May 2, 1967 H. J. SADLER 3,316,852

PUMP

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2 Sheets-Sheet 1

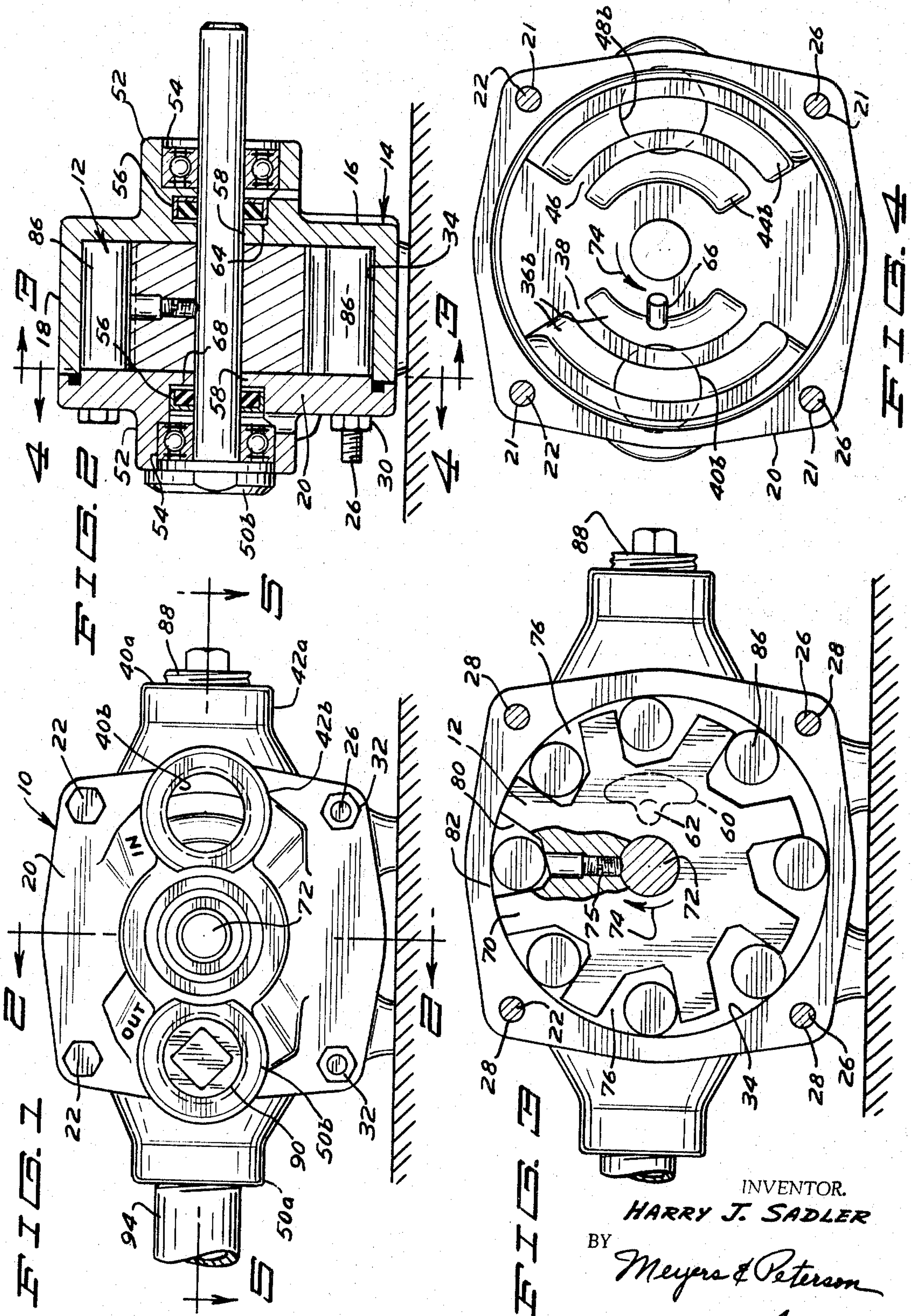

FIG. 1 FIG. 2 FIG. 3 FIG. 4

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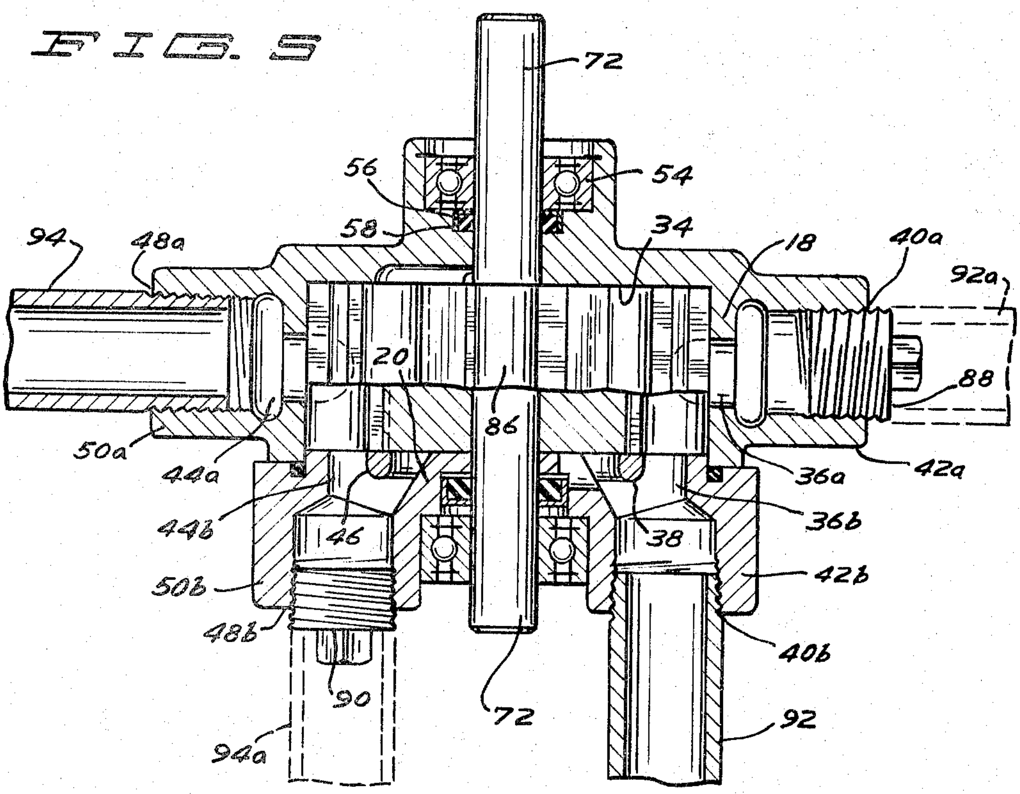
FIG. 5



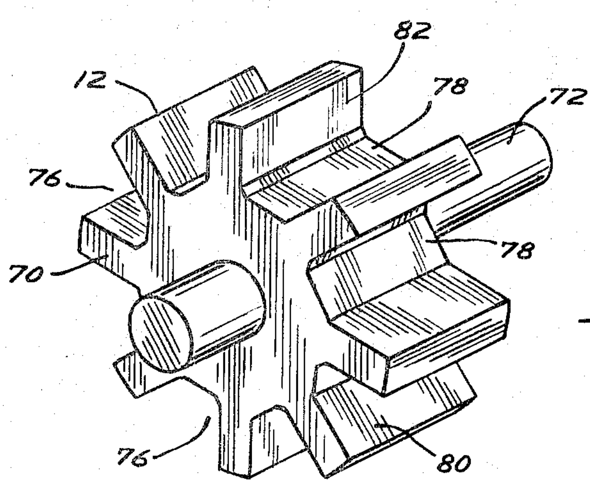


FIG. 6

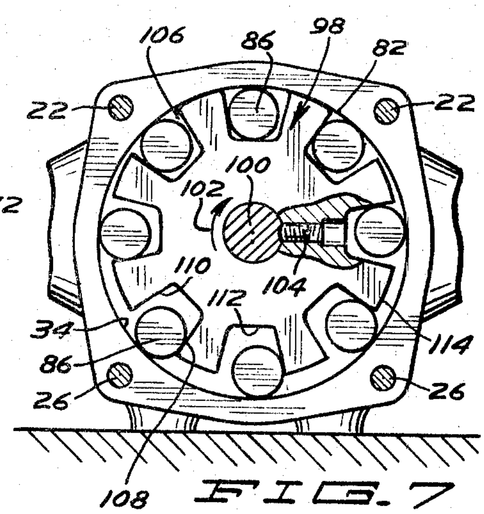


FIG. 7

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Continuation of application Ser. No. 419,022, Dec. 17, 1964. This application Sept. 22, 1966, Ser. No. 584,628
14 Claims. (Cl. 103—136)

The present invention relates to rotary pumps and more particularly to rotary pumps of the type which employ free floating roller elements, and is a continuation of my co-pending application Ser. No. 419,022, filed Dec. 17, 1964, and entitled, "Pump."

In the normal performance of pumps, it is generally desirable to provide a pump unit which has high capacity for its size and which is economical to produce in a manufacturing operation. As a class, roller pumps generally meet these desirous performance characteristics, and have certain performance parameters which adapt them to use in a wide variety of applications. Roller pumps are defined generally in United States Patents 2,765,745 and 3,119,345, the former patent defining a side-ported unit, the latter patent defining an end-ported unit. Each of these patents is assigned to the assignee of the present invention.

