

June 12, 1962

E. A. MARGUS

3,038,414

PUMP

Filed June 5, 1958

3 Sheets-Sheet 1

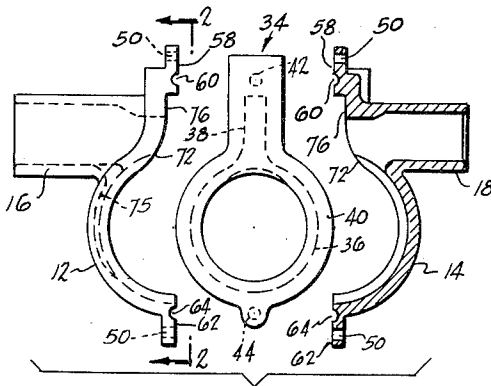


Fig. 1.

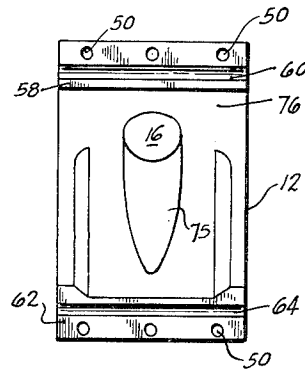


Fig. 2.

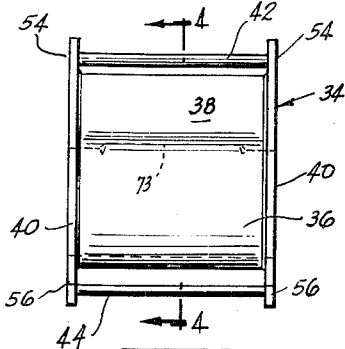


Fig. 3.

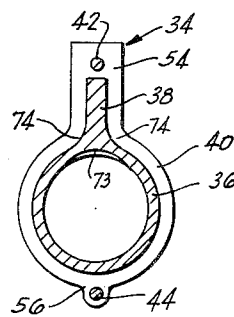


Fig. 4.

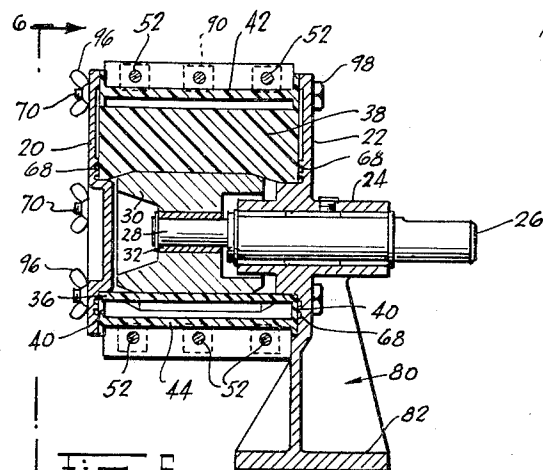


Fig. 5.

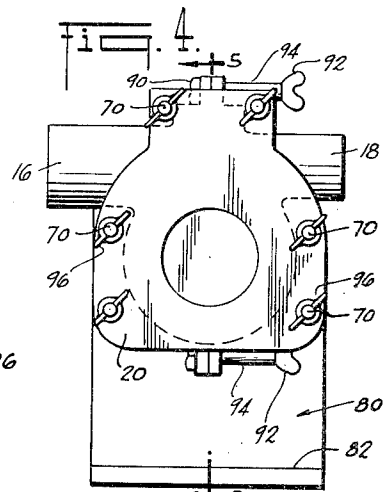


Fig. 6.

