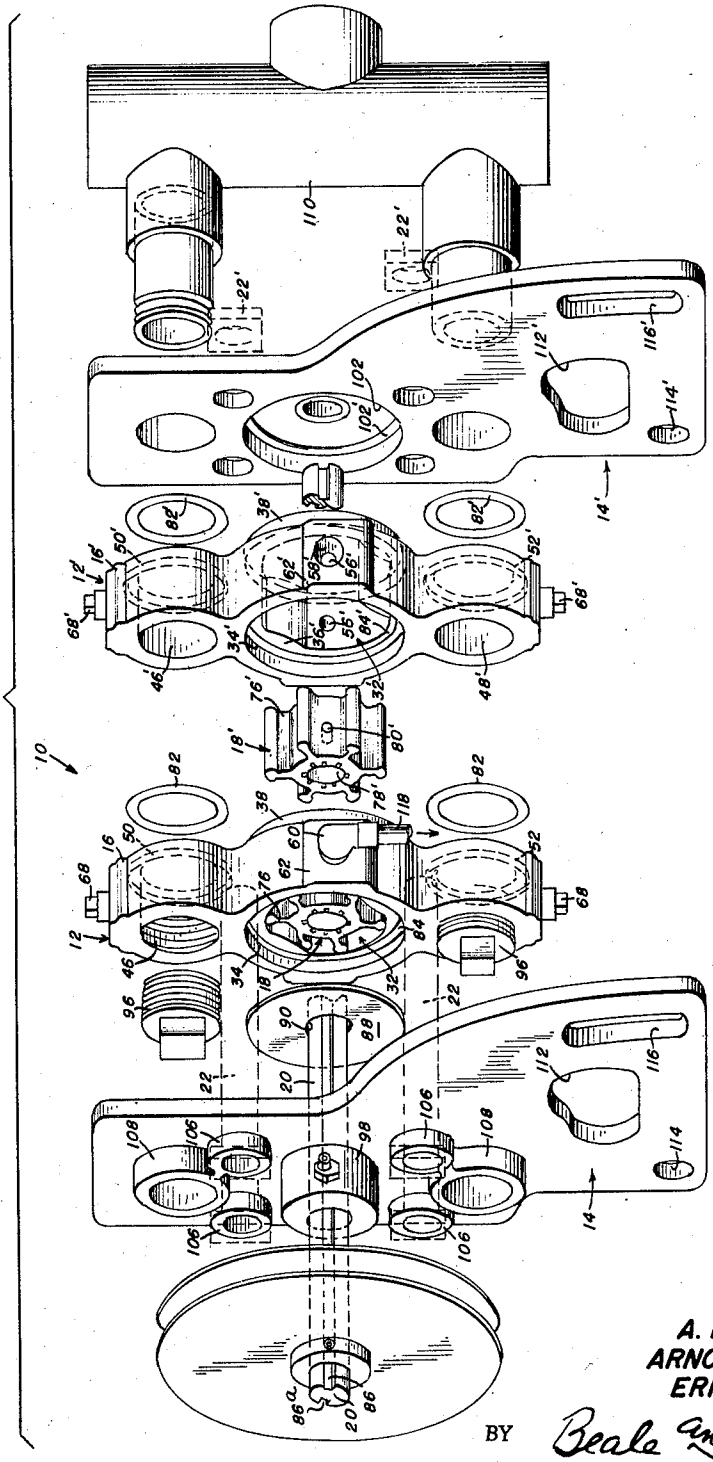
Sept. 8, 1959 A. D. DINNISON ET AL 2,902,935

