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R. R. CURTIS ET AL

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SUBMERGED BOOSTER PUMP CONSTRUCTION

Filed Feb. 6, 1943

3 Sheets-Sheet 1

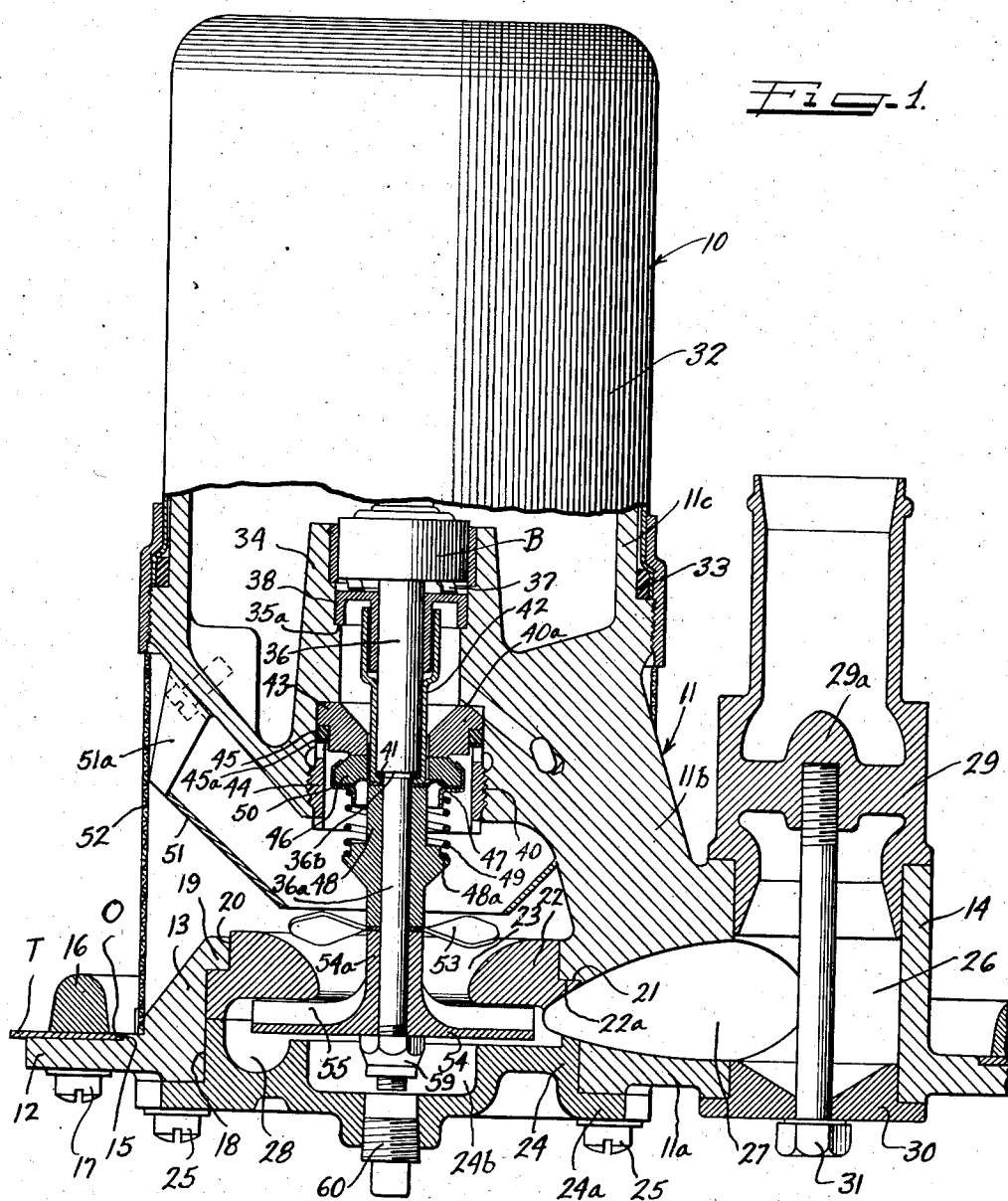


Fig. 1.