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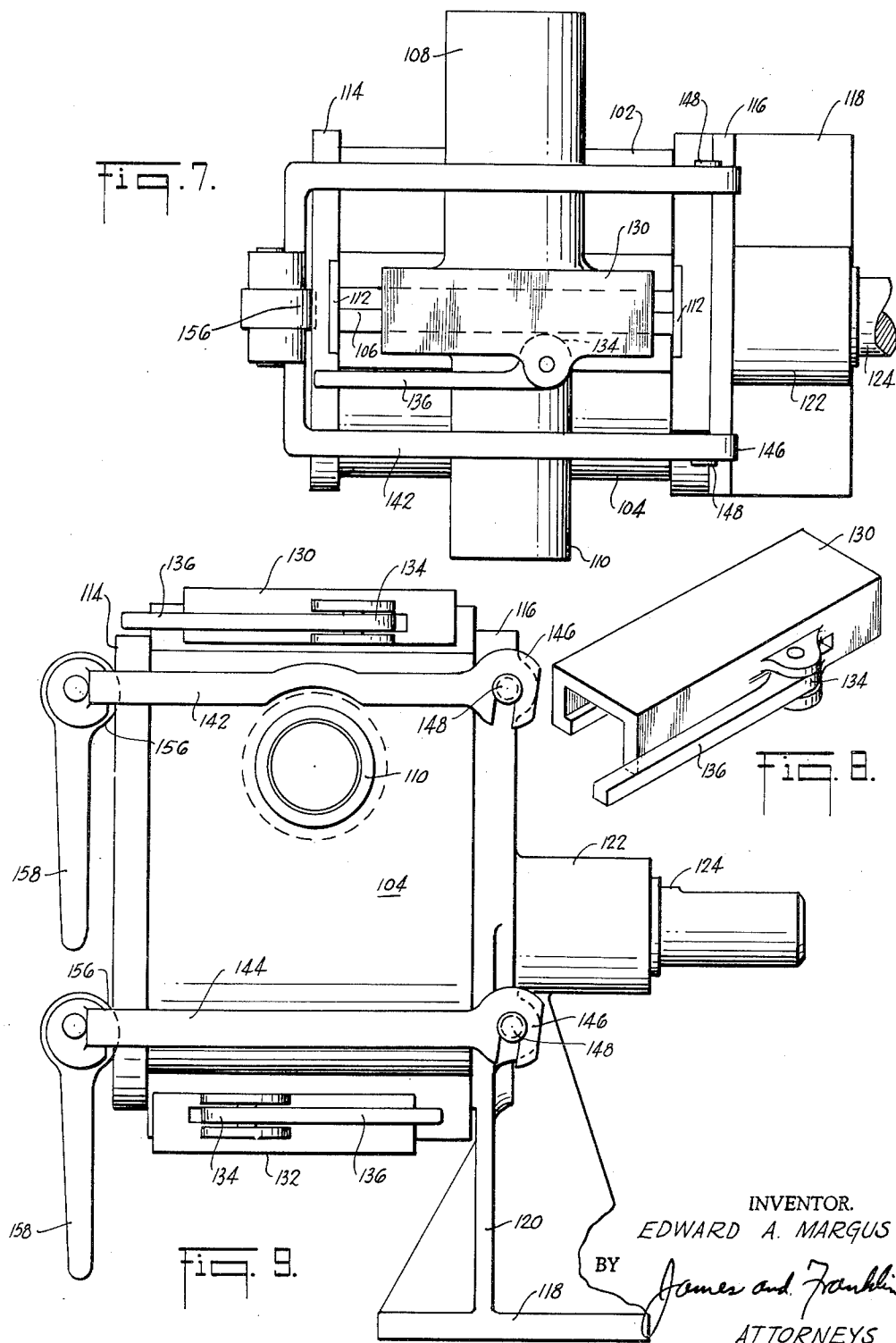
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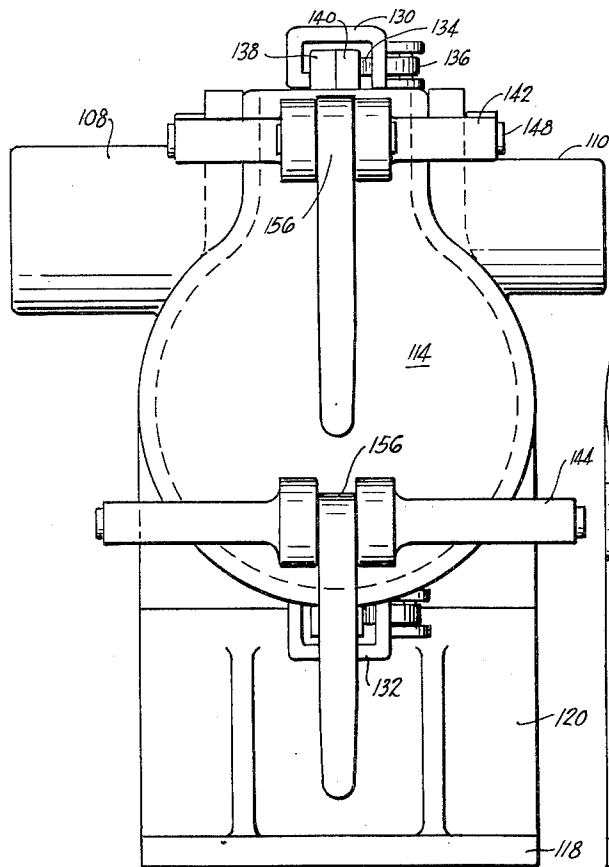


Fig. 10.

