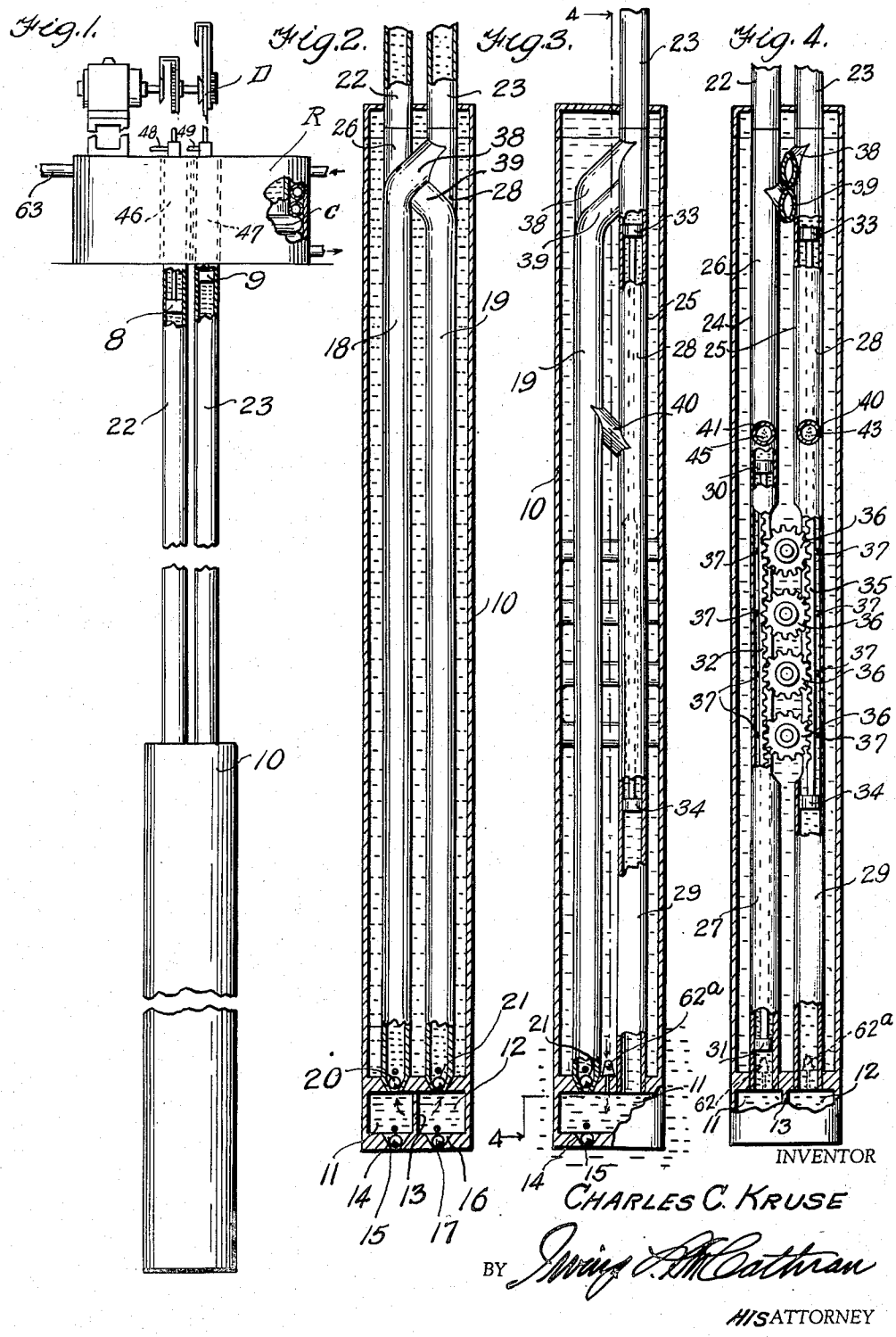
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Fig. 5.