PUMP ASSEMBLY HAVING PLURALITY OF INDIVIDUAL PUMP UNITS

Filed May 24, 1957 3 Sheets-Sheet 1

FIG. 1



INVENTORS
A. DEAN DINNISON
ARNOLD H. WAMSLEY
ERNEST W. HANSEN

BY Beale and Jones

ATTORNEYS

Sept. 8, 1959 A. D. DINNISON ET AL 2,902,935

PUMP ASSEMBLY HAVING PLURALITY OF INDIVIDUAL PUMP UNITS

Filed May 24, 1957 3 Sheets-Sheet 2

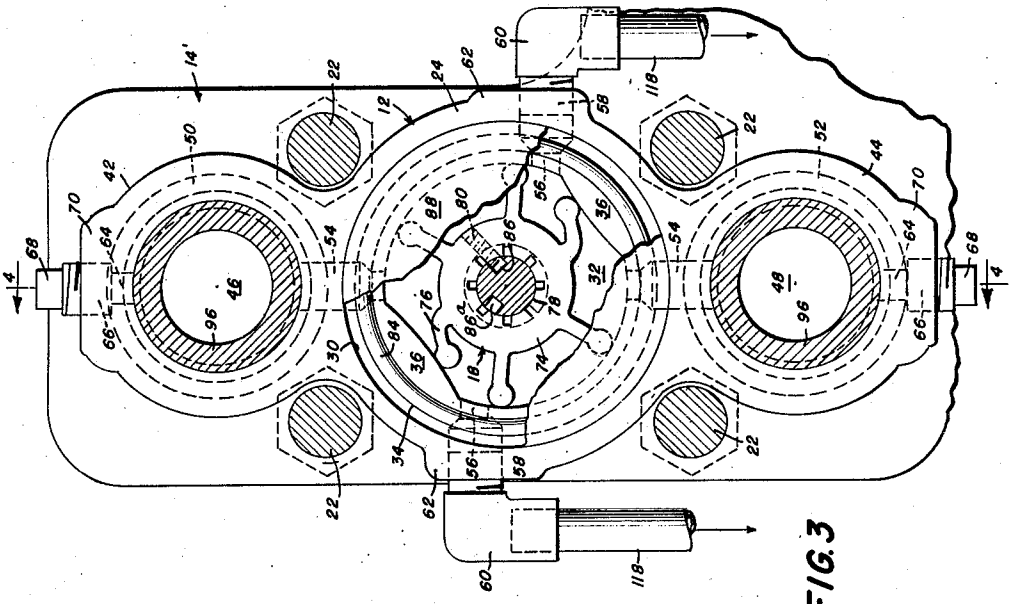


FIG. 3

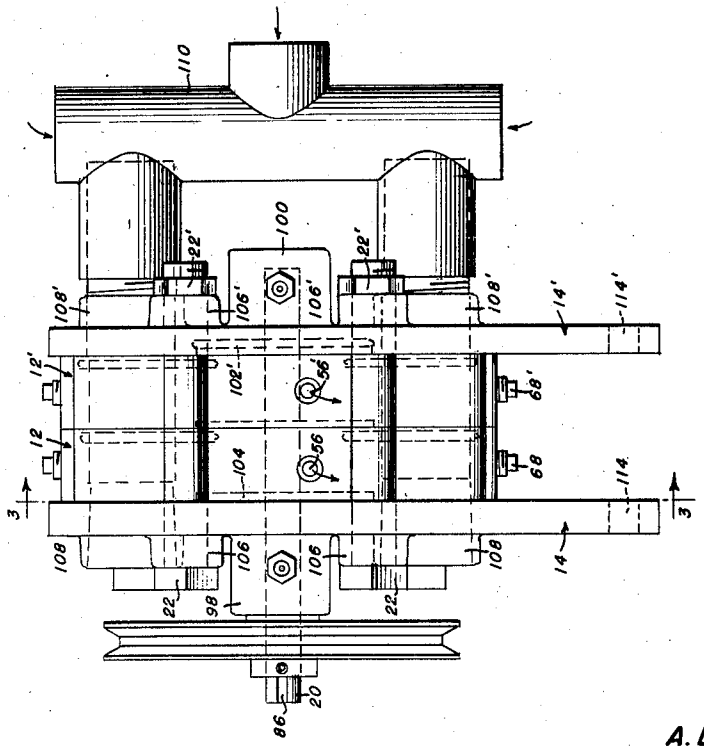


FIG. 2

INVENTORS
A. DEAN DINNISON
ARNOLD H. WAMSLEY
ERNEST W. HANSEN

BY Beale and Jones

ATTORNEYS

Sept. 8, 1959 A. D. DINNISON ET AL 2,902,935

PUMP ASSEMBLY HAVING PLURALITY OF INDIVIDUAL PUMP UNITS

Filed May 24, 1957 3 Sheets-Sheet 3

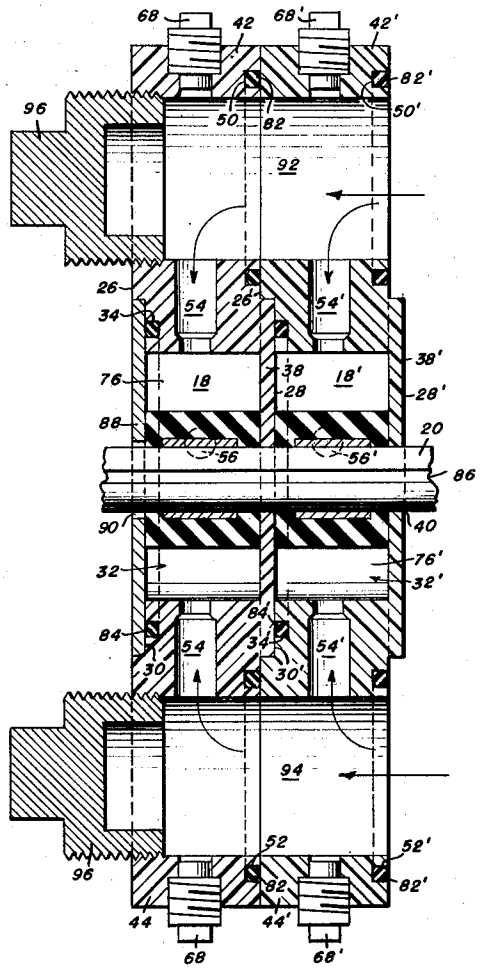


FIG. 4

INVENTORS
A. DEAN DINNISON
ARNOLD H. WAMSLEY
ERNEST W. HANSEN

BY Beale and Jones

ATTORNEYS

United States Patent Office 2,902,935
Patented Sept. 8, 1959

2,902,935

PUMP ASSEMBLY HAVING PLURALITY OF INDIVIDUAL PUMP UNITS

Arthur Dean Dinnison, Veradale, Arnold H. Wamsley, Spokane, and Ernest W. Hansen, Clarkston, Wash.

Application May 24, 1957, Serial No. 661,411

3 Claims. (Cl. 103—4)

This invention relates to a pump assembly comprised of a plurality of individual pump units. More specifically, this invention relates to a pump assembly comprising a plurality of individual pump units, each unit comprising a casing and a rotor, each of said casings having coupling means on its ends, said units being coupled in end-to-end relation, each of said rotors being operated by a single rotor shaft passing through the assembly.

Still more specifically, this invention relates to a pumping assembly comprising a plurality of identical pump casing units, each unit having a projection on one end and a recess in its other end, whereby as said units are arranged in a row in end-to-end relation with the projection of one unit nesting in the recess of an adjacent unit, the units form a compact series of individual self-contained pumps drivable by a single shaft.