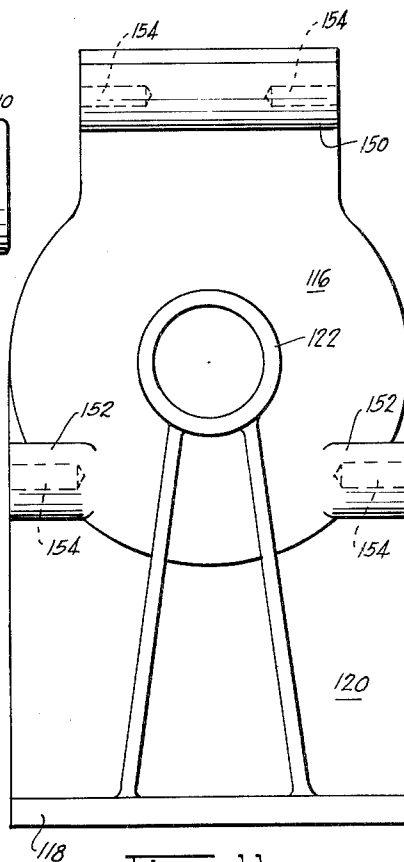


Fig. 11.

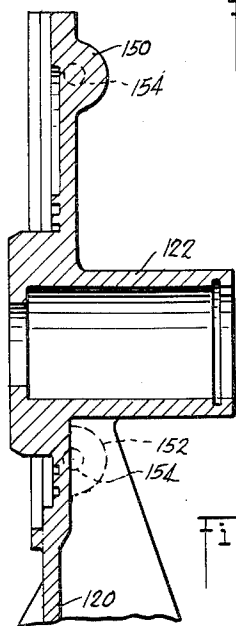


Fig. 12.

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13 Claims. (Cl. 103-149)

This invention relates to pumps, and more particularly to pumps using a flexible liner.

The primary object of the present invention is to generally improve pumps of the flexible liner type. A more particular object is to improve pumps of the type disclosed in United States Patent 2,585,949, issued February 19, 1952, to John G. MacCormack.

A further object of the present invention is to provide such a pump which is readily and quickly disassembled into parts which are widely open and fully accessible for thorough cleaning, thus making the pump particularly suitable for use with products requiring a high degree of sanitation, such as foodstuffs and pharmaceuticals. Moreover, the same open accessibility makes it possible to provide a mirror finish during manufacture, which also is desirable for sanitation.

To accomplish the foregoing general objects, and other more specific objects which will hereinafter appear, my invention resides in the pump elements, and their relation one to another, as are more particularly disclosed in the following specification. The specification is accompanied by drawings in which:

FIG. 1 shows the halves of a split pump body, separated, with the liner therebetween;

FIG. 2 is an interior face view of one-half of the pump body, looking in the direction of the arrows 2-2 of FIG. 1;

FIG. 3 is a side view of the one-piece flexible liner of the pump;

FIG. 4 is a transverse section through the liner taken approximately in the plane of the line 4-4 of FIG. 3;

FIG. 5 is a vertical section taken through the shaft of an assembled pump embodying features of my invention;

FIG. 6 is an end view of the pump, looking in the direction of the arrows 6-6 of FIG. 5;

FIG. 7 is a plan view of a modified pump having quick release means;

FIG. 8 is a perspective view of one of the clamps used in FIG. 7;

FIG. 9 is a side elevation of the pump shown in FIG. 7;

FIG. 10 is a front elevation of the same;

FIG. 11 is a rear elevation of the pedestal of the same pump; and

FIG. 12 is a fragmentary vertical section through the pedestal.

