

March 10, 1936.

C. R. YIRAVA

2,033,218

ROTARY PUMP

Filed Oct. 3, 1933

4 Sheets-Sheet 1

FIG. 1

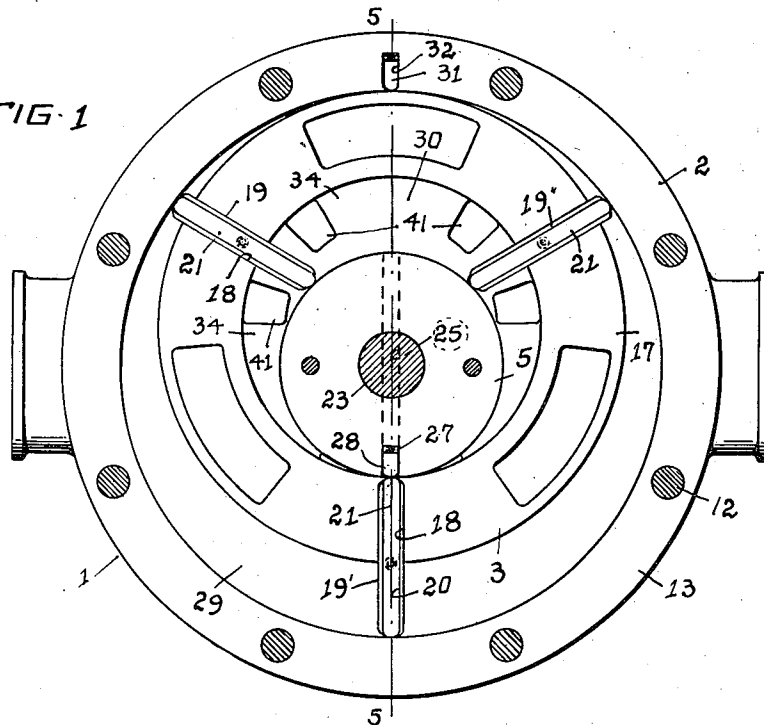
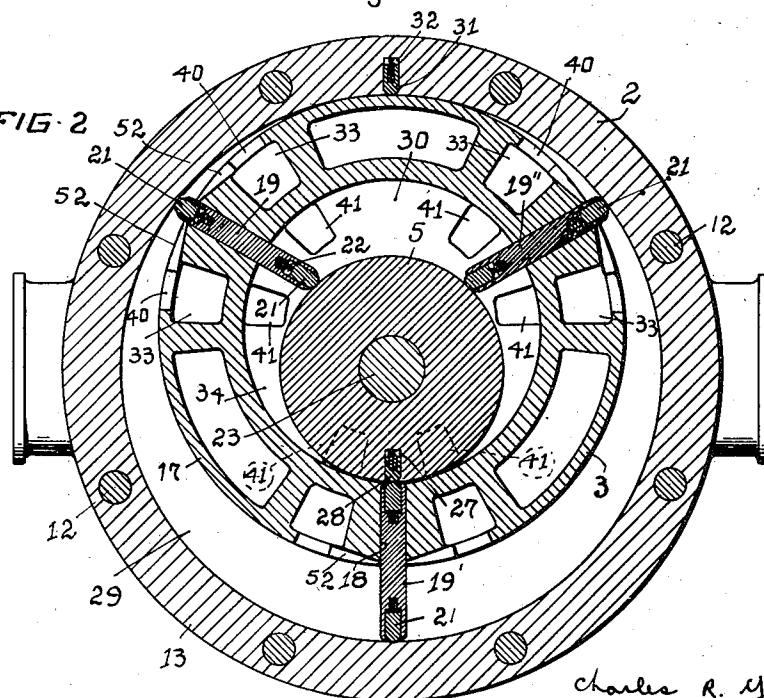