INVENTORS
RUSSELL B. CURTIS.
ROBERT J. SCHROEDER.

Charles Hill

Attorneys

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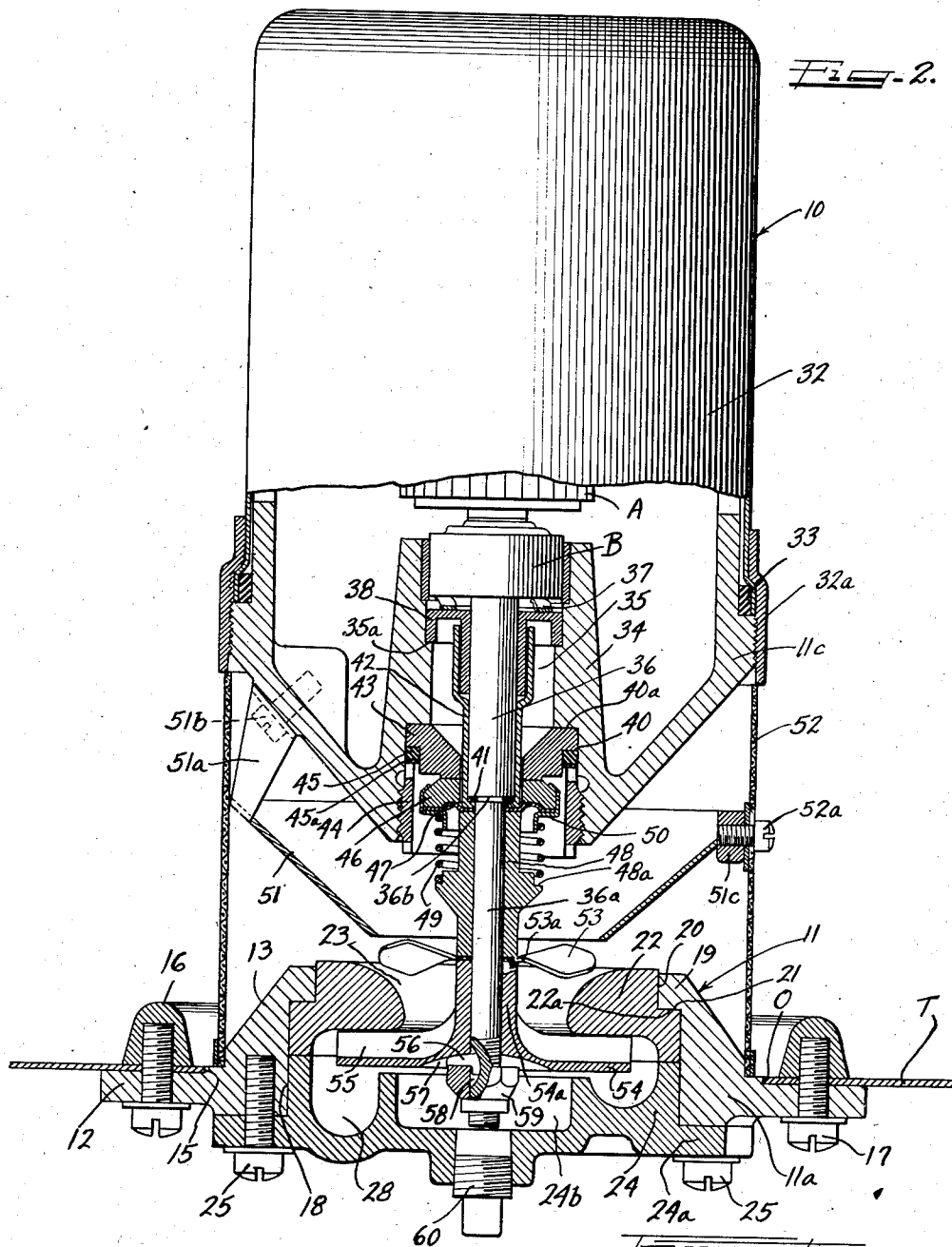
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3 Sheets-Sheet 2



Inventors
 RUSSELL E. CURTIS.
 ROBERT J. SCHROEDER.