Since the output of a roller pump is a result of work performed by the individual roller elements, any manner of eliminating or reducing roller wear will enhance the over-all operation of the pump. The improved rotor design of the present invention is one which substantially reduces roller wear, and thus increases the life of the roller for a given application, and also permits the use of new varieties of materials as roller elements. The adaptability of roller pumps to a wider variety of applications generally is therefore accomplished.

In accordance with the present invention, a roller pump is provided having a cylindrical pumping chamber with an improved rotor journaled for rotation therewithin. The rotor has a modified slot or roller receiving design for enhancing the over-all operation of the pump. The improved rotor has arcuately spaced roller receiving slots, each slot being defined by angularly disposed leading and trailing faces, the trailing face being located substantially along a radius line through the central axis of the rotor. This design permits a more extended or extensive trailing edge to be employed, thus increasing the capacity of the pump to a practical maximum for the housing size employed, increasing the pressure capability by improving the dynamic or running seal, and also limiting or practically eliminating any possibility of scuffing action between the surfaces of the roller receiving slot of the rotor and the body of the roller per se. Furthermore, the need for a scoop to be formed in the rotor adjacent to the roller receiving slots is eliminated by the design of the present invention, thereby increasing the area of restriction defined between the rotor surface and the housing surface. This increase in area effectively enhances the valving action between adjacent slots, increases the area of contact that the roller makes with the rotor surface, reduces wear on the rollers, and reduces clattering or chattering of the rollers between opposed faces of the roller receiving slots particularly as the rotor, in a dynamic situation, traverses the zone between the suction side and the pressure side of the pump. The rotor design is also adaptable for simple reversal of rotation for running.

Therefore, it is an object of the present invention to provide an improved rotor design for roller pumps which increases the capacity and pressure capability of the pump to a practical maximum permissible by the configuration of the pump housing.

It is a further object of the present invention to provide an improved design for a rotor for roller pumps which will

permit the use of a rotor having roller receiving slots which are designed to maintain the roller in close running tolerance with the inner surface of the housing, and thus permit the leading and trailing surfaces of each roller receiving slot to act as an efficient low friction dynamic or running seal in the sector between the angularly spaced inlet and outlet ports of the pump chamber.

It is yet a further object of the present invention to provide an improved rotor design having rotor receiving slots arranged in angularly spaced disposition therearound, each slot having a bottom surface and a pair of angularly disposed leading and trailing faces arranged in radially outwardly diverging relationship, the slot design providing improved pumping action manifested by increased efficiency and reduction of noise and wear in the various pump components.

It is still a further object of the present invention to provide a pump design which will accommodate either end-porting or side-porting arrangements such that fluid flow may be established through the pump with either circumferential or circumferential-transverse displacement.

Other and further objects of the present invention will become apparent to those skilled in the art upon a study of the following specification, appended claims, and accompanying drawings, wherein:

FIGURE 1 is an end elevational view of a pump construction exemplifying the invention, and being particularly adapted to utilize the improved rotor of the present invention, the side inlet being shown in a blocked or plugged condition, and the end outlet being similarly plugged or blocked;

FIGURE 2 is a vertical sectional view taken along the line and in the direction of the arrows 2—2 of FIGURE 1;

FIGURE 3 is a view corresponding to FIGURE 1 but with the detachable end wall or face plate of the pump being removed, the view showing the configuration of the improved rotor structure, and being taken along the line and in the direction of arrows 3—3 of FIGURE 2;

FIGURE 4 is a view of the inside face of the detachable end wall or face plate, the view being taken along the line and in the direction of arrows 4—4 of FIGURE 2;

FIGURE 5 is a horizontal sectional view taken along the line and in the direction of the arrows 5—5 of FIGURE 1;

FIGURES 6 is a perspective view of a rotor together with its accompanying shaft, the view illustrating the specific design of the roller receiving slots which are formed in the rotor; and

FIGURE 7 is a view similar to FIGURE 3 showing a rotor with a somewhat modified configuration.

Referring now in detail to the drawing which illustrates the preferred embodiment of the present invention, the rotary pump selected to illustrate the invention together with its environment and use comprises a housing generally designated **10** and a rotor assemblage generally designated **12** which is journaled therein. The housing **10** includes a cup-shaped body **14** having an integral plate or end wall **16** and an intermediate circumferential wall **18**. Additionally, the housing **10** includes a removable or detachable face plate or end wall **20**. The end wall **20** is provided with quadrantly spaced holes **21** (FIGURE 4). The upper two holes accommodate a pair of tap screws **22** that extend into two tapped upper holes **24** (FIGURE 3) located in the cup-shaped body **14**. In a somewhat similar fashion, a pair of threaded studs **26** are anchored in a pair of tapped lower holes **28** in the cup-shaped body **14**. Threaded into the studs **26** are a pair of set nuts **30** which cooperate in holding the face plate or end wall **20** against the cup-shaped body **14**. The studs **26** also function as a mounting means for attaching the entire pump to a suitable mounting fixture, as required, a pair of retaining cuts **32** being provided to act in this capacity.