FIG. 2



Inventor

Charles R. Yirava

By Fisher, Wason & Moore

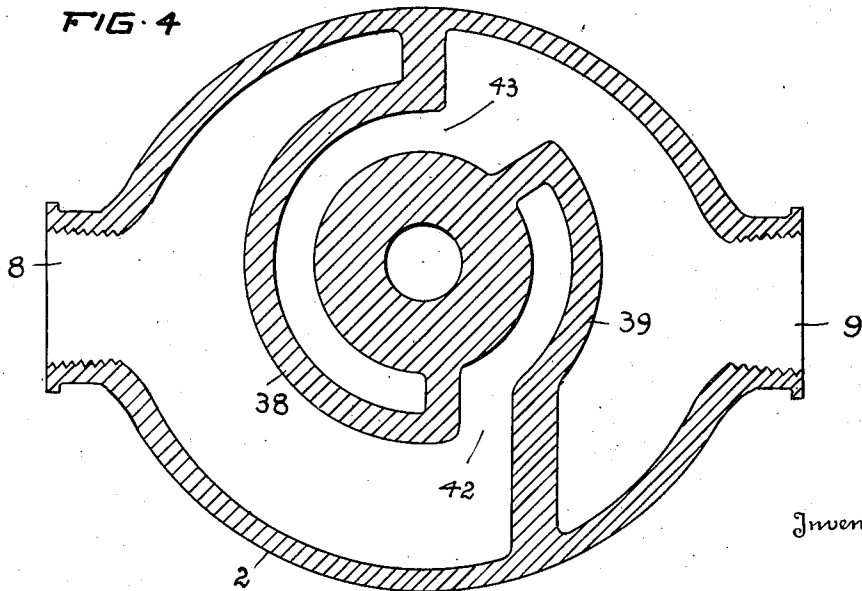
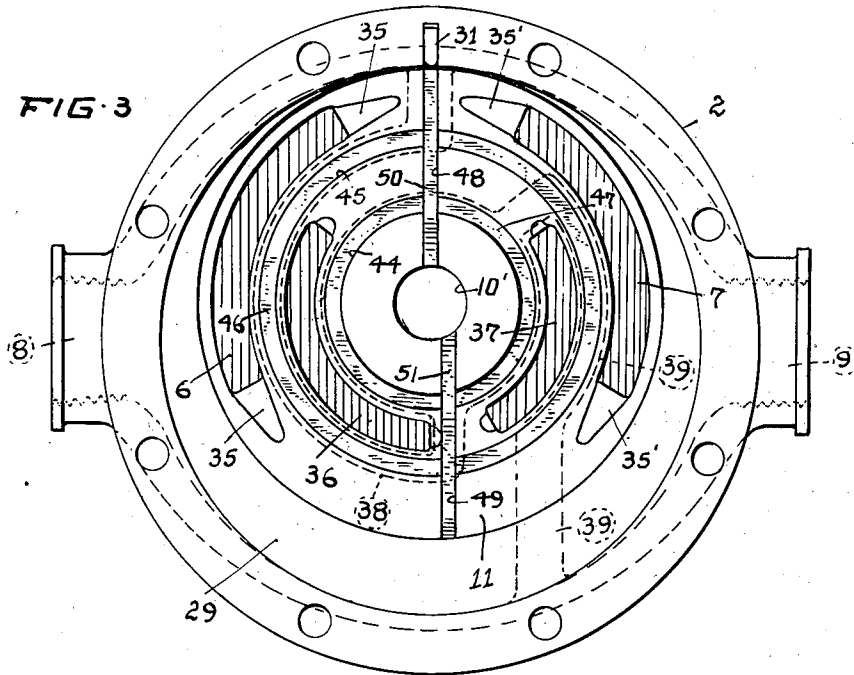
Attorneys

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Inventor

Charles R. Yerxa

By Fisher, Moore & Moore
Attorneys

March 10, 1936.