Charles J. [Signature] Attys

Feb. 13, 1945.

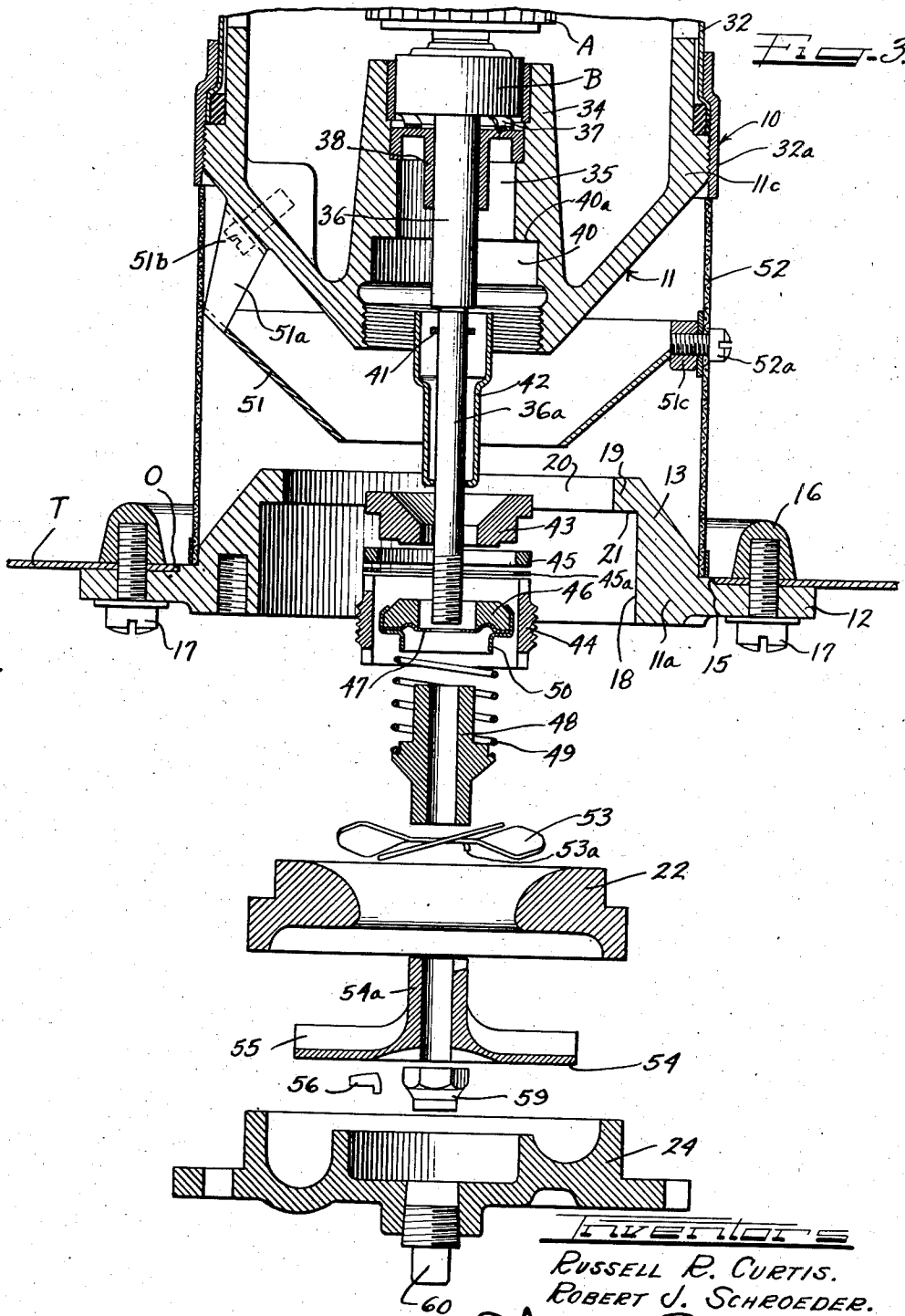
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3 Sheets-Sheet 3