It is often desirable in pumping a liquid from single or multiple sources to a plurality of outlets that the pressure at each of said outlets be equal. As an example, in the distribution of liquid fertilizer from a mobile tank having a plurality of ground-engaging fertilizer injectors, it is desirable that the pressure at each of the injectors be equal in order to discharge approximately the same amount of liquid through each injector over a given period of time so that distribution of the fertilizer will be even over the area worked and "spotty" growth will not result. In effecting such pumping in the past, it has been common to provide an outlet from the tank to a pump and to lead the pump discharge to a single manifold connecting the injectors. Disadvantages in this arrangement is obvious. In the first place, the injector nearest the pump obviously receives the greatest pressure and will therefore discharge the greatest amount of liquid. Secondly, great pump pressure is required to build up enough head to pressurize the last injector on the manifold. Thirdly, since the injectors all are connected to a single manifold, they do not operate independently: should one injector become plugged with dirt or other foreign matter, the remaining injectors would receive greater liquid pressure and would, consequently, discharge more liquid.

Hence, in the application of liquid fertilizer to the ground in a system as described above, it is desirable to have each injector connected to an independent pressure source. In the past, to accomplish such a result, individual pumps each with its casing, rotor, and shaft have been used. The cost of such an arrangement has been found to be prohibitive.

It is an object of the present invention to provide a pump assembly comprising a plurality of pump units simple and economical to manufacture.

Another object of this invention is to provide an assembly comprising a plurality of identical pump units to which plurality additional units can be easily and simply added as desired.

Another object of this invention is to provide a pump assembly comprising a plurality of individual pump units each unit having a case including only one closed end,

said units being placed end-to-end in assembly whereby the closed end of a unit becomes the second closed end of an adjacent unit, and whereby each unit is closed from its adjacent units.

Another object of this invention is to provide a pump assembly comprising a plurality of individual pump units, arranged in an end-to-end row, the outlets of each of said units being separate and independent of the other outlets.

A further object of this invention is to provide a pump assembly comprising a plurality of individual pump units, each unit having an extension defining a portion of a manifold, said portions forming, when the units are arranged in end-to-end relation, a manifold for the assembly.

A still further object of this invention is to provide a pump assembly comprising a plurality of individual units arranged end-to-end and having novel end plate means to keep the units in the assembled disposition.

This invention embodies other novel features, details of construction and arrangement of parts which are hereinafter set forth in the specification and claims, and illustrated in the accompanying drawings wherein:

Fig. 1 is an exploded view in perspective of the pump assembly;

Fig. 2 is a front elevational view of the assembled pump assembly;

Fig. 3 is an enlarged sectional view taken on line 3—3 of Fig. 2 showing the circular filler plate partially broken away to exhibit the rotor; and

Fig. 4 is an enlarged sectional view taken on the line 4—4 of Fig. 3 showing two juxtaposed pump units.

Briefly, the invention is a pump assembly comprising a plurality of individual pump units, each unit including a substantially cylindrical block having an open end and a closed end, said open end having a recess therein and a well, and said closed end having a raised projection of substantially the same shape and size and location as said recess, a central shaft hole in each closed end, each of said blocks having peripheral cylindrical projections, said peripheral projections having axial bores therethrough communicating with the inside of said well, a rotor received in each well, said assembly including a plurality of said units disposed end to end with the circular projection of one unit fitting into the recess of an adjacent unit, said peripheral projections forming manifolds, sealing means between adjacent units, and a single drive shaft extending through the shaft hole in each of said units to drive said rotors, and means to hold said units in said assembled disposition.

Referring more specifically to the drawings, the assembly of my invention is shown in the exploded view in Fig. 1 wherein the assembly is broadly designated **10**. The assembly comprises a plurality of pump units **12** and **12'** arranged in end-to-end relation and held together by end plates **14** and **14'**. While Fig. 1 shows an assembly comprising only two units, obviously any number of units could be used. Each unit includes a casing **16** and **16'** having a rotor **18** and **18'** therein, and a single shaft **20** extends through the assembly to drive the rotors in the individual units. The end plates are held together by bolt means **22** running longitudinally of the assembly. Bolt means **22** and nuts **22'** are shown in phantom in Fig. 1.