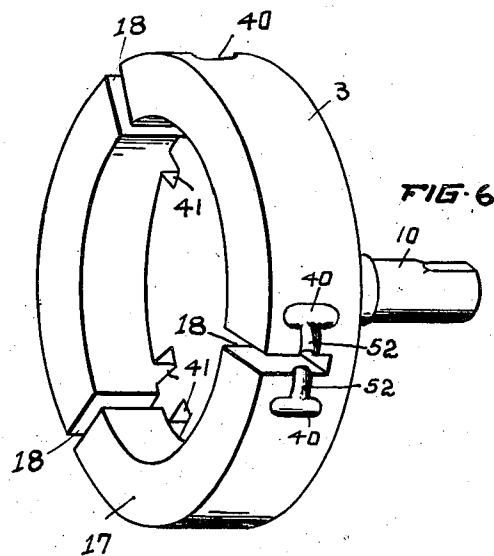
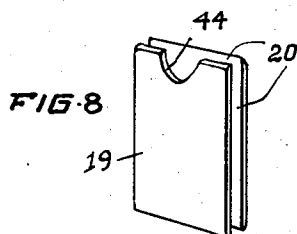
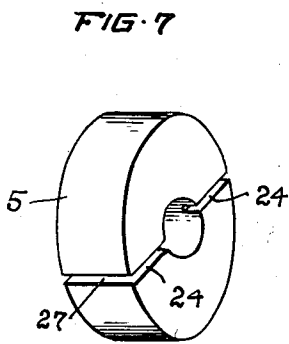
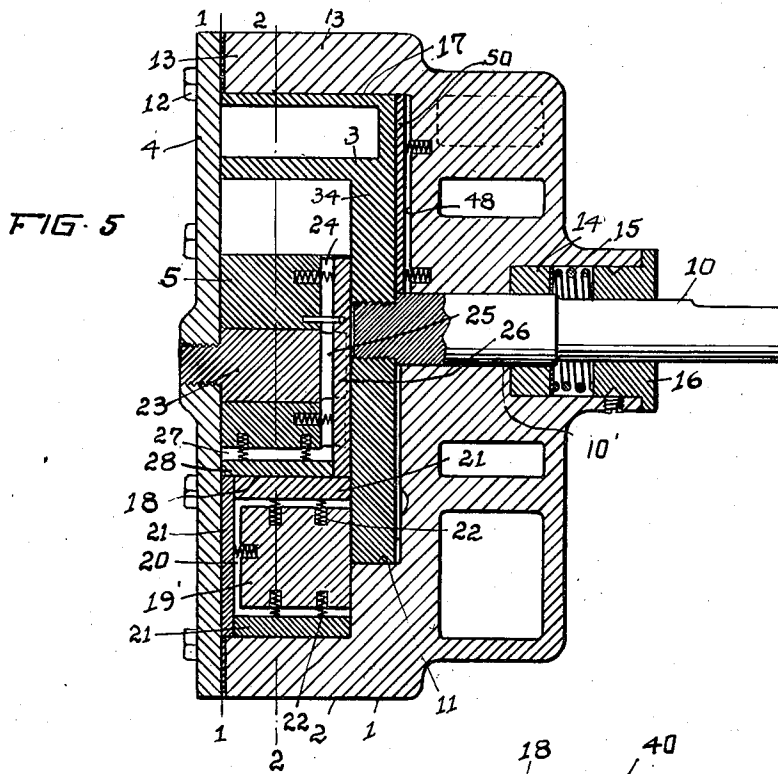
C. R. YIRAVA

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Inventor

Charles R. Yirava

By Fisher, Moore & Moore

Attorneys

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C. R. YIRAVA

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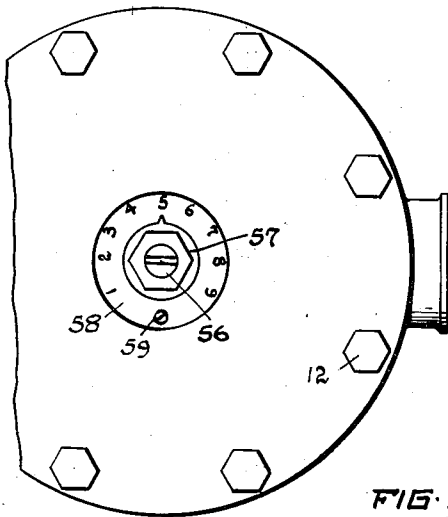