The integral end wall **16** and the intermediate circumferential wall **18** of the cup-shaped body **14** in combination with the removable end wall **20** forms a cylindrical pumping chamber **34**. Leading into the pumping chamber **32** from one side is an inlet port *36a*, as best shown in FIGURE 5, this port being located in the wall **18**. End inlet port *36b*, as shown in FIGURES 4 and 5, leads into the pumping chamber **34** through the wall **20**. As best viewed in FIGURES 4 and 5, the end inlet port is divided by means of an arcuate rib **38**. The side inlet port *36a* has direct communication with an inlet *40a*, whereas the end inlet port *36b* has direct communication with an inlet *40b*. The inlet *40a* is formed by reason of an internally threaded boss *42a* and the inlet *40b* is similarly formed by an internally threaded boss *42b*. A side outlet port *44a*, as shown in FIGURE 5, is formed in the wall **18** and an end outlet port *44b* as illustrated in FIGURES 4 and 5 is provided in the wall **20**. As with the end inlet port *36b*, the end outlet port *44b* is divided by an arcuate rib, the rib bearing the reference numeral **45**. Directly communicatign with the outlet numeral **45**. Directly communicating with the outlet ports *44a* and *44b* are outlets *48a* and *48b* respectively, which are formed by reason of internally threaded bosses *50a* and *50b*.

As illustrated in FIGURE 2, the end walls **16** and **20** are provided with oppositely directed bosses **52**, each of which contains a bearing **54** and a shaft seal **46**. These walls **16** and **20** additionally include aligned shaft openings **58**. The end wall **16** is formed with a shallow cavity **60**, as shown in FIGURE 3, which communicates with a small passageway **62** leading from a space or void **64** between the end wall **16** and the shaft seal **56** nearest thereto, the passageway extending to a point of reduced pressure within the pumping chamber **34**. In a similar fashion, a passageway **66** in the wall **20** extends from a space or void **68** between the wall **20** and the seal **56** adjacent thereto to the inlet port *30b* which is, of course, at a point of reduced pressure.

Describing now the rotor assemblage **12**, with particular attention being directed to FIGURES 3 and 6 of the drawings, it will be observed that this assemblage includes a rotor body **70** appropriately secured, as by set screw **75** or alternatively by key means (not shown) to a shaft **72** passing through the previously mentioned shaft openings **58** and being journaled in the bearings **54**. The shaft is driven by a source of rotative power (not shown) in the direction indicated by arrow **74**. In other words, the shaft **72** and the rotor body **70** mounted thereon are rotated in a clockwise direction as viewed in FIGURE 3. As is customary in pumps of this type, the axis of rotation of the rotor body **70** is offset from the central axis of the cylindrical pumping chamber **34**.

From FIGURES 3 and 6, it can be seen that the rotor body **70** is formed with a plurality of roller receiving slots **76** that extend radially inwardly from the periphery of the rotor and also extend across the entire width thereof. In other words, the slots **76** are substantially coextensive in length with the axial length of cylindrical pumping chamber **34**. The slots **76**, therefore, each have a bottom surface **78** together with a leading face **80** and a trailing face **82**, the leading and trailing faces **80** and **82** being generally angularly oriented, one to another, in radially outwardly diverging relationship. The leading and trailing faces **80** and **82** are preferably disposed at an acute angle of between 30° and 50°, one to another. More specifically, this angle is between about 35° and 45°, and preferably about 45°. In operation, the trailing face **82** provides a driving face for the roller which is retained within the slot, and it will be observed that this trailing face **82** is disposed along a radius line or along a plane passing through the center of the rotor body **70**. Thus, the trailing face **82** extends along substantially a full dimension or full radius of the pumping chamber thus utilizing the maximum available capacity of the pumping chamber for controlling the roller disposition during the pumping action. For reasons to be given below, scuffing action on the surface of the roller is substantially eliminated by this design.

Disposed in each of the individual slots **76** and coextensive with the length thereof is a cylindrical roller element **86** that is movable inwardly and outwardly within its particular slot. The roller elements **86** sequentially produce the requisite pumping action as they move radially inwardly and outwardly with rotation of the rotor body **70**.