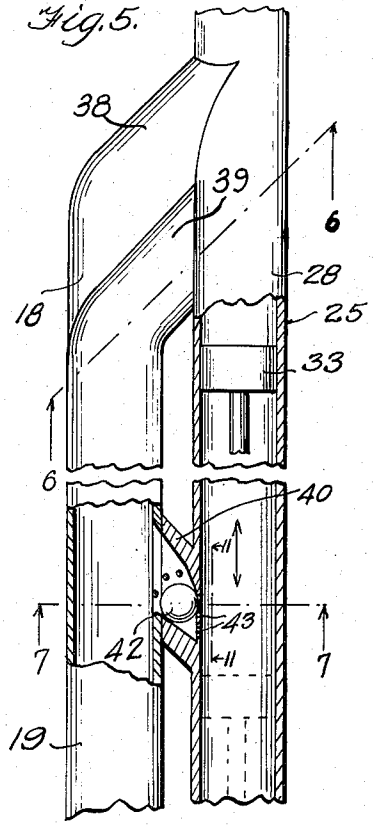


Fig. 6

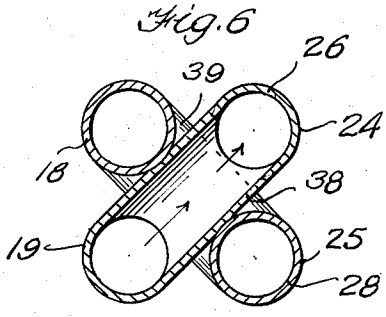


Fig. 7.

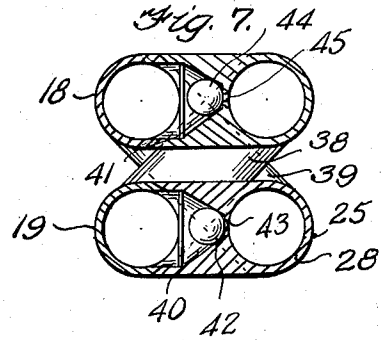


Fig. 11.

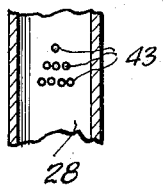


Fig. 8.

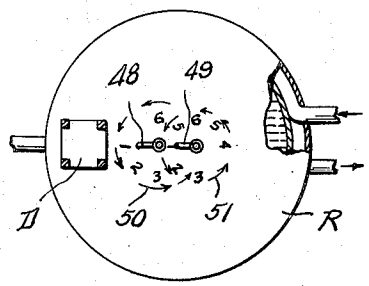


Fig. 9.

Fig. 10.

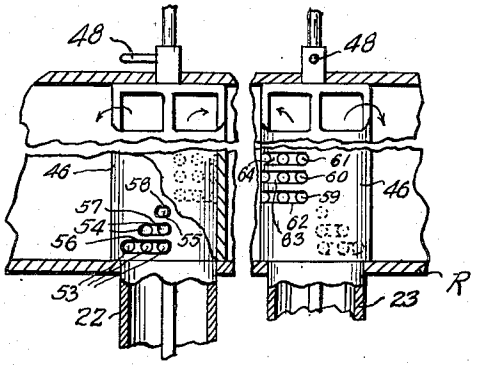
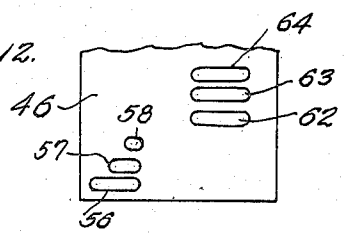


Fig. 12.



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PUMP

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Application April 6, 1951, Serial No. 219,720

6 Claims. (Cl. 103—44)

This invention relates to pumps, and has for one of its objects the production of a simple and efficient pump mechanism which is especially adapted for pumping or elevating water, oil, or fluid of any type, from one elevation to another by fluid pressure and balanced columns of liquid.