FIG. 9

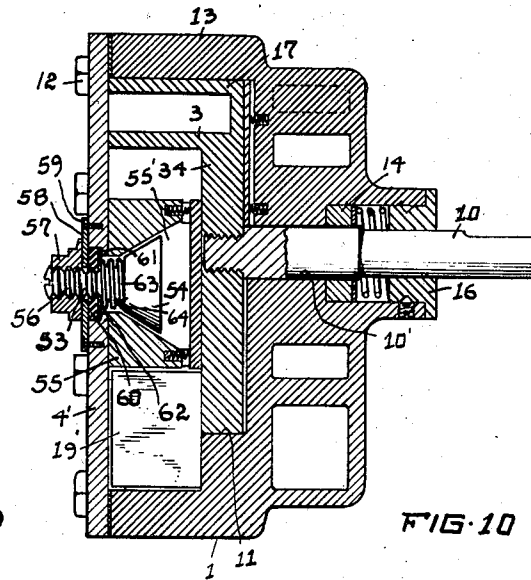


FIG. 10

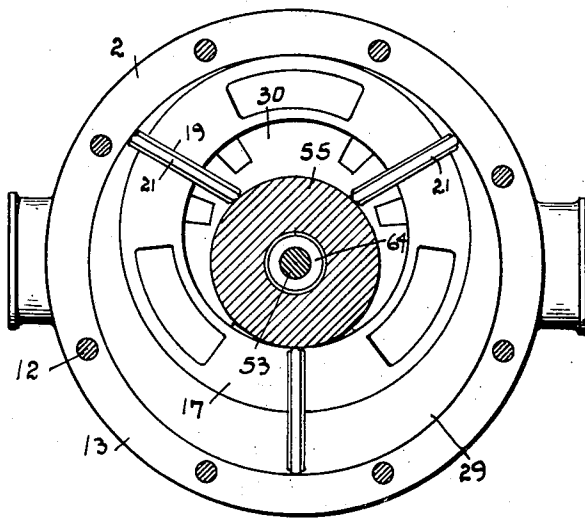


FIG. 11

Inventor

Charles A. Yivara

Fisher, Moser & Moser

Attorneys

UNITED STATES PATENT OFFICE

2,033,218

ROTARY PUMP

Charles R. Yirava, Cleveland, Ohio

Application October 3, 1933, Serial No. 691,995

6 Claims. (Cl. 103-136)

This invention relates to pumps, and its object is, generally, to provide a rotary pump improved in respects hereinafter appearing; and more particularly to provide such a pump having inner and outer compression and suction chambers arranged to function alternately with multiple pumping effect, thus increasing the capacity of the pump and insuring an even flow of fluid with minimum pressure and wear upon the main bearing and rotor shaft.

Other and more specific objects and advantages of the invention will be apparent as the following specification is considered in connection with the accompanying drawings in which:

Figure 1 is a cross sectional view through the pump according to the invention showing the rotor and blades in elevation, the section being taken on line 1-1 of Fig. 5;

Figure 2 is a cross sectional view on line 2-2 of Figure 5;

Figure 3 is a plan view of the housing showing the arcuate passages for the inner and outer chambers and the sealing members for sealing the arcuate passages against each other, when the rotor is placed in the housing;

Figure 4 is a cross sectional view through the bottom of the housing showing the communication of the intake and outlet sides of the pump with the inner and outer working chambers of the pump;

Figure 5 is a longitudinal sectional view through the pump, the section being taken on line 5-5 of Figure 1;

Figure 6 is a perspective view of the rotor;

Figure 7 is a perspective view of the blade guide and actuating member;

Figure 8 is a perspective view of one of the blades without the sealing strips;

Figure 9 is a fragmentary front elevation of a modified form of the pump according to the invention embodying a floating blade guide and actuating member, the floating action of which is adjustable;

Figure 10 is a longitudinal sectional view through the pump shown in Figure 9, the section being taken on line 10-10 of Figure 9; and

Figure 11 is a cross sectional view through the pump shown in Figures 9 and 10 showing the rotor and blades in elevation and the floating blade guide and actuating member in cross section, the section being taken on line 11-11 of Figure 10.