RUSSELL P. CURTIS.
ROBERT J. SCHROEDER.

Charles H. Hill, Att'y.

UNITED STATES PATENT OFFICE

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SUBMERGED BOOSTER PUMP
CONSTRUCTION

Russell R. Curtis and Robert J. Schroeder, Dayton,
Ohio, assignors to Curtis Pump Company,
Dayton, Ohio, a corporation of Ohio

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8 Claims. (Cl. 103—87)

This invention relates to a pump construction adapted to be mounted on a wall of a tank to pump fluid from the interior of the tank and having a removable end assembly on the outside of the tank giving access to all interior pump parts.

Specifically this invention relates to a combined motor and centrifugal pump unit adapted to be mounted on a tank wall and submerged in liquid such as gasoline contained in the tank, which unit is arranged so that the pump parts can be completely serviced from the outside of the tank.

The pump and motor unit of this invention includes a one-piece casting having a base portion adapted to be mounted on the wall of a tank together with a pilot portion insertable in an aperture of the tank wall and defining an open-ended chamber for receiving a removable pump volute defining cap and throat ring. The casting has an upstanding leg portion carrying, in spaced relation above the throat ring, a motor support and seal chamber.

A motor mounted on the support portion of the casting has a drive shaft extending through the seal chamber, and through the space between the pilot portion and motor support into the pump volute chamber. An impeller, a propeller, and seal constructions are mounted on this shaft. All of these constructions are removable from the assembly without removing the unit from the tank by removal of the end cap and throat ring from the base portion of the casting. The end cap can be removed without disturbing the mounting of the unit on the tank. The throat ring is held in place by the end cap and can be removed when the end cap is removed.

A feature of the invention resides in the provision of removable members including an end cap and a throat ring to define, in the pilot portion of the casting, a pump volute chamber.

It is an object of the invention to provide a pump and motor unit that is readily mounted on a tank wall to be submerged in the contents of the tank and, when so mounted, is readily accessible from outside of the tank for repair and replacement of parts.

A further object of the invention is to provide a submerged type motor and centrifugal pump unit having a base portion for mounting on a tank wall which base portion carries a removable end cap giving access to internal pump parts from the outside of the tank.

A still further object of the invention is to

provide a very lightweight, compact and efficient submerged type booster pump adapted for airplane fuel systems.

A still further object of the invention is to provide an electric motor-driven centrifugal type pump unit adapted to be submerged in liquid for diverting bubbles of gas and vapor in the liquid away from the pump impeller so that the pump will only discharge fully liquid material.

A still further object of the invention is to provide a combined electric motor—centrifugal pump unit having a single part serving as a mounting means, a pump chamber receptacle, and a motor support.

Another object of this invention is to provide a pump and motor unit with a drive shaft carrying an impeller, a propeller, a seal construction, and a flange trap construction, all of which are accessible by removal of an end cap on the unit.

Other and further objects of the invention will be apparent to those skilled in the art from the following detailed description of the annexed sheets of drawings which, by way of a preferred example only, illustrate one embodiment of the invention.

On the drawings:

Figure 1 is a side elevational view, with parts in vertical cross section, of a pump and motor unit according to this invention mounted on a tank wall.

Figure 2 is a view similar to Figure 1 taken in a plane at right angles to Figure 1.