A further object of this invention is the production of a pump wherein quantities of heated fluid are forced down in measured quantities through one discharge column and up through an adjoining discharge column by way of bypass connections to clear the upper portions of the discharge columns of frozen or tightly congealed fluid and to thereby facilitate continued operation of the pump without the necessity of removing sections of the pump to steam out masses of congealed substances.

A still further object of this invention is the production of a pump for elevating fluid by forcing a selected volume of fluid from the base of the pump through alternate columns to a receiving reservoir, and maintaining a continuous circulation between the reservoir and the alternate columns.

In the drawings:

Figure 1 is a side elevational view of the pump, certain parts being shown in section;

Figure 2 is a vertical sectional view of the lower casing of the pump, certain parts being shown in elevation;

Figure 3 is a vertical sectional view of the lower casing of the pump taken at right-angles to Figure 2;

Figure 4 is a vertical sectional view of the lower casing of the pump taken on line 4—4 of Figure 3;

Figure 5 is an enlarged vertical fragmentary sectional view of the lower portion of the pump mechanism, certain parts being shown in elevation;

Figure 6 is a horizontal sectional view taken on line 6—6 of Figure 5;

Figure 7 is a horizontal sectional view taken on line 7—7 of Figure 5;

Figure 8 is a top plan view of the upper tank, partly in horizontal section;

Figure 9 is an enlarged fragmentary vertical sectional view of the upper tank showing the control means for the discharge end of one discharge tube or column;

Figure 10 is a view similar to Figure 9, showing the reverse side of the sleeve and discharge end of one of the columns;

Figure 11 is a fragmentary sectional view taken on line 11—11 of Figure 5;

Figure 12 is a diagrammatic view illustrating the relative positions of the slots which are formed in each sleeve of the control device.

By referring to the drawings in detail, it will be seen that 10 designates the lower pump casing which is provided at its lower end with a pair of intake compartments 11 and 12 which are separated by a partition 13. An intake port 14 provides an intake at the bottom of the compartment 11 and a check valve 15 is seated in the port 14 to permit inflow and check outflow in a conventional manner. A similar port 16 is provided for the compartment 12, and a similar check valve 17 is seated in the port 16.

Vertically extending parallel intake pipes 18 and 19 are carried within the casing 10, the lower end of the pipe 18 communicating with the intake compartment 11 and the lower end of the intake pipe 19 communicating with the intake compartment 12, as shown in Figure 2. A check valve 20 is carried in the lower end of the pipe 18 and a check valve 21 is carried in the lower end of the

pipe 19. These valves 20 and 21 permit flow into the pipes 18 and 19 and prevent return flow into the compartments 11 and 12.

Pumping columns 22 and 23 extend upwardly through the top of the casing 10 to the reservoir R, which reservoir is located at a convenient place to facilitate operation. Power driven pistons 8 and 9 are preferably operated by a driven mechanism D, to oppositely reciprocate the pistons within the upper ends of the columns 22 and 23. This drive mechanism D may be of the type set forth in my Patent Number 2,666,396, issued January 19, 1954, and relating to Multiple Reciprocating Pump with Rack and Pinion Actuating Means. Any type of drive means may be used, however, within the spirit of the invention.

The columns 22 and 23 carry at their lower ends secondary pumping mechanisms 24 and 25 respectively, which are located within the casing 10 and extend parallel to the intake pipes 18 and 19, in the manner shown in Figures 3 and 4. The mechanism 24 comprises an upper cylinder 26 and a lower pumping cylinder 27. The mechanism 25 comprises an upper cylinder 28 and a lower pumping cylinder 29. A piston 30 is reciprocally mounted in the cylinder 26, and a piston 31 is mounted in the cylinder 27, the pistons 30 and 31 being rigidly connected by means of a rack bar 32. A piston 33 is reciprocally mounted in the cylinder 28, and a piston 34 is mounted in the cylinder 29. The pistons 33 and 34 are connected together by means of a rack bar 35. Pinions 36 are journalled in the casing 10 between the rack bars 32 and 35 and in meshing relation with said rack bars to simultaneously reciprocate the pistons 30 and 31 in an opposite direction relative to the pistons 33 and 34. The pinions 36 are preferably aligned in vertical spaced relation and the rack bars 32 and 35 are preferably held in meshing engagement with the pinions 36 by means of suitable bearings or rollers 37, carried by the connecting areas between the cylinders 26 and 27 and the cylinders 28 and 29. These connecting areas are preferably cut away to permit the pinions 36 to freely engage the rack bars 32 and 35, as shown in Figure 4. The pistons 33 and 34 with their connecting rack bar 35, and the pistons 30 and 31 with their connecting rack bar 32, constitute shuttle pistons.