Figs. 3 and 4 show in detail the structure of the individual pump units. Each comprises a casing including a substantially cylindrical block **24** having an open end **26** and a closed end **28**. A circular recess **30** is disposed concentrically in the open end, and arranged concentrically in the recess is a deep well **32** adapted to serve as a pumping chamber. An annular groove **34** is disposed in the radial floor of the recess concentrically around the well. Formed on diametrically opposite

sides of the walls of the well are a pair of convex cams 36. On the closed end of the cylindrical block is a circular projection 38 disposed concentric with respect to the block. Projection 38 is of slightly lesser dimension than the recess 30 and is of the same shape and location with respect to the axis of the block. A shaft hole 40 extends axially through the closed end of the block.

A pair of cylindrical projections 42 and 44 having axes parallel to the axis or the block are secured to the periphery of the block at diametrically opposed points. The peripheral projections each have axial bores 46 and 48, and an annular groove 50 or 52 is disposed on the end of each of the peripheral projections adjacent the closed end of the cylindrical block. The height of the block and of the peripheral projections are the same and they are coextensive.

From inside the well of the block, openings extend more or less radially out to the outside of the block. One pair of openings 54 extend from the well through the walls of the block 24 and into the axial bores 46 or 48 in the peripheral projections. As can be seen in Fig. 3, these openings extend more or less longitudinally of the block. The openings form the inlets into the pump housing when the cam surfaces 36 are arranged on the walls of the block as shown in Fig. 3 and the impeller 18 which fits in the well 32 is turned clockwise. As can be seen in Fig. 3, the cam surfaces 36 are disposed with their centers approximately 45 degrees off the longitudinal center line of the casing 16, said angle being measured at the axis of the block. A second pair of substantially radial openings 56 form the discharge outlets for the pump and extend roughly widthwise of the block. Openings 56 are enlarged and tapped at 58 to each receive an elbow fitting 60 as shown in Fig. 3. Preferably, the block is somewhat thickened in this area 62 for extra strength in support of the fitting. At each of the extreme ends of the casing 12 an opening 64 extends radial of the peripheral projection in a direction away from the cylindrical block 24. These openings are enlarged and tapped as at 66 to each receive a threaded plug 68. The plugs terminate in a square nut adapted to be engaged by a wrench. By this means the openings may be easily opened for cleaning or inspection purposes. The peripheral projections are thickened in this area 70 to support the plugs.

The structure of an individual pump unit according to this invention has been described. A plurality of identical individual units may be used to form a pump assembly. In the drawings, an assembly comprising two units is illustrated and, for the sake of simplicity, the same reference numerals have been used to designate the same parts of each pump unit. For clarity, however, in the second unit, these reference numerals have been primed.

While the casing 12 may be made of any material, it has been found inexpensive and entirely satisfactory to form the casing of the unit from a rigid plastic. This results in a light weight unit that is non-corrosive. In using such plastic, the casing may be molded in one piece with the peripheral projections 42 and 44 integral with the cylindrical block 24.

In assembling a plurality of pump units 12, the impeller 18 or rotor made of a molded flexible material such as rubber or plastic and preferably of a corrosion resistant resilient material such as neoprene rubber is inserted in each well. The impeller (see Fig. 3) comprises a central hub 74 having a plurality of vanes 76 or fins arranged radially therefrom. The vanes 76 or fins are of such resilient nature that as the impeller 18 is turned they are distorted out of position by the convex cam surfaces 36 in the wall of the well 32. This action is as described in the Mayus et al. Patent 2,663,263. Each impeller 18 is provided with an axial shaftway 78 and a radially extending threaded opening adapted to receive a set screw 80 whereby said impeller is keyed to the shaft 20. The pump unit 12 also comprises a number of O-rings; one 82 of which is disposed in the annular groove 50 and 52 about the axial bore in each peripheral cylindrical projection 42 and 44. The third O-ring 84 is of larger size and fits into the annular groove 34 in the circular recess in the open end of the block. The O-rings are annular sealing members and are of sufficient dimension to protrude above the annular grooves in which they are positioned, respectively. They are also of sufficiently resilient nature as to give under the pressure of the abutting surface and to form a tight seal therewith so that no liquid may seep therebetween. (See Fig. 4.)