The clearance available between each roller member **86** and each leading edge **80** of the slot permits free flow of fluid within the individual slots **76**, and also renders the pump capable of being ported universally, that is, either side ported or end ported as shown in the drawings. In addition, the slot design prevents vibration of the pump during operation because of the improved valving between adjacent slots as provided by the uniformly formed solid webs defined by adjacent leading and trailing faces.

Because of the positioning of the trailing face, that is, along the radius line of the rotor, it is possible to extend this face to a point which is below the center line or center axis of the roller while still maintaining a proper circumferential clearance between the rotor and the housing surface. For a roller having a diameter of 0.675 inch, an extension of the trailing face of about 0.045 inch below the center line of the roller when the roller is in fully extended position has been found to be useful. Other rotor sizes may be similarly proportioned. The roller materials may be nylon, hard rubber or the like, the improved rotor design making it possible to employ roller materials which previously have been found unsuitable for this type of pumping operation. Because of the narrow clearance which exists at the upper end of the pumping chamber, this is being made possible by locating the trailing face **82** along a radius line of a rotor, and because of the design of the roller receiving slot, there is less tendency during operation for the individual roller to be sharply driven or drawn across the slot by the pressure gradient which exists in the seal area or sector and vacuum sides of a pumping chamber, thus eliminating clatter and its accompanying roller scuffing. This feature is equally true when the individual rollers are at the fully extended disposition at the 6 o'clock position in the pumping chamber as illustrated in FIGURE 3.

Each roller receiving slot is designed and dimensioned to receive its roller in a particular manner. The roller is never confined tightly between the leading face **80** and the trailing face **82**, but when fully retracted within the slot **76**, may rest against the substantially planar bottom surface **78** without contacting either leading face **80** or trailing face **82**. In a running condition, when the rotor is in the center of the seal area or sector, such as in a 12 o'clock position in FIGURE 3, the roller extends substantially between the inner surface of the housing chamber and the bottom surface **78** of the roller receiving slot.

While approaching this 12 o'clock position, the roller contacts the inner surface of the pumping chamber and the trailing edge **82** of the slot **76**. Upon reaching the top or 12 o'clock position, the roller will be in substantially mutual contact with the surface of the pumping chamber and the bottom of the slot **76** while transversing the path from the trailing face to the leading face. Upon leaving the center of the seal area, the 12 o'clock position, the pressure differential in the areas of the chamber between the pressure side and the vacuum side will drive the roller from the trailing face **82** toward the leading face **80**. Since the slots **76** are sufficiently wide, the rollers are free to so move and fluid is also free to move into and out of the confines of the slot. This arcuate movement of the rollers is smooth and no scoop or rotor porting arrangement is neecssary. The leading face **80** is therefore planar and offers a broad contacting surface area for the rollers, thereby reducing roller wear when contact is made between the roller surface and this leading face. Therefore, the depth of the roller receiving slots **76** is substantially equal to the diameter of the roller retained therein, and the allowances being made for running tolerances, width dimension of these outwardly diverging slots at the bottom or narrowest point exceeds the radius of the roller. Additionally, the width dimension of these slots **76** measured or taken along a plane which passes through the central axis of a roller and intersecting both the leading face and trailing face thereof is always greater than the diameter of the individual rollers. For a 3.85 inch diameter rotor having 8 slots, and using 0.675 inch diameter rollers, a bottom width of 0.5 inch with a 45° divergence angle has been found satisfactory.

It is a feature of this arrangement that roller wear is reduced and therefore a wider range of roller materials may be used. It is a further and significant feature of this arrangement that the output curve is flattened, that is, the output does not drop rapidly with an increase in pressure. The slot width and configuration provides for exceptionally smooth running of the pump. Thus, as the roller is moving between, for example, the pressure sector and the suction sector, there will be a tendency to transfer the roller from a disposition adjacent the trailing surface to a disposition adjacent the forward surface. In the structure as provided herein, this transfer is smooth, gentle, and is accomplished without any unusual roller wear being experienced. As previously indicated, the walls of the rotor slots are planar, and there is no unusual occurrence of discontinuities which will tend to render the surface forces concentrated so as to increase the rate of roller wear. When seated in the roller slot, contact is available between the roller and the slot walls against the bottom surface, and one or the other of the leading or trailing surfaces. The width is wide enough at this point to accommodate the roller in either disposition.

By a similar fashion, as the individual rollers traverse the area between the suction side and the pressure side, they are free to move against the surfaces of the slots in such a fashion that chattering is generally avoided, and since the surfaces of the slots are planar, concentrations of contact area are avoided and the pressure contact is available across the entire surface of the slot faces. In this fashion, enhanced valving action is available to permit fluid to freely flow on all sides of the rollers as they move radially within the confines of the individual slots.