The lower end of the cylinder 29 opens into the compartment 12, whereas the lower end of the cylinder 27 opens into the compartment 11. The intake pipe 18 is provided with a hollow elbow 38 at its upper end which is connected to the upper end of the cylinder 28 and provides a communication between the upper end of the pipe 18 and the upper end of the cylinder 28. The intake pipe 19 also is provided with a hollow elbow 39 at its upper end which is connected to the upper end of the cylinder 26 and provides a communication between the upper end of the pipe 19 and the cylinder 26. These elbows 38 and 39 are located above the upper limit of the stroke of the pistons 30 and 33 respectively. A communicating port 40 provides a communication between the pipe 19 and the cylinder 28, a short distance above the lower limit of the stroke of the piston 33. A similar communicating port 41 forms a communication between the intake pipe 18 and the cylinder 26 a short distance above the lower limit of the stroke of the piston 30. These ports 40 and 41 preferably incline downwardly from the intake pipes toward the cylinder.

A check valve 42 is mounted in the port 40 to permit flow from the cylinder 28 into the intake 19 and to prevent reverse flow. A perforated shield separates the port 40 from the interior of the cylinder 28 defining perforations 43, the perforations being arranged in an upwardly tapering formation as shown in Figure 10, to progressively decrease the volume of discharge through the port 40 into the pipe 19, as the piston 33 moves upwardly across the perforations.

A check valve 44 is mounted in the port 41 to permit flow from the cylinder 26 to the intake pipe 18 and to prevent reverse or return flow through the port 41. A perforated shield 45 similar to that shown in Figures 5 and 10 separates the port 41 from the interior of the cylinder 26. It should be noted that the intake pipe 18 communicates with the cylinder 26 directly in the rear of the pipe 18 through the medium of the port 41. The in-

take pipe 19 communicates with the cylinder 28 directly in the rear of the pipe 19 through the medium of the port 40. However, the elbow 38 at the upper end of pipe 18 communicates with the upper end of the cylinder 28, which is laterally offset relative to the pipe 18, and the elbow 39 at the upper end of the pipe 19 communicates with the upper end of the cylinder 26, which is laterally offset relative to the pipe 19. The elbows 38 and 39 are upwardly inclined in the direction of the cylinders 26 and 28 respectively and are arranged in crossed relation, as shown in Figures 2, 3 and 4. The volume of the intake pipe 18 between the port 41 and the elbow 38 constitutes a by-pass from the lower end of the cylinder 26 and the upper end of the cylinder 28. The volume of the intake pipe 19 between the port 40 and the elbow 39 constitutes a by-pass from the lower end of the cylinder 28 and the upper end of the cylinder 26.

The upper ends of the columns 22 and 23 extend through the bottom of the tank R and upwardly into the tank. A sleeve 46 is rotatably mounted upon the upper end of the column 22 within the tank, and a sleeve 47 is rotatably mounted upon the upper end of the column 23 within the tank R. An actuating handle 48 is carried by the sleeve 46 above the tank and an actuating handle 49 is carried by the sleeve 47 above the tank. The top of the tank R is graduated as at 50 and 51, adjacent the handles to provide an index for each handle, so that an operator may determine the positions of the sleeves by registering the handles with the graduate markings 1 to 6 as indicated in Figure 8. The upper end 52 of the column which extends in the tank R is provided with a lower series of apertures 53, for example three in number, adjacent the bottom of tank R, a second higher series of apertures 54, two in number, and a further aperture 55 which is located above the second series of apertures, all of these apertures being arranged in triangular formation, in the manner shown in Figure 9. The sleeve 46 is provided with a series of superimposed radial slots 56, 57 and 58, of progressively different lengths, so that the apertures of the series 53 and 54 and the aperture 55 may be progressively uncovered as the sleeve 46 is rotated in one direction, and progressively closed when the sleeve 46 is rotated in the opposite direction. This structure constitutes a volume output control for the fluid passing through the columns 22 and 23.