Referring more particularly to the drawings wherein like reference numerals denote corresponding parts throughout the several views, 1

denotes the pump as a whole comprising a flanged body 2, a rotor 3 within the body portion and mounted eccentric to the axis of the latter, and a front plate or cover member 4 supporting a cylindrical blade guide and actuating member 5, within the rotor and eccentric to the axis thereof, but concentric to the axis of the body. This body is cored to form arcuate open outer fluid passages 6 and 7 on opposite sides of the pump communicating respectively with the oppositely disposed threaded inlet and outlet ports 8 and 9, through which the fluid is delivered to and expelled from the pump. Inner arcuate fluid passages 36 and 37 also formed by coring the body 2, are separated from the outer passages 6 and 7 by walls 38 and 39.

Rotor 3 is suitably connected to a shaft 10 which extends through an eccentrically arranged bearing bore 10' in the body 1 and is driven from any suitable source of power, such as an electric motor, not shown. The rotor is rotatably confined within a circular recess 11 in the body by means of cover plate 4, and normally closes the fluid passages 6 and 7 against communication with each other, any suitable means such as bolts 12 being employed to securely fasten the cover plate to the peripheral flange 13 of the body. The axis of recess 11 coincides with the axis of bearing bore 10' in the body 2 and consequently is eccentric to the axis of the body including the flange 13, thereof. The outer end of bore 10' through which shaft 10 extends is tightly sealed by means of a washer, 14 held in place by a coil spring 15 and plug member 16.

The rotor is formed with an outwardly extending flange 17 having a plurality of radially extending slots 18 for slidably receiving and guiding blades 19, 19' and 19'' therein. These blades are formed in their outer side and end edges with recesses or slots 20 adapted to snugly receive metal sealing strips 21 which seat upon coil springs 22 suitably retained in the bottom of the recesses. The outer ends of blades 19 are held in constant engagement with the inner wall of body flange 13 by means of the cylindrical guide and actuating member 5 with which the inner ends of the blades have sliding contact. Member 5 is mounted upon a stud 23 secured to cover 4, and is stationarily supported within the confines of and in close working contact with the rotor flange 17. The inner flat end of member 5 is provided with radial grooves or slots 24 aligned with a groove 25 formed in the inner end of stud 23. A spring pressed metal sealing strip 26 seated in these intersecting grooves locks the mem-

ber 5 against rotation and forms a tight seal between the opposing flat faces of member 5 and the rotor. An additional groove 27 formed in the periphery of the member 5, at right angles to and communicating with one of the grooves 24, seats a spring pressed metal sealing strip 28 which contacts with the inner circular face of rotor flange 17 to effect a fluid seal between these two parts. If deemed desirable friction can be reduced by mounting the member 5 rotatably on stud 5, however the fluid seal would be somewhat less tight with such a construction.

It will be seen that two suction and compression chambers 29 and 30 of crescent shape, are formed respectively between the periphery of rotor flange 17 and the inner face of body flange 13 and between the inner face of the rotor flange and the periphery of the blade guide and actuating member 5. The outer ends of blades 19 in cooperation with a spring pressed metal sealing strip 31 seated in a groove 32 formed in the body flange 13, seal the suction side of the outer chamber 29, from the compression side of the chamber, while the inner ends of blades 19 cooperate with the sealing strip 28 previously described, to seal the suction side of inner chamber 30 from the compression side thereof. Chambers 29 and 30, which are offset 180 degrees one from the other, are placed in communication with outer arcuate fluid passages 6-7, inner arcuate fluid passages 37-38 and with each other in a manner about to be described. However it will be noted that the compression side of outer arcuate passage 6 is always in communication with the compression side of inner arcuate passage 37 at the point 42 around the lower bent end of wall 36, and that the compression side of outer arcuate passage 7 has constant communication with the compression side of inner arcuate passage 38 at the point 43 around the upper bent end of wall 38.