Referring to FIG. 1 of the drawing, the pump comprises a body 12, 14 having inlet and discharge ports 16 and 18. It further comprises end plates 20 and 22 (FIGS. 5 and 6), at least and preferably only one of which, in this case the plate 22, includes a shaft bearing 24. A shaft 26 has an eccentric portion 28 which carries a rotor 30. Preferably an anti-friction or self lubricating bearing 32 is disposed therebetween.

The pump further comprises a one-piece flexible liner which is shown separately in FIGS. 3 and 4 of the drawing. In FIG. 1, the liner is shown at 34. In FIGS. 3 and 4, it will be seen that the liner comprises a barrel 36, a barrier 38, flanges 40, and gaskets 42 and 44. The barrel 40 is dimensioned to be received snugly over the rotor 30. The barrier 38 is disposed radially and longitudinally outside the barrel 36, and is located in the pump body across the space between the ports 16 and 18. It

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thus acts as a divider or partition which insures flow from the inlet port to the discharge port, as the revolutions of the eccentric rotor flex the barrel portion of the liner with a circular wiping motion around the inside of the body.

The end flanges 40 of the liner are compressed between the body of the pump and the end plates 20 and 22, thus sealing the assembly. The arrangement is such that the liquid being pumped is confined between the outside of the liner and the inside of the body, and these parts may be made of appropriate corrosion-proof or chemically-resistant materials, including synthetic plastics. In any case, the shaft and eccentric and rotor are not exposed to the liquid being pumped, and no shaft seal or stuffing box is needed.

A main feature of the present pump is that the body 12, 14 is made up of two separable parts, preferably divided on a diametral plane, as is most clearly shown in FIG. 1. These halves may be secured together by appropriate fastening means, preferably rows of screws or bolts at the top and bottom, passing through holes indicated at 50 in FIGS. 1 and 2, and the screws being indicated at 52 in FIG. 5. They may have wing nuts for easy disassembly without tools. To seal the body, it is preferably provided with gaskets at the top and bottom between the contacting faces 58 and 62, and in the particular construction here illustrated, the gaskets are cylindrical or O gaskets, made of the same material as the liner, and made integral with the liner.

For this purpose, the flanges 40 are extended radially outward, as shown at 54, and gasket 42 runs in axial direction between the extension 54. Similarly, the flanges 40 are extended in diametrically opposite direction as indicated at 56, and the gasket 44 extends axially between the extensions 56.

Referring now to FIGS. 1 and 2, it will be seen that the abutting faces 58 of the body are provided with registering channels 60 to receive the gasket 42. Similarly, the abutting faces 62 of the body have registering channels 64 to receive the gasket 44. Of course, the channels are not as large as the gasket, and are intended to compress the same in order to seal the pump against leakage at the top and bottom.

The flanges 40 seal the pump against leakage at the ends, and for this purpose, the body is provided with a plurality, in this case, six bolts 70, best shown in FIG. 6. These extend in axial direction, and in the present case are located outside the body 12, 14. They may have wing nuts for easy hand disassembly. The pull of the bolts 70 draws the ends 20 and 22 against the body, and compresses the flanges 40 therebetween, thus completing the sealing of the pump. Moreover, the ends may have concentric circular ridges, indicated at 68 in FIG. 5, to improve the sealing action.

It will be observed that the interior of the pump body is approximately cylindrical. There is an upward slope at 72 (FIG. 1) conforming somewhat to a corresponding slope of the liner indicated at 74 in FIG. 4. Although the parts 72 and 74 have a somewhat general conformation, there nevertheless is a space therebetween which facilitates the up and down movement of the liner during rotation of the rotor.

In FIG. 4 it will be noted that the liner is cut away or raised somewhat at the top, for most of its length, relative to a true cylinder. This is indicated at 73, and has the advantage of eliminating some thump and vibration which otherwise may occur as the rotor moves through the top portion of its rotation.

In FIGS. 1 and 2 a part of casting 12 is recessed or slotted beneath the port 16, as shown at 75. This port is used as the inlet port, and no similar recess is provided at the outlet port 18. It has been found that the recess

75 increases the suction of the pump; somewhat increases the displacement of the pump; and most important in many instances, helps keep the pump primed when not used for some time. When the recess 75 is not employed the pump is symmetrical and reversible, and either port may be used as the inlet or outlet. However, when the recess 75 is employed, it is important to use the port 16 as the inlet, and the port 18 as the outlet.