In the general operation of the pump, the shaft **72** together with rotor body **70** rotates in the direction of the arrow **74**, this being in a clockwise direction, as viewed in FIGURES 1, 3 and 6. The various roller elements **86** are forced outwardly by the centrifugal force present in the dynamically moving system so as to ride against the inner surface of the circumferential wall **18**. In this regard, it will be remembered that the roller elements are free to move within the slots **76**, the roller elements being carried along with the rotor by reason of the engagement of the roller elements with the respective trailing face **82** of the individual slot **76** within which the roller is positioned. The rotor body **70** has its ends residing in a proximal relationship with the end walls **16** and **18**, with normal running clearances or tolerances being utilized. Hence, the roller elements **86** are prevented from shifting or moving axially within the individual slots **76**.

As best seen in FIGURE 3, as the roller elements **86** move into juxtaposition with the inlet ports **36a** and **36b**, fluid will be drawn or sucked through the particular inlet ports **36a** and **36b** (or both) depending upon which are operative, being unblocked or unplugged and accordingly coupled to a suitable source of fluid. When the side inlet port **36a** is plugged as indicated at **88**, under these circumstances, the fluid will be drawn in by way of the inlet port **36b**. While under these assumed conditions, the fluid originally enters between the bottom **78** of the particular slots **76** which pass the inlet port **36b**. The fluid is further caused to be drawn into the space between the intermediate circumferential wall **18** and the periphery of the rotor body **70** due to the action derived from the preceding roller **36**. In this regard, it will be recalled that the leading face **82** of each slot **76** is generally angularly oriented with regard to the trailing face so that this specific type of pumping action is believed to be occurring.

As the roller elements **86** are progressively moved from a horizontal or 3 o'clock position to a bottom or 6 o'clock position, more and more fluid is drawn into the regions between the cylindrical roller elements **86** and the bottom **78** of the various individual slots **76**. However, as the roller elements **86** are moved upwardly from their lowermost successive positions toward a horizontal 9 o'clock position, the region or volume intermediate the circumferential wall **18** and the periphery of the rotor body **70** decreases, as is clearly visible in FIGURE 3, and the progressive decrease causes the entrapped fluid to be forced outwardly through the outlet port **44a** inasmuch as the outlet port **44b** is shown blocked by the plug **90**. Thus, communication is provided in such a fashion that the fluid will be discharged through the pipe **94**.

When the end inlet port **36b** is blocked and the side inlet port **36a** is open, the pipe **92a** shown in phantom outline is connected to the internally threaded boss **42a**, and the plug **88** is placed in the boss **42b**. Similarly, the pipe **94a** can be utilized as the outlet conduit, the plug **90** then being positioned in the boss **50a**.

In the modified situation mentioned above, it is readily apparent that as the various roller elements **86** pass the inlet port **36a**, fluid will be drawn into the region between the circumferential wall **18** and the periphery of the rotor body **70**. As the rotor carries the roller elements around the chamber, the confined fluid will be forced outwardly because of the space between the circumferential wall **18** and the periphery of the rotor body **70** gradually decreases. Any fluid between the circumferential wall **18** and the periphery of the rotor bodies **70** will be forced into the roller slots and thence outwardly through the now open outlet port **48b**. It will be remembered that the plug **90** has, for the sake of discussion, been transposed from the boss **50b** to **50a**. Hence, fluid will be discharged under pressure through the pipe **94a**, shown in phantom outline in FIGURE 5.

Attention is now directed to FIGURE 7 of the drawings wherein there is illustrated a modified form of rotor body generally designated **98**. The rotor **98** is secured to shaft **100** and is adapted for rotation in the arcuate direction indicated by arrow **102**, the rotor being locked to the shaft **100** by means of the set screw **104** which is disposed in a threaded bore in the rotor **98** as indicated. Along the peripheral surface of the rotor **98**, a plurality of arcuately spaced slots **106** are formed, each slot having angularly disposed trailing and leading faces **108** and **110** respectively. These faces are at an acute angle of between about 15° and 25°, and preferably about 20°. The slots **106** further have a bottom surface **112** which is spaced from the outer surface **114** a sufficient distance to accommodate a roller **85** therewithin. When roller **86** is disposed in contact with the bottom surface **112**, there is preferably a narrow gap between the trailing and leading faces **108** and **110** and the roller.