The rotor is provided with fluid passages 33, opening through the end wall 34, of the rotor for communication with outer arcuate passages 6 and 7, and extending outwardly nearly to the outer face of the rotor flange 17. There are six of these passages 33, one on each side of blades 19, 19' and 19'', and each passage is adapted to intermittently communicate with the outer crescent shaped suction and compression chamber 29 through openings 40 in the peripheral face of the flange 17 during normal operation of the pump. Inclined grooves 32 in the peripheral face of flange 17 extend from opposite sides of the openings 40, to the blade slots 18, for a continuous communication of the compression side and the suction side of outer chamber 29 with the arcuate passages 6 and 7. The crescent shaped inner suction and compression chamber 30 communicates with inner arcuate fluid passages 36 and 37, previously described, through openings 41 formed in the end wall 34 of the rotor adjacent each side of the inner end of blade slots 18, as best illustrated in Figures 1 and 2 of the drawings.

Assuming the pump which is adapted for rotation in either direction to be on dead center position, with the blade 19 in contact with the sealing strip 31, rotation of rotor 3 in an anticlockwise direction causes this blade to be advanced to Figure 2 position, during which movement that passage 33 following the blade 19 will be moved across inclined groove 35 and into communication with outer arcuate fluid passage 6.

Fluid is sucked from passage 6, up through passage 33 and thence out through opening 40 into chamber 29, in gradually increasing volume due to the presence of inclined groove 35, until passage 33 clears the said groove 35 and registers directly with arcuate passage 6, whereupon full communication between the intake 8 and chamber 29 is established. A very even flow is thus obtained and all danger of knocking and chattering is eliminated. As rotation of the rotor is continued blade 19 is forced outwardly by the stationary guiding and actuating member 5 against the flange 17 of the body and the fluid is then carried around in chamber 29, while additional fluid is being continuously sucked thereinto until passage 33 in advance of blades 19' is carried beyond the far end of arcuate passage 6 and the groove 35 adjacent said far end. Continued movement of the rotor from this point causes the fluid thus trapped between blades 19 and 19' to be compressed in the compression side of chamber 29 while the passage 33 following blade 19 is brought into alignment with the groove 35' at the lower end of arcuate passage 7 whereupon discharge is had through said groove 35' and passage 7 to and throughout outlet port 9. While this action is occurring a supply of fluid is being sucked into that portion of chamber 29 between blades 19' and 19'' in an obvious manner.

While the action just described is taking place fluid is being discharged from and sucked into inner crescent shaped chamber 30 through openings 41 adapted to be alternately brought into communication with arcuate passages 36 and 37. Six openings 41 are provided in the end wall of the rotor, one in advance of and one following each blade slot 18, and in radial alignment with but inwardly offset from passages 33. The action which takes place in the inner crescent shaped compressing and suction chamber 30 is identical with that just described as occurring in outer chamber 29, with the exception that while fluid is being sucked into a certain area in chamber 29, fluid is being discharged from the corresponding area of chamber 30 and vice versa. This lag or differential is due to the fact that chamber 30 is offset 180 degrees from chamber 29. The inner and outer arrangement of cylinders and pistons results in a reduction of approximately forty percent of the pressure load on member 5, thus reducing wear to the minimum. The capacity of the pump over known rotor single cylinder pumps is also increased to an extent corresponding to the area of chamber 30.

The inner flat face of body 2 is formed with inner and outer circular recesses 44 and 45 in which half circular spring pressed metal sealing members 46 and 47 are respectively seated, and with radially disposed grooves 48 and 49 extending from the bore 10' to opposite sides of chamber 30 for the reception of straight metal sealing strips 50 and 51. Strip 51 is slightly offset from or out of alignment with strip 50 to insure a full discharge or scavenging action on the discharge side of the pump.

The blades 19 are provided with recesses 44 communicating with the recesses 20 for sealing strip 21, which recesses 44 have been found most desirable in actual practice in that they permit liquid to freely enter and leave the space between the lower face of the sealing members and the bottom of the grooves during rotation of rotor.