Superimposed rows of apertures 59, 60 and 61 are formed in the column 22 above the apertures 53, 54 and 55, the apertures in the superimposed rows being in vertical alignment and being angularly offset relative to the apertures 53, 54 and 55. Circumferentially extending slots 62, 63 and 64 arranged in superimposed relation, are formed in the sleeve 46 and are adapted to move over the rows of apertures 59, 60 and 61 as the sleeve is rotated in one direction to progressively uncover the apertures in the rows 59, 60 and 61 to selectively increase or decrease the volume of fluid discharge from the column 22. The sleeve 47 is a duplicate of the sleeve 46, and the upper end of the column 23 is provided with apertures similar to that described with respect to the column 22 so that the volume of fluid discharged from column 23 may be selectively increased or decreased and the volume output of the column 23 may be controlled by rotating the sleeve 47.

The operation of the pump is as follows:

The pistons 8 and 9 are reciprocated alternately in opposite directions, by the driving mechanism D. The volume output control devices on the columns 22 and 23 are set by an operator to selectively and progressively open or close the volume control ports 53, 54 and 55 to obtain a desired volume of pumped fluid through the columns 22 and 23. By selectively opening these ports, the point of elevation at which the pistons 8 and 9 contact the column of fluid in the columns 22 and 23 will be elevated, thereby adding a surplus amount of fluid in each of the columns 22 and 23 over and above the amount of fluid which is required to actuate the pistons in the secondary pumping mechanisms 24 and 25. Then on the up-stroke of each piston, this surplus will be forced through the ports 40 and 41 into the intake pipes 18 and 19 and upwardly through the elbows 38 and 39 in crossed relation. The fluid from the pipe 18 will be passed across into the upper end of the cylinder 28 and out through the column 23, whereas the fluid from the pipe 19 will be passed across into the upper end of the cylinder 26 and out through the column 22, the upper portions of the pipes 18 above the ports 40 and 41 acting as by-passes, as above described. Since the pistons 33 and 34 are connected by the rack bar 35, and the pistons 30 and 31 are connected by the rack bar 32, and these rack bars engage the pinions 37 therebetween, the pistons 30 and 31 will reciprocate in opposite directions to the pistons 33 and 34. The pistons 31 and 34 on the up-stroke will alternately draw fluid from the well into the compartments 11 and 12, and on the down-stroke the fluid in the compartments 11 and 12 will be alternately forced up through the intake pipes 18 and 19 where it will receive an additional boost as a selected amount of surplus fluid is forced through the ports 40 and 41 by the pistons 30 and 33. The fluid passes up through the columns 22 and 23 and is discharged into the tank through the apertures in the upper ends of these columns 22 and 23.