The trailing and leading faces **108** and **110** are preferably formed in a planar configuration, and the faces nevertheless are disposed generally along a plane passing through the central axis of the rotor. In other words, a plane which passes through the central axis of the rotor **98** will also pass along both the trailing face **108** as well as the leading face **110** of each of the individual slots **106**. It will be appreciated that it is not essential that the individual trailing and leading faces be formed with a planar surface, and the arcuate surfaces may be used as well, however. It has been found that the planar faces more effectively relieve the scuffing action which may otherwise result in connection with the roller devices during their operation. The radius of the arc upon which the surfaces of the trailing and leading faces **108** and **110** is sufficiently great in order to prevent a substantial moment force being applied against the surface of the roller in the direction of the cylindrical surface of the pumping chamber. For a rotor having a diameter of 3.8 inches, and employing a roller having a diameter of 0.675 inch, an arcuate surface having a radius of 0.175 inch has been found satisfactory. Other sizes will be in the same general proportion.

Inasmuch as the individual trailing and leading surfaces **108** and **110** are symmetrically disposed relative to the central axis of the rotor, the rotor may be readily turned for reversal when desired. Rotor **98** will normally employ the shallow cavity **60**, as shown in FIGURE 3, which communicates with a small passageway **62** leading from a space or void **64** between the end wall **16** and the shaft seal **56** nearest thereto, the rotor should be reversed in the chamber in order that the cavity **60** will be in the proper relationship relative to the ports and seals.

Because of the uniform design of the rotor elements **70** and **98**, it will be possible to fabricate these components using powdered metallurgy techniques. Close or fine machining may not be required when these techniques are employed.

Therefore, the versatility of the pump of the character disclosed herein will be readily appreciated. It will, of course, be understood that various changes may be made in the form, details, arrangements, and proportions of the parts without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed:

1. A fluid pump comprising:
(a) a housing having a cylindrical pumping chamber therein;
(b) said pumping chamber being defined by an inner circumferential wall and a pair of spaced circular end walls;
(c) a rotor rotatably mounted within said pumping chamber and having its axis in offset parallel relation to that of said pumping chamber and having a width such as to extend from one of said circular end walls to the other;
(d) said rotor having a plurality of roller receiving slots of predetermined depth formed into and across the circumferential surface thereof;
(e) a roller having a predetermined diameter disposed for free rotation in each of said roller receiving slots and having an axial length extending from one of said circular end walls to the other;
(f) arcuately spaced inlet and outlet ports communicating with said chamber through arcuately spaced openings in said walls; and
(g) the said roller receiving slots in said rotor having a bottom surface with a generally planar central portion and generally angularly oriented planar leading and trailing faces disposed in radially outwardly diverging relationship, one to another, with the said trailing face being disposed substantially along a radius line of said rotor, and with the sum of said predetermined depth and a gap between said rotor edge and said inner circumferential wall and being substantially equal to said predetermined diameter and with the slot width at a distance radially outwardly from the base of said slot equal to the radius of said roller being greater than the diameter of said roller, the arrangement being such that simultaneous contact is possible between said roller, said bottom surface, and one only of said leading and trailing surfaces.

2. The fluid pump as defined in claim **1** being particularly characterized in that the outer edge of said trailing face surface is spaced from said inner circumferential surface a distance which is always less than the radius of said roller.

3. The fluid pump as defined in claim **1** being particularly characterized in that said leading and trailing faces are spaced apart by said bottom surface a distance which exceeds the radius of said roller, and are spaced apart at a point radially outwardly from the bottom surface equal to the radius of said roller by a distance substantially equal to the diameter of said roller.

4. A fluid pump comprising:
(a) a housing having a cylindrical pumping chamber therein;
(b) said pumping chamber being defined by an inner circumferential wall and a pair of spaced circular end walls;
(c) a generally cylindrical rotor rotatably mounted within said pumping chamber and having its axis in offset parallel relation to that of said pumping chamber and having a width such as to extend from one of said circular end walls to the other;
(d) said rotor having a plurality of roller receiving slots of predetermined depth formed into and across the circumferential surface thereof;
(e) a roller having a predetermined diameter disposed for free rotation in each of said slots and being spaced from, but in close clearance with, the sides thereof and extending from one of said circular end walls to the other;
(f) arcuately spaced inlet and outlet ports communicating with said chamber through arcuately spaced openings in said walls; and
(g) the said roller receiving slots in said rotor having a bottom and generally angularly oriented generally planar leading and trailing faces disposed at an acute angle to one another in radially outwardly diverging relationship with the said trailing surface being substantially along a radius line of said rotor, and with the sum of said predetermined depth and a gap between said rotor edge and said inner circumferential wall being substantially equal to said predetermined diameter and with the slot width at a distance radially outwardly from the base of said slot equal to the radius of said roller being greater than the diameter of said roller, the arrangement being such that simultaneous peripheral contact occurs between the surface of said roller and said bottom surface and one only of said leading and trailing surfaces.