Figure 3 is an exploded fragmentary vertical cross-sectional view, with parts in elevation, of the pump and motor unit shown in Figures 1 and 2, illustrating the manner in which parts of the unit can be removed by removal of an end cap of the unit without disturbing the mounting of the unit on the tank.

As shown on the drawings:

In Figures 1 to 3 inclusive the reference numeral 10 designates generally an electric motor—centrifugal type pump unit of this invention. The unit 10 includes a one-piece casting 11 having a base portion 11a, an upstanding post or leg portion 11b, and a motor support portion 11c in spaced relation above the base portion 11a.

The base portion 11a has an annular mounting flange 12 therearound together with an apertured thickened annular portion 13 inwardly of the flange 12. An upstanding boss portion 14, as best shown in Figure 1, is also

formed on the base portion 11a outwardly of the pedestal or post 11b.

The base portion 11a has an upstanding annular shoulder 15 outwardly of the thickened portion 13 and boss portion 14 but inwardly of the flange portion 12. This shoulder 15 provides a pilot seatable in an opening O of a tank wall T such as the bottom wall of a tank. The shoulder 15 will fit snugly in the opening O and the flange 12 can abut the outside surface of the tank wall to position the thickened portion 13 and boss portion 14 of the base 11a inside of the tank. A mounting ring 16 is mounted inside the tank on the tank wall T around the opening O and is tapped to receive cap screws 17 which extend through the flange 12 and the tank wall T for mounting the unit 10 on the tank.

The thickened portion 13 of the base 11a has a cylindrical bore 18 therein opening at the bottom of the base portion and terminating at the other end in an inturned flange portion 19 providing a reduced cylindrical opening 20 at the top end of the thickened portion as well as an abutment shoulder 21 at the top end of the cylindrical bore.

As shown in Figures 1 and 2, a throat ring 22 is seated in the upper end of the cylindrical bore 18 and in the opening 20 of the thickened portion 13 and has a shoulder 22a bottomed on the shoulder 21. This throat ring 22 has a central aperture 23 therein which converges inwardly from the top thereof to provide a flaring throat.

An end cap 24 fits in the bore 18 and has an annular bottom flange 24a secured on the bottom face of the base portion 11a. This flange 24a is apertured and receives cap screws 25 there-through. These screws 25 are threaded into the base portion 11a to secure the cap to the base portion. It will be noted that the screws 25 are accessible from outside of the tank wall T. The end cap 24 bottoms on the throat ring 22 to hold the ring 22 against the shoulder 21 of the thickened portion 13.

A gasket (not shown) can be provided between the flange 24a of the end cap 24 and the base 11a to seal the end cap relative to the base even though the throat ring prevents full seating of this flange on the base.

As shown in Figure 1, the boss 14 on the base portion 11a defines an open-ended passageway 26, open at the bottom end, through the base portion 11a and open at the top end inside of the tank. This passageway 26 communicates with a port or passageway 27 through the thickened portion 13 and leg 11b with a volute chamber 28 defined in the thickened portion by the throat ring 22 and end cap 24. This volute chamber 28 communicates with the throat 23 and is shaped in the conventional pump volute form with the restricted portion thereof discharging into the passageway 27. The passageway 27, in turn, discharges into the vertical passageway 26 of the boss 14.

A conduit fitting 29 is seatable on either end of the boss 14 so that the passageway 26 can discharge either to the inside or to the outside of the tank T. As illustrated in Figure 1, the fitting 29 is on the inside of the tank and the other end of the passageway 26 is closed by a cap 30. A single bolt 31 extends through the cap and is threaded into a spider 29a of the conduit fitting 29 to hold both the conduit fitting and the end cap in position on the ends of the boss 14. Gaskets (not shown) can be provided between the

fitting 29 and boss 14 and between the cap 30 and boss 14 to prevent leakage out of the passageway 26 at these points.