In the modified form shown in Figures 9 through 11, the pump structure is identical in

construction with the pump structure described in Figures 1 through 8 with the exception that the blade guide and actuating member 55 is not secured to the cover plate 4' but freely rotatably mounted on a stud shaft 53 which is longitudinally adjustably secured to plate 4'. Stud shaft 53 carries at its rear end a conical enlargement 54 adapted to extend into a conically shaped recess 55' of the blade guide 55 and the front end 56 of said shaft is threadedly engaged by an adjusting nut member 57 abutting against a dial plate 58, which latter is secured to cover plate 4' by means of screws 59. A packing 60 and washer 61 seal the opening 62 in plate 4' through which the stud shaft extends and a spring 63 seated at opposite ends against washer 61 and the shoulder portion 64 of conical enlargement 54 compresses the packing and forces nut member 57 against dial plate 58.

In the arrangement just described the guide member 55, freely rotatably mounted on stud shaft 53, will have a limited floating action, when said shaft is adjusted to Figure 10 position by rotation of nut member 57. This floating action permits necessary adjustment of the output of the pump when pumping viscous liquids. This is important in many industries particularly in the manufacturing of rayon, where the proper amount of the viscous liquid fed to the perforated dies determines the strength and even thicknesses of the finished product.

Rotation of nut member 57 governs the output of the pump to the desired quantity because nut member 57 controls the seal between the guide member and rotor. Decrease in output caused by wear may be overcome by decreasing the floating action of the guide member.

Having thus described my invention,

What I claim is:

1. A rotary pump comprising a body having a chamber therein and intake and discharge passages, a circular recess in said chamber eccentrically arranged in the bottom thereof, a concentrically chambered rotor mounted within said recess and extending into said chamber for forming a crescent shaped working space in said body, a cylindrical member eccentrically floating within said chambered rotor forming a crescent shaped working space in said rotor, spring pressed means for limiting the floating action of said member to predetermined areas, shiftable means extending through the wall of said rotor into and through both said working spaces and revolvable with said rotor for subdividing these working spaces and floatingly supporting said cylindrical member in said chambered rotor, and passages within said recess and in communication with said intake and discharge passages adapted to be brought into communication with said crescent shaped working spaces.

2. A rotary pump, comprising a body, intake

and discharge passages in said body, a crescent shaped working chamber within said body, a second crescent shaped working chamber enclosed by said first chamber and offset 180 degrees with respect thereto, longitudinal shiftable means extending into and subdividing said working chambers, said second shaped working chamber having its inner wall formed by a freely rotatable, floating circular member cooperating with and floatingly guided by said longitudinal shiftable means, and spring pressed means for limiting the floating action of said member to predetermined areas.

3. A rotary pump comprising a body having a chamber therein and intake and discharge passages, a circular recess in said chamber arranged in the bottom thereof, a rotor eccentrically mounted within said recess forming a crescent shaped working space in said body, a floatingly supported cylindrical member arranged within said rotor forming a crescent shaped working space in said rotor, spring pressed means for limiting the floating action of said member to predetermined areas, shiftable means extending through the wall of said rotor into both said working spaces and revolvable with said rotor for subdividing the working spaces, and passages in communication with said intake and discharge passages adapted to be brought into communication with said crescent shaped working spaces, said cylindrical member being rotatably and floatingly supported by said shiftable means.

4. A rotary pump according to claim 3 in which the spring pressed means for limiting the floating action of the cylindrical member are adjustably supported by said body to adjustably limit the free floating action of said cylindrical member.

5. A rotary pump comprising a body, intake and discharge passages in said body, a crescent shaped working chamber within said body, a second crescent shaped working chamber enclosed by said first chamber and offset 180 degrees with respect thereto, longitudinal shiftable means extending into and subdividing both said working chambers, said second chamber having its inner wall formed by a rotatable circular member embodying a conical bore axially extending therethrough and said member being floatingly guided by said longitudinal shiftable means and longitudinally adjustable conically shaped means extending through the bore of said circular member to limit the floating action of said member to predetermined proportions.

6. A rotary pump according to claim 5, wherein the longitudinally shiftable means extend outwardly through the wall of said body and means on the outside of said body for shifting said shaft longitudinally of the desired position.

CHARLES R. YIRAVA. 60