The manner in which two adjacent pumping units are assembled in end-to-end relation is shown in Fig. 4. With the O-rings in their respective grooves, the units are arranged with the circular projection 38 on one unit extending into the circular recess 30' of a second unit so that the recess O-ring 84' abuts the circular projection 38. The axial bores 46 and 48 in the peripheral projections 42 and 44 respectively are aligned, and the O-rings 82 are placed between peripheral projections on adjacent units. Under compression the three O-rings which are disposed between adjacent units 12 and 12' are flattened to form a seal about the axial bores and the pump chambers. The single shaft 20 which extends through the shaft holes 40 in the row of end-to-end units and also through the axial shaft-ways 78 of the impellers 18 is formed with a spline 86, and the set screw 80 of each impeller 18 extends into the spline slightly to key the impellers with respect to the shaft. The set screws 80 are not tightened: instead the impellers 18 are allowed free play along the shaft 20 so that the abutment of the ends of each impeller on the opposite walls of its pump chamber are equalized, affording a good seal on both ends. The shaft 20 may be splined at two points as shown at 86 and 86a to enable the impellers 18 to be staggered radial to distribute the load.

To close off the open end of the cylindrical block 24 disposed at the end of the row of units, a circular plate 88 having a central aperture 90 is provided. As shown in Fig. 4, this plate 88 fits around the shaft 20 and, under compression, engages the end of the impeller hub 74 and the O-ring 84 in the recess 30 to seal the pump chamber from leakage.

As can be seen, the axial bores 46 and 48 of peripheral projection of adjacent units, when aligned, form manifolds 92 and 94 to supply liquid to the inlet ports of the pump units. As shown in Fig. 4, one end of each of the manifolds may be internally threaded and plugged by a conventional threaded plug 96. These plugs are similar to the plugs 68 in the peripheral cylindrical projections.

Covering the ends of the assembled row of pump units are the end plates 14 and 14', one plate being disposed respectively over each end. The end plates are each provided with an outwardly extending cylindrical projection 98 and 100, respectively, housing a bearing (not shown) adapted to journal the shaft. Bearing 98 is opened at its end to allow an end of the shaft 20 to extend therethrough for engagement by suitable driving means. Bearing 100 may be closed at its end. Appropriate grease fittings are provided in the bearings. The end plate 14' which is adapted to engage the end of the row of units exposing a closed end having a circular projection 38' has a suitable recess 102 located concentrically about bearing 100 to receive the projection. An annular cushion 102' may be provided in the recess to form a seating for the projection. The opposite end plate 14 is adapted to engage the end of the row of units having an open end closed by circular plate 88. Therefore, its inside surface is unrecessed. Instead, a circular projection 104 may be provided around

the hole for shaft **20** to force the plate against the O-ring **84**. (See Fig. 2.)

The outer surfaces of both end plates **14** and **14'** have a plurality of raised bosses thereon. (See Fig. 2.) Each end plate is equipped with four open bosses **106** arranged preferably symmetrical about the bearing projection, and adapted to receive in abutment on their outer surfaces the head of a bolt **22** or a nut **22'**. The bolts **22** extend the length of the unit and draw the end plates together, causing the units **12** and **12'** to be held compressively therebetween. Additional open bosses **108** are arranged on the outer surfaces of the end plates. These additional bosses may all be interiorly threaded to receive in the case of the end plate **14'** a portion of the closing plugs **96** threadedly engaged by the end unit **12**. In the case of the end plate **14'** the larger open bosses **108'** may be internally threaded to receive exterior piping connection such as the ends of the Y-shaped connecting member **110** as shown in Figs. 1 and 2. End plate **14'** may be referred to as the connecting end plate.