The interior of the body is in contact with the liquid being pumped, and is preferably given a highly polished or mirror finish. This greatly simplifies the task of thoroughly cleaning the pump when disassembled, and is not only desirable but sometimes is specified as a governmental requirement when the pump is used for sanitary purposes, as in the manufacture of food, drugs etc.

The plane of division of the split body is preferably a plane extending through the barrier 38. Thus, the space to receive the barrier is formed between the two halves of the body, as is indicated at 76 in FIG. 1. This space fits the barrier snugly enough to prevent back leakage from outlet to inlet.

One advantage of splitting the body in the plane of the barrier is that the interior surfaces 76 (FIGS. 1 and 2) which engage the barrier are readily given the desired mirror polish during manufacture of the pump. It would be difficult and expensive, or perhaps even impossible, to do this if the pump body were not split, or if it were split on some plane other than one through the barrier.

In FIGS. 5 and 6 it will be seen that the pump is carried by a pedestal 80 cast integrally with a base 82. Only one bearing 24 is employed, this acting as an overhung bearing. The end plate 22 is cast integrally with the pedestal 80, and thus the bolts 70 serve not only to hold the ends on the body, but also to mount the parts of the pump on the pedestal.

This makes for maximum convenience in disassembling and servicing or cleaning the pump. The pedestal and shaft and the motor connected thereto may be left undisturbed. To disassemble the pump, it is merely necessary to release the bolts 70, whereupon the end 20 and the body and the liner subassembly may be withdrawn from the end 22 and shaft 26. By then releasing the screws 52, the halves of the body come apart, thus freeing the liner. The rotor may be separated from the liner by simply pushing the same axially. This need be done only in the event of replacement of the liner when worn. For mere cleaning, the exterior of the liner and the interior of the body are fully exposed by separation of the halves of the body, and without pulling the liner from the rotor, although that is readily done if desired.

A modified form of pump is shown in FIGS. 7 through 12 of the drawing. This differs primarily in providing quick release clamps for holding the parts of the pump body together. As before, the body is made up of two halves or sides 102 and 104, divided on a diametrical plane 106 (FIG. 7) extending through the barrier, this plane in the usual case being vertical. The body has an inlet port 108 forming a part of the side 102, and a discharge port 110 forming a part of the side 104. The interior of the body is not shown, but as before it is generally cylindrical and houses a rotor having a barrel, a barrier, flanges, and gaskets, all as previously described. The upper end of the flanges are visible in FIG. 7 at 112.

The body further comprises an end plate 114 and a combined end plate 116 and pedestal base 118. The pedestal itself is shown at 120 in FIGS. 9-12. The end plate 116 includes an overhung bearing 122 for a drive shaft 124, all as previously described.

The fastening means for securing the halves 102 and 104 together against the gaskets comprise two clamps 130 and 132, each with a lever-operated clamping cam 134, the lever being indicated at 136. With the dividing plane of the body vertical as here shown these clamps are located at the top and bottom of the body. They are in

diametrically opposed positions straddling the diametrical plane of division 106 of the body.

In the present case the clamps 130 and 132 are channel shaped, as is best shown in FIGS. 8 and 10. The clamps may be made alike, in which case the lever of one extends in one direction while the lever of the other extends in opposite direction. It will be understood that the clamp receives the upstanding flanges 138, 140 (FIG. 10) at the top of the body, and the corresponding flanges at the bottom.

The additional fastening means for pulling the ends 114 and 116 against the liner flanges and the body comprises two U-shaped yokes generally designated 142 and 144. As is best shown in FIG. 9, the yokes have hooks 146 at the free ends of the U, for engaging mating parts 148 on end plate 116. The parts 148 here illustrated are pins projecting horizontally from bosses on the end plate, and referring to FIG. 11, it will be seen that the end plate is thickened at 150 and 152 to provide bosses in which holes 154 are formed to receive the pins 148 (not shown) with a force fit or weld or other expedient.

By comparison of the upper and lower portions of FIGS. 10 and 11 it will be seen that the yokes are not alike in that yoke 144 is wider than yoke 142. In both, however, there is a lever-operated cam 156 (FIG. 9) at the middle of the U for engaging the end plate 114. The operating levers are indicated at 158. It will be evident that by swinging the levers upward the cams are turned from large radius to small radius position, thereby releasing the yokes and permitting the same to be freed from the pins 148 and removed. The end plate 114 is then removable. By releasing the levers 136 the top and bottom clamps 130 and 132 are readily removed, whereupon the sides of the body may be separated.