A cup shaped motor casing 32 is carried on the motor support portion 11c of the casting 11 and has an outwardly flanged mouth enveloping a gasket 33 on the support portion 11c of the casting 11. A collar 32a is threaded on the support portion 11c and surrounds the flanged mouth to compress a gasket 33 between the support portion and the casing.

The motor support portion 11c of the casting 11 has a central open ended boss portion 34 defining a shaft well 35 through which a drive shaft 36 from the armature A of a motor in the casing 32 projects. This boss portion 34 provides a seat at the upper end thereof for a shaft bearing B. A spring washer 37 is mounted in the well 35 under the bearing B and is bottomed on a flame trap member 38 press fitted into the well 35 on a shoulder 35a of the well. The spring takes up axial movements of the bearing B. The flame trap member 38 freely receives the drive shaft 36 therethrough.

The shaft well 35 is counterbored at the lower end thereof to provide an enlarged chamber 40 which is topped by a shoulder 40a. The drive shaft 36 has a reduced portion 36a starting at a flat shoulder 36b in the enlarged chamber portion 40 and extending into a central hollow portion 24b of the end cap 24.

A resilient gasket or washer 41 is seated on the shoulder 36b and receives thereover the end wall of a second flame trap member 42 which closely hugs the shaft 36 and has an outwardly flaring upper end enveloping the first mentioned flame trap member 38 in spaced relation therefrom. The members 38 and 42 cooperate to provide an elongated narrow path joining the well 35 with the bearing 36. This path will allow passage of gases and vapor but will not permit propagation of flame therethrough. The member 38 is stationary and can be composed of ceramic material or other non-heat conductor while the member 42 revolves with the shaft 36.

A stationary seal ring 43 is seated in the enlarged well chamber 40 against the shoulder 40a thereof. This seal ring 43 has a central aperture therethrough larger than the member 42 to loosely accommodate this member.

The seal ring 43 is held in the chamber 40 by means of a sleeve 44 which is threaded in the chamber against a washer 45a covering a resilient gasket 45 bottomed on the seal ring.

The seal ring 43 has a flat bottom face around the central aperture thereof receiving in sliding contact therewith the top face of a rotating seal ring 46. This rotating seal ring 46 loosely receives the flame trap member 42 therethrough but has a flexible diaphragm 47 preventing leakage between the flame trap member 42 and the ring. This flexible diaphragm 47 is clamped around the inner marginal portion thereof between the end wall of the member 42 and a spacer sleeve 48 on the shaft portion 36a. This spacer sleeve 48 has an annular shoulder-defining portion 48a bottoming a coil spring 49 which acts on a cup 50 that is spun onto the seal ring 46 around the periphery thereof. This cup 50 clamps the marginal portion of the diaphragm 47 against the seal ring so that both the inner and outer portions of the diaphragm are sealed.

The stationary seal ring 43 is preferably composed of compressed graphitic carbon material, while the rotating seal ring 46 is preferably com-

posed of a hard metal such as nitra-alloy. The spring 49 urges the rotating seal ring 46 into sliding face to face engagement with the stationary seal ring 43. The ring 46 is driven by the drive shaft of the motor.

A hollow conical guide shield 51 has legs 51a on the enlarged upper end thereof secured to the underface of the motor support portion 11c by means of cap screws such as 51b. This guide shield 51 has the lower end thereof held in spaced relation above the throat ring 22 while the upper end thereof is below the motor support portion 11c.

The space between the motor support portion 11c and the base 11a is enveloped by a screen 52 which also surrounds the shield 51. This screen can be fitted around an upstanding shoulder at the base of the thickened portion 13 and extends into abutting engagement with the collar 32a of the motor casing. The screen 52 is attached to tapped bosses such as 51c (Fig. 2) on the upper end of the guide shield 51 by means of screws such as 52a.