5. The fluid pump as defined in claim **4** being particularly characterized in that said roller receiving slots define a roller receiving cavity having a spacing between leading and trailing faces greater than the diameter of said roller as measured along a plane passing through the central axis of said roller and outwardly from the base of said slot a distance greater than the radius of said rollers.

6. The fluid pump as defined in claim **4** being particularly characterized in that said acute angle ranges from between 30° and 50°.

7. The fluid pump as defined in claim **6** being particularly characterized in that said acute angle ranges from between about 35° and 45°.

8. The fluid pump as defined in claim **6** being particularly characterized in that said acute angle is 45°.

9. A fluid pump comprising:
(a) a housing having a cylindrical pumping chamber therein;
(b) said pumping chamber being defined by an inner circumferential wall and a pair of spaced circular walls;
(c) a rotor rotatably mounted within said pumping chamber and having its axis in offset parallel relation

to that of said pumping chamber and having a width such as to extend from one of said circular end walls to the other;

(d) said rotor having a plurality of roller receiving slots of predetermined depth formed into and across the circumferential surface thereof and having a bottom and angularly oriented leading and trailing faces;

(e) a roller disposed for free rotation in each of said slots having a diameter equal to the sum of said predetermined depth and the gap between said rotor edge and said inner circumferential wall, and being spaced from each of said faces along the entire depth thereof in and extending from one of said circular end walls to the other;

(f) arcuately spaced inlet and outlet ports communicating with said chamber through arcuately spaced openings in said walls;

(g) the said leading and trailing faces being disposed at an acute angle, one to another, in radially outwardly diverging relationship, the said trailing face being disposed substantially along a radius line of said rotor and terminating in a surface arranged in closely spaced relationship along a predetermined portion of the inner surface of said circumferential wall between said inlet and outlet ports; and

(h) the arrangement being such that simultaneous conthat occurs between the surface of said roller, said bottom surface and only one of said leading and trailing surfaces.

10. The fluid pump as defined in claim **9** being particularly characterized in that the surface along which said trailing face terminates is an arcuate surface forming a running barrier along said predetermined portion of said circumferential wall substantially midway between said arcuately spaced inlet and outlet ports.

11. A fluid pump comprising:

(a) a housing having a cylindrical pumping chamber therein;

(b) said pumping chamber being defined by an inner circumferential wall and a pair of spaced circular end walls;

(c) a rotor rotatably mounted within said pumping chamber and having its axis in offset parallel relation to that of said pumping chamber and having a width such as to extend from one of said circular end walls to the other;

(d) said rotor having a plurality of roller receiving slots of predetermined depth formed into and across the circumferential surface thereof;

(e) a roller having a predetermined diameter disposed for free rotation in each of said slots and extending from one of said circular end walls to the other with the predetermined diameter being substantially equal to the sum of said predetermined depth and the gap between said rotor edge and said inner circumferential wall;

(f) arcuately spaced inlet and outlet ports communicating with said chamber through arcuately spaced openings in said walls; and

(g) the said roller receiving slots in said rotor having generally angularly oriented leading and trailing faces disposed in radially outwardly diverging relationship, one to another, with the said leading and trailing faces each being disposed substantially along

planes passing through the central axis of said rotor, the arrangement being such that simultaneous contact occurs between the surface of said roller, said bottom surface and only one of said leading and trailing surfaces.

12. The fluid pump as defined in claim **11** being particularly characterized in that said angularly oriented leading and trailing faces are disposed at an angle of between about 15° and 25°, one to another along and adjacent the base thereof.

13. The fluid pump as defined in claim **12** being particularly characterized in that said angle is substantially 20°.

14. A fluid pump comprising:

(a) a housing having a cylindrical pumping chamber therein;

(b) said pumping chamber being defined by an inner circumferential wall and a pair of spaced circular end walls;

(c) a rotor rotatably mounted within said pumping chamber and having its axis in offset parallel relation to that of said pumping chamber and having a width such as to extend from one of said circular end walls to the other;

(d) said rotor having a plurality of roller receiving slots of predetermined depth formed into and across the circumferential surfaces thereof;

(e) a roller having a predetermined diameter substantially equal to the sum of said predetermined depth and the gap between said rotor edge and said inner circumferential wall and being disposed for free rotation in each of said slots and extending from one of said circular end walls to the other;

(f) arcuately spaced inlet and outlet ports communicating with said chamber through arcuately spaced openings in said walls; and

(g) the said roller receiving slots in said rotor having a planar bottom face and generally spaced apart planar leading and trailing faces, that portion of said leading and trailing faces spaced radially outwardly from the bottom face thereof by a distance at least equal to the radius of said roller being spaced apart a distance which is substantially greater than said predetermined diameter, the arrangement being such that simultaneous contact is possible between said roller and bottom surface and one only of said leading and trailing surfaces.

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