Reverting to FIGS. 3 and 4, the integrality of the gaskets 42 and 44 with the rest of the liner is important. Separate gaskets 42 and 44 might be attempted, and would seal the two halves of the body against leakage at points intermediate the ends of the body. However, there would still be a vulnerable point of probable leakage at the ends of the gaskets 42 and 44. With a two-piece body as here shown, the circular flanges and the two linear gaskets would not alone do, if separate from one another, because of leakage between the ends of the gaskets and the flanges of the liner. Moreover, there is great convenience in servicing and handling the pump, and quicker assembly and disassembly, when the gaskets are made integral with the liner.

There is an additional advantage in assuring use of proper material for the gaskets. One important advantage of the liner type pump is the variety of materials which may be used. Thus, the body may be made for example of polyethylene, polyvinylchloride, phenolic resins, hard rubber either natural or synthetic, Teflon, or stainless steel. The liner should be a relatively soft and elastic material, and may be made of natural rubber, synthetics such as nitrile, neoprene or butyl, plastics materials such as Hypalon, Kel F, Compar, and also silicone materials. The proper material is selected dependent upon the chemical or other liquid to be handled by the pump. The integral liner structure here shown assures that the gaskets 42 and 44 will also be made of the same material.

The pump has additional general advantages. No stuffing boxes or glands or shaft seals are needed. No check valves are used. The pump is self-priming. It does not agitate or churn the liquid, which is of advantage in handling suspensions, emulsions or the like. Maintenance is simple and low in cost. The pump will handle corrosive chemicals, abrasive slurries, pharmaceuticals, foodstuffs, etc.

In addition to keeping the pump primed, the recess 75 increases the output of the pump. The port 16 is then used as an inlet if these advantages are wanted, although port 18 may be used as an inlet if the said advantages are not wanted.

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The recess 75 makes it possible to adjust the output of the pump to help meet the requirements of the purchaser. If the recess is small, the output is less, and if the recess is large, the output is more. The shutoff pressure is tapered off somewhat as the output is increased and, therefore, it is possible to vary both the pressure and the output by changing the size of the recess 75.

It is believed that the construction and the advantages of my improved pump will be apparent from the foregoing detailed description. It will also be apparent that while I have shown and described my invention in several preferred forms, changes may be made in the structures shown, without departing from the scope of the invention, as sought to be defined in the following claims.

I claim:

1. A combined flexible liner and fluid displacement member for a pump of the collapsible chamber rotary compress flexible liner type, said liner being a single integral piece of flexible material, and comprising a barrel portion, a barrier portion disposed radially and longitudinally outside the barrel portion, end flanges at the ends of the barrel and barrier portions, said end flanges extending radially outward beyond the barrier portion, and also extending radially outward at a point diametrically opposite the barrier portion, a gasket extending between the flange extensions outside of the barrier portion, and another gasket extending between the other flange extensions outside of the barrel portion.

2. A pump comprising a body with an approximately cylindrical interior and having inlet and discharge ports, end plates at least one of which includes a shaft bearing, a shaft carried by said bearings, an eccentric carried by said shaft and extending within the pump body, a rotor rotatably carried on said eccentric, and a one-piece flexible liner having a barrel, a barrier, end flanges and gaskets, said liner barrel being disposed around said rotor within said body, said eccentrically mounted rotor fitting snugly within the barrel of said flexible liner thereby causing the exterior of the barrel to wipe the cylindrical interior of the pump body as the barrel moves between the inlet and discharge ports when the shaft and eccentric are rotated, said liner barrier being disposed radially and longitudinally outside the liner barrel between said inlet and discharge ports, said liner end flanges being disposed at the ends of said liner barrel and being compressed between said body and end plates, a first liner gasket extending axially of the liner between said liner end flanges and spaced from said liner barrel, and a second liner gasket diametrically located with respect to the first liner gasket and also extending axially between said liner flanges and spaced from said liner barrier, said body being made up of two halves divided on a plane extending through said liner barrier, and said liner gaskets serving to seal the halves of the body.