Since the entire unit 10 is suspended in liquid in the tank T, this liquid can flow through the screen 52 and be guided by the shield 51 into the throat 23 of the pump.

A propeller 53 is mounted on the shaft portion 36a under the spacer sleeve 48 and has the blades thereof at a level between the throat ring 22 and the bottom of the guide shield 51.

An impeller 54 in the form of a disk with upstanding vanes 55 thereon has a central hub portion 54a mounted on the shaft 36a and clamping the propeller 53 against the bottom of the sleeve 48. The propeller 53 has a central hub portion which can be provided with a tang 53a pressed into a groove on top of the impeller hub 54a so that the propeller will be driven.

The impeller 54 itself is keyed to the shaft 36 by means of a key 56 having one leg seated in a groove 57 in the bottom of the impeller and the other leg seated in a keyway 58 in the shaft 36a, as shown in Figure 2.

A nut 59 is threaded on the end of the shaft portion 36a to hold the key in the keyway or groove 57 as well as in the keyway 58. This nut thrusts against the bottom of the impeller 55 and exerts a thrust on the impeller, the propeller 53, the sleeve 48, the diaphragm 47, the flame trap member 42 and the gasket 41 to clamp all of these members between the nut and the shoulder 36b of the shaft 36.

As shown in Figure 3, all of the members thrusting against the shoulder 36b of the shaft are removable from the pump construction by removal of the end cap 24 and nut 59. By means of this assembly all interior working parts of the pump are completely removable from the pump without disturbing the mounting for the pump-motor unit. Thus the pump can be quickly serviced without removing it from the tank T.

As also indicated in Figure 3, the parts carried in the well chamber 40 are likewise removable by simple removal of the sleeve 44. In addition, and as further shown in Figure 3, the throat ring 22 is removable from the pump assembly.

The end cap 24, as explained above, has a central hollow portion 24b receiving the end of the shaft 36a and the nut 59. This hollow portion can have a port closed by a screw plug 60. The plug can be removed to drain impurities from the hollow portion 24b without removing the end cap.

From the above descriptions it should be un-

derstood that this invention now provides a submerged pump and motor unit adapted to be mounted on the wall of a tank which unit is equipped with a removable end cap construction giving access to all interior pump parts and making possible a quick replacement of these parts without disturbing the mounting for the unit. A feature of the invention resides in the provision of an end cap and a throat ring to define a pump volute chamber and inlet to this chamber.

Another feature resides in the mounting of an impeller, a propeller, a spacer sleeve, a rotating seal part, and a rotating flame trap part on a motor drive shaft and in clamping all of these parts in operative relation between a nut on the end of the shaft and a shoulder formed on the shaft.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

We claim as our invention:

1. In a fuel system, a fuel tank, a pump and motor assembly in said tank to deliver gas-freed liquid fuel which comprises a member having spaced opposed pump chamber and motor chamber portions, said pump chamber portion having a central liquids inlet communicating with the space between said portions to receive fuel directly from the tank, a motor in said motor chamber portion, drive means extending from said motor across said space between said portions into said pump chamber, a pump impeller in the pump chamber portion connected to said drive means, and a propeller on said drive means positioned in the space between the pump chamber and motor chamber portions of the casing in advance of the central liquids inlet for directing bubbles of gas and vapor away from said central liquids inlet.
2. A pump and motor assembly adapted for submersion in liquid to deliver gas-freed liquid which comprises a member having spaced opposed pump chamber and motor chamber portions, said pump chamber portion having a central liquids inlet communicating with the space between said portions, a motor in said motor chamber portion, drive means extending from said motor across the space between said portions into said pump chamber portion, a pump impeller in the pump chamber portion mounted on said drive means, a propeller mounted on said drive means in advance of the central liquids inlet of the pump chamber portion, and an inverted hollow conical guide shield suspended from said motor chamber portion in the space between the motor chamber portion and the pump chamber portion, said guide shield having a large open end in spaced relation beneath the motor chamber portion and a small open end adjacent said propeller whereby liquid can flow through the guide shield to the propeller and whereby liquid from the propeller can flow along the outer face of the guide shield.
3. A pump and motor unit adapted for submersion in liquid which comprises a member having a base portion with an annular mounting flange therearound, an upstanding portion, and a motor support portion on said upstanding portion in spaced opposed relation from said base portion, said base portion having a chamber