At their lower ends, the end plates **14** and **14'** are each enlarged and each is provided with a lightening hole **112** or **112'** respectively to reduce the weight of the members. The enlarged areas in the two end plates have aligned openings **114** and **114'** being aligned, to provide means to pivot mount the assembly **10** and aligned arcuate slots **116** and **116'** for fixing the pivot.

With the device assembled (see Fig. 2) it is easy to install. Briefly, the assembly is firmly supported by bolts engaging holes and arcuate slots. A source of liquid is connected to the manifolds **92** and **94** through the Y-shaped fixture **110**. Thus, liquid is supplied to each of the pump chambers through both its inlet passages **54**. To the outlet elbow fittings **60** suitable flexible hosing **118** may be attached leading to the desired point of use of the fluid. The shaft **20** is then turned by drive means associated with its end. As it rotates, the impellers **18** force fluid by positive displacement out of the separate outlet ports **56** to the point of use.

Because the assembly according to this invention is extremely simple and inexpensive, it is now feasible to provide in a compact assembly a separate pump for each of multiple outlets. By making this accomplishment feasible, our invention will be appreciated in all sorts of uses, the distribution of liquid fertilizer merely being one.

In addition, this invention offers the feature that if more individual outlets are needed, additional units **12** need only be added to the assembly.

While this invention has been shown in but one form, it will be obvious to those skilled in the art that it is not so limited but is susceptible of various changes and modifications. We do not desire to be limited by this specific disclosure, but by the spirit of the appended claims.

We claim as our invention:

1. A pump assembly comprising a plurality of identical pump units, each unit comprising a substantially cylindrical block and a pump rotor, said block having an opened end and a closed end, said open end having a circular axially inwardly extending recess having a radial floor, said floor having a substantially circular axially inwardly extending well adapted to serve as a pumping chamber, said recess and said well being located concentrically in said substantially cylindrical block and said well receiving said pump rotor, said block having peripherally outwardly extending manifold sections on diametrically opposite sides thereof, each of said manifold sections having a bore extending therethrough in a direction parallel to the axis of the block, means communicating each of said bores to said well, each of said wells having radially extending outlet openings, said closed end having a shaft hole therein and an axially outwardly extending circular projection, said shaft hole and said circular projection being located concentrically in said substantially cylindrical block, said circular projection being of slightly less diameter than said recess, said blocks being juxtaposed in an end-to-end row, with the projection of the closed end of one block nesting into the recess in the open end of the next adjacent block, said projection closing the well of the said next adjacent block, said bores in the manifold sections of adjacent blocks being aligned to form fluid manifolds each communicating with the wells of each of the individual pump units, a shaft extending through the shaft hole in each of said blocks and engaging each of said rotors whereby as the shaft is turned relative to said blocks, said rotors turn with respect to said blocks to pump fluid through said manifolds, into said wells and out of said outlet openings.

2. A pump assembly as described in claim 1 wherein the radial floor of said recess is formed with an annular groove located concentrically about said well, said last named groove receiving an annular resilient sealing member, said annular resilient sealing member engaging the axially outwardly extending circular projection on the adjacent block which nests in said recess.

3. A pump assembly as described in claim 1 wherein one side of each manifold section is formed with an annular groove located concentrically about each bore and an annular resilient sealing member is received into each groove respectively, said annular resilient sealing member engaging the adjacent manifold section on the adjacent pump unit about the bore thereof.

References Cited in the file of this patent

UNITED STATES PATENTS

796,724	Hewitt	Aug. 8, 1905
1,218,300	Nelson	Mar. 6, 1917
1,531,607	Green	Mar. 31, 1925
2,548,865	Gordinier	Feb. 5, 1952
2,620,553	Schultz	Dec. 9, 1952
2,663,263	Mayus et al.	Dec. 22, 1953
2,669,466	Cloete	Feb. 16, 1954

FOREIGN PATENTS

25,545	Finland	Aug. 27, 1952
596,064	Great Britain	Dec. 24, 1947
630,393	Great Britain	Oct. 12, 1949