3. A pump comprising a body with an approximately cylindrical interior and having inlet and discharge ports, a first end plate, a pedestal and second end plate including an overhung shaft bearing, said pedestal being made integral with said second end plate, a shaft carried by said bearing, an eccentric carried by said shaft and extending within the pump body, a rotor rotatably carried on said eccentric, and a one-piece flexible liner having a barrel, a barrier, end flanges and gaskets, said liner barrel being disposed around said rotor within said body, said eccentrically mounted rotor fitting snugly within the barrel of said flexible liner thereby causing the exterior of the barrel to wipe the cylindrical interior of the pump body as the barrel moves between the inlet and discharge ports when the shaft and eccentric are rotated, said liner barrier being disposed radially and longitudinally outside the liner barrel between said inlet and discharge ports, said liner end flanges being disposed at the ends of said liner barrel and being compressed between said body and end plates, a first liner gasket extending axially of the liner between said liner end flanges and spaced from said

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liner barrel, and a second liner gasket diametrically located with respect to the first liner gasket and also extending axially between said liner flanges and spaced from said liner barrier, said body being made up of two halves divided on a plane extending through said liner barrier, and said liner gaskets serving to seal the halves of the body.

4. A quick-disassembly pump comprising a body with an approximately cylindrical interior and having inlet and discharge ports, end plates at least one of which includes a shaft bearing, a shaft carried by said bearing, an eccentric carried on said shaft and extending within the pump body, a rotor rotatably carried on said eccentric, and a one-piece flexible liner having a barrel, a barrier, end flanges and gaskets, said liner barrel being disposed around said rotor within said body, the eccentrically mounted rotor fitting snugly within the barrel of the flexible liner thereby causing the exterior of the barrel to wipe the cylindrical interior of the pump body as the barrel moves between the inlet and discharge ports when the shaft and eccentric are rotated, said liner barrier being disposed radially and longitudinally outside the liner barrel between said end plates and between said inlet and discharge ports, said liner end flanges being disposed at the end of said liner barrel and being compressed between said body and said end plates, a first liner gasket extending axially of the liner between said liner end flanges and spaced from said liner barrel, and a second liner gasket being diametrically located with respect to the first liner gasket and also extending axially between said liner flanges and spaced from said liner barrier, said body being made up of two halves divided on a plane extending through said liner barrier, said liner gaskets serving to seal the halves of the body, quick-release fastening means securing the halves of the body together against said liner gaskets, and additional quick-release fastening means outside the body pulling the aforesaid end plates against the aforesaid liner flanges and body.

5. A quick-disassembly pump comprising a body with an approximately cylindrical interior, and having inlet and discharge ports, a first end plate, a pedestal and second end plate including an overhung shaft bearing, said pedestal being made integral with said second end plate, a shaft carried by said bearing, an eccentric carried by said shaft and extending within the pump body, a rotor rotatably carried on said eccentric, and a one-piece flexible liner having a barrel, a barrier, end flanges and gaskets, said liner barrel being disposed around said rotor within said body, the eccentrically mounted rotor fitting snugly within the barrel of the flexible liner thereby causing the exterior of the barrel to wipe the cylindrical interior of the pump body as the barrel moves between the inlet and discharge ports when the shaft and eccentric are rotated, said liner barrier being disposed radially and longitudinally outside the liner barrel between said inlet and discharge ports, said liner end flanges being disposed at the ends of said liner barrel and being compressed between said body and end plates, a first liner gasket extending axially of the liner between said liner end flanges and spaced from the liner barrel, and a second liner gasket being diametrically located with respect to the first liner gasket and also extending axially between said liner flanges and spaced from said liner barrier, said body being made up of two halves divided on a plane extending through said liner barrier, said liner gaskets serving to seal the halves of the body, quick-release fastening means securing the halves of the body together against said liner gaskets, and additional quick-release fastening means outside the body pulling the aforesaid end plates against the aforesaid liner flanges and body and affording support by the pedestal.