As is shown in Figure 1, the tank R is provided with a suitable heating means to increase the temperature of the oil or fluid within the tank. This heating means may be in the nature of a heating coil C, or if desired any suitable heating means may be employed within the scope of the invention. By heating the fluid in the tank R, congealed or frozen fluid within the upper ends of the columns 22 and 23 may be readily freed and ejected. This is particularly advantageous where the pump or the columns 22 and 23 pass through a frozen strata of great depth, and where these columns are likely to become clogged or closed because of low surrounding temperatures which might result in discontinuance of operations. The heated fluid may be drawn from the tank R and fed through the by-pass portions of the pipes 18 and 19 above the ports 40 and 41, and alternately through the columns 22 and 23 to the tank R upon the up-stroke of the pistons 8 and 9. A circulation is obtained through the by-pass portions of the pipes 18 and 19 as the power pistons 8 and 9 and the pistons 30 and 33 are actuated. The fluid between the piston 9 and the piston 33 and the fluid between the pistons 8 and 9 drives the pistons 30 and 33, and consequently actuates the pumping pistons 31 and 34. A relief valve 62a, such as is shown in Figure 3, provides a communication between the interior of the casing 10 and each compartment 11 and 12. One such valve 62a is provided for each compartment 11 and 12, and will prevent inflow therethrough into the casing 10, but will permit outflow into the compartments. Consequently, when pressure within the casing 10 exceeds pressure within the compartments 11 and 12, discharge may be made from the interior of the casing 10 into the compartments and such discharged material, water, etc., will then be pumped out through the pipes 18 and 19. The casing 10 contains fluid as shown in Figures 2 to 4, inclusive. The tank R is provided with a discharge or overflow pipe 63 which may lead to suitable storage facilities.

The parts of the pump which are to be connected together, are preferably welded when assembling the pump. It should be noted that the pistons 30 and 33 are hydraulically actuated shuttle pistons to which are connected the pumping pistons 31 and 34 respectively, through the medium of the rack bars 32 and 35. In operation, the column pipes 22 and 23 contain fluid above and below the pistons 8 and 9, and the pistons 31, 34, 32 and 35 work within the fluid contained cylinders with the fluid above and below the pistons. By the addition of the regulated surplus fluid which is admitted through the control means shown in Figures 9 and 10, the pumping mechanism will be prevented from locking since an additional selected amount of fluid will be added to each column under each piston 8 and 9 on each down-stroke of each piston, and any surplus over and above the amount necessary to actuate the pistons 30 and 33 will pass through the ports 40 and 41 and will be forced upwardly through the by-pass portions of the pipes 18 and 19. It should be understood of course that the pistons 8 and 9 on their up-strokes pass above the apertures 52, 53 and 54 and in fact move to the top ends of the pipes 22 and 23 at the top of the tank R, to discharge the fluid out through the openings in the top of the sleeves 46 and 47.

Having described the invention, what I claim as new is:

1. A pump of the class described comprising a plurality of fluid containing column pipes, a power piston in each pipe, a fluid receiving tank connected to and communicating with said pipes for receiving fluid from said pipes, means carried adjacent said tank for actuating said power pistons simultaneously in opposite directions, each pipe being adapted to contain fluid, a secondary pumping mechanism carried by said pipes, means carried by

said pipes for transferring fluid from one column pipe to an adjoining column pipe as said power pistons are actuated, each of said pipes having an extremity extending into said tank, and a selective and progressively variable volume output control device carried by the extremities of said pipes for controlling the volume of fluid flow into said pipes from said tank.

2. A pump of the class described comprising a plurality of fluid containing column pipes, a power piston in each pipe, a fluid receiving tank connected to and communicating with said pipes for receiving fluid from said pipes, means carried adjacent said tank for actuating said power pistons, each pipe being adapted to contain fluid, a secondary pumping mechanism carried by said pipes, means carried by said pipes for transferring fluid from one column pipe to an adjoining column pipe as said power pistons are actuated, each of said pipes having an extremity extending into said tank, each extremity having a series of volume intake apertures, a volume control sleeve movably fitted over each extremity, said sleeves having a series of slots adapted to selectively register with said volume intake apertures in said pipes, and means engaging said sleeves for facilitating the movement of said sleeves to bring said slots of said sleeves into selective registration with said intake apertures in said pipes to control the volume output of fluid flow from the tank into said pipes.

3. A pump as defined in claim 2, wherein each sleeve is provided with a graduated index and said means for facilitating the movement of each sleeve comprises a handle adapted to register with said index to indicate the position of each sleeve and to indicate the volume of output from said tank into each pipe.

4. A pump of the class described comprising a pair of fluid containing column pipes, a tank connected to and communicating with said pipes for receiving fluid