aligned with said motor support portion, removable means mounted in said chamber defining a pump volute and a central inlet for said volute, a motor on said motor support portion having a drive shaft extending through said central inlet, an impeller on said drive shaft for pumping liquid from said inlet to said volute, and an integral upstanding hollow boss on said base portion in laterally spaced relation from said chamber but communicating with said volute to receive liquid therefrom.

4. In a centrifugal type pump assembly the improvement of a member adapted for attachment to a tank wall, said member having a portion adapted to project through an aperture in the tank wall on which the member is mounted, said portion defining an open ended chamber with a restricted open end projecting inside of the tank on which the member is mounted, a removable throat ring in said chamber abutting said restricted open end thereof and providing a central inlet, and a removable end cap in said chamber cooperating with said throat ring to define a pumping chamber therebetween, said end cap and said throat ring being removable from said member from outside the tank on which the member is mounted.

5. In a centrifugal type pump assembly the improvement of a mounting base adapted to be attached to a tank wall around an aperture in the wall to cover the aperture, said base having a chamber-defining portion adapted to project into the tank, a removable throat ring insertable in said chamber through the bottom of said base from outside of a tank on which the base is mounted and defining a central liquids inlet, and a removable end cap insertable in said chamber through the bottom of said base from outside of a tank on which the base is mounted for cooperating with said throat ring to define a pump volute chamber.

6. In an electric motor and pump unit the improvement of a one-piece member having a base portion adapted to be mounted on a tank wall around an aperture in the tank wall, said member including an open-ended chamber defining portion having one open end projecting through said aperture into the tank and the other open end on the outside of the tank, said member having an upstanding post portion projecting in the tank and a motor support portion on the upper end of said post portion, a motor drive shaft

extending from said motor support portion into the open-ended chamber, a removable end cap closing the bottom of said chamber, a removable throat ring held in said chamber by said end cap and cooperating therewith to define a pumping chamber, pump means on said drive shaft, seal means on said drive shaft, and means adjacent said end cap on said drive shaft releasably securing said pump and seal means on the drive shaft whereby all of said means and said throat ring can be removed from the drive shaft by removal of the end cap without removing the unit from the tank.

7. In a submerged type booster pump including spaced opposed pump casing and motor casing portions, removable means in said motor casing portion defining a pump volute and a central inlet for said volute, an electric motor on said motor support portion, a drive shaft extending from said electric motor into said central inlet, said drive shaft having an abutment thereon intermediate the ends thereof, a removable fastening means on the end of said drive shaft, and pump and seal means on said drive shaft clamped between said abutment and said removable means.

8. A pump and motor unit comprising a one-piece casting having a flat base portion with an attachment flange around the periphery thereof and an annular thickened portion adapted to project into a tank when the attachment flange is mounted on the outside of the tank wall, a post portion extending from said base portion and a motor support portion on said post portion aligned with said thickened portion, a motor drive shaft supported on said support portion extending into the thickened portion, means in the thickened portion providing a pumping chamber, said means being removable from said thickened portion from outside of the tank, said drive means having a shoulder thereon, a flame trap member, a spacer sleeve, a propeller, and an impeller on said drive shaft, and a removable nut on the end of the drive shaft for thrusting said flame trap member, said sleeve, said propeller and said impeller against said shoulder whereby all of said members can be removed from the unit from the outside of the tank by removal of said removable members in the thickened portion and said nut on the drive shaft.

RUSSELL R. CURTIS.

ROBERT J. SCHROEDER.