6. A pump comprising a body with an approximately cylindrical interior, having inlet and discharge ports, end plates at least one of which includes a shaft bearing, a shaft carried by said bearing, an eccentric carried by said shaft and extending within the pump body, a rotor rotatably

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carried on said eccentric, and a one-piece flexible liner having a barrel, a barrier, and end flanges, said liner barrel being disposed around said rotor within said body, the eccentrically mounted rotor fitting snugly within the barrel of the flexible liner thereby causing the exterior of the barrel to wipe the cylindrical interior of the pump body as the barrel moves between the inlet and discharge ports when the shaft and eccentric are rotated, said liner barrier being disposed radially and longitudinally outside the liner barrel between said inlet and discharge ports, said liner end flanges being disposed at the ends of said liner barrel and being compressed between said body and end plates, and fastening means pulling the end plates against said inner flanges and body, said body being recessed outwardly relative to the cylindrical contour of the interior of the body beneath said inlet port.

7. A pump comprising a body with an approximately cylindrical interior, having inlet and discharge ports, end plates at least one of which includes a shaft bearing, a shaft carried by said bearing, an eccentric carried by said shaft and extending within the pump body, a rotor rotatably carried on said eccentric, and a one-piece flexible liner having a barrel, a barrier, end flanges, and gaskets, said liner barrel being disposed around said rotor within said body, the eccentrically mounted rotor fitting snugly within the barrel of the flexible liner thereby causing the exterior of the barrel to wipe the cylindrical interior of the pump body as the barrel moves between the inlet and discharge ports when the shaft and eccentric are rotated, said liner barrier being disposed radially and longitudinally outside the barrel between said inlet and discharge ports, said liner end flanges being disposed at the ends of said liner barrel and being compressed between said body and end plates, a first liner gasket extending axially of the liner between said end flanges and spaced from said liner barrel, and a second liner gasket diametrically located with respect to the first liner gasket and also extending axially between said liner flanges and spaced from said liner barrier, said body being made up of two halves divided on a plane extending through said liner barrier, and said liner gaskets serving to seal the halves of the body, said body being recessed outwardly away from said liner beneath said inlet port.

8. A pump as defined in claim 4 in which the fastening means securing the halves together comprise two clamps each with a lever operated clamping cam, said clamps receiving the halves of the body at diametrically opposed positions on the aforesaid diametrical plane.

9. A pump as defined in claim 4 in which the additional fastening means pulling the end plates against the flanges and body comprise two U-shaped yokes each having hooks at the free ends of the U for engaging mating parts of one end plate and having a lever operated cam at the middle of the U for engaging the other end plate, said

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yokes being disposed at diametrically opposed parts of the body.

10. A pump as defined in claim 4 in which the fastening means securing the halves together comprise two channel shaped clamps each with a lever operated clamping cam, said clamps receiving the halves of the body at diametrically opposed positions on the aforesaid diametrical plane, and in which the additional fastening means pulling the end plates against the flanges and body comprise two U-shaped yokes each having hooks at the free ends of the U for engaging mating parts of one end plate and having a lever operated cam at the middle of the U for engaging the other end plate, said yokes being disposed adjacent the aforesaid channel shaped clamps.

11. A pump as defined in claim 5 in which the fastening means securing the halves together comprise two channel shaped clamps each with a lever operated clamping cam, said clamps receiving the halves of the body at diametrically opposed positions on the aforesaid diametrical plane, and in which the additional fastening means pulling the end plates against the flanges and body comprise two U-shaped yokes each having hooks at the free ends of the U for engaging mating parts of one end plate and having a lever operated cam at the middle of the U for engaging the other end plate, said yoke being disposed adjacent the aforesaid channel shaped clamps.

12. A pump as defined in claim 4 in which the interior surfaces of the body including those engaging the barrier have a mirror polish finish.

13. A pump as defined in claim 4 in which the additional fastening means pulling the end plates against the flanges and body comprises a U-shaped yoke having hooks at the free ends of the U for engaging mating parts of one end plate and having a lever operated cam at the middle of the U for engaging the other end plate.

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UNITED STATES PATENT OFFICE  
CERTIFICATE OF CORRECTION

Patent No. 3,038,414

June 12, 1962

Edward A. Margus

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 32, for "extension" read -- extensions --;  
column 5, line 32, for "bearings" read -- bearing --; column 6,  
line 60, for "the" read -- said --; column 7, line 14, for  
"inner" read -- liner --.

Signed and sealed this 2nd day of October 1962.

(SEAL)  
Attest:

ERNEST W. SWIDER  
Attesting Officer

DAVID L. LADD  
Commissioner of Patents