end of said cylindrical inner support surface to form an annular housing support groove, a front head portion, a circular rear head portion having a flat front face and having a flat rear face parallel to said flat front face, a cylindrical side wall portion intermediate said front head portion and said rear head portion and having an inner cylindrical surface and having an outer cylindrical surface, said rear head portion having the outer periphery of its rear face defined by a first cylindrical surface spaced axially from and parallel to and concentric with and of a greater diameter than a second cylindrical surface defining the outer periphery of the front face of said rear head portion, a re-entrant annular groove encircling said rear head portion intermediate said first cylindrical surface and said second cylindrical surface and extending axially from said second cylindrical surface toward said rear face of said rear head portion, a first flat annular surface concentric with said first cylindrical surface and parallel to said rear face of said rear head portion and extending radially inwardly from said first cylindrical surface to said re-entrant annular groove, a resilient and compressible annular seal element snugly seated in said groove and having its outermost peripheral surface when said seal means is not compressed extending radially outwardly of said rear head portion beyond said second cylindrical surface, said cylindrical side wall portion of said pump housing having a flat annular end surface extending radially inwardly from the outer surface of said side wall and being parallel to and abutting against said first flat annular surface on said rear head portion, said first flat annular surface having an outer diameter equal to the outer diameter of said flat annular end surface, and a conical surface extending from said flat annular end surface to the inner cylindrical surface of said side wall portion and compressively engaging said seal element, said inner cylindrical surface of said side wall portion being spaced radially from said second cylindrical surface defining the outer periphery of the front face of said rear head portion by a distance less than the radial dimension of said annular seal element, said first cylindrical surface of said rear head portion and the adjacent portion of said outer surface of said cylindrical side wall being snugly telescoped into and radially seated in said cylindrical inner support surface of said

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frame and said rear head portion having the radially outer portion of its said rear face parallel to and abuttingly seated against said flat annular support surface of said frame, and compression means urging said front head portion and said side wall portion toward said rear head portion, whereby said front head portion and said side wall portion and said rear head portion are maintained in predetermined fixed position axially and radially with respect to one another and with respect to said frame.

6. A supported housing, comprising, in combination, a frame adapted to support a sectional and substantially cylindrical housing, said frame having a cylindrical inner surface at one end thereof and having a flat annular surface extending inwardly from said cylindrical inner surface to form an annular groove, a circular housing wall having an outer diameter substantially equal to the diameter of said cylindrical inner surface and telescoped into said cylindrical inner surface and having an annular flat side portion complementary to and abuttingly engaging said flat annular surface of said frame and having a peripheral circular seal seat, said seal seat being substantially concentric with the cylindrical inner surface of said frame, seal means surrounding said seal seat and extending radially outwardly therefrom, a cylindrical housing wall having an annular flat end which has an outer diameter substantially equal to the outer diameter of said circular housing wall and substantially equal to the diameter of said cylindrical inner surface of said frame and having said annular flat end thereof telescoped into said cylindrical inner surface of said frame and having an inner surface sealingly engaging said seal means and having said annular flat end thereof abutting against an adjacent annular and flat surface comprising part of said circular housing wall.

7. A device according to claim 6, wherein the inner surface of said cylindrical housing wall terminates in an outwardly beveled circular surface at the locus of engagement between said seal means and said cylindrical housing wall, and means for maintaining said cylindrical housing wall engaged with said circular housing wall and for maintaining fixed axial and radial engagement between said frame and said cylindrical housing wall and said circular housing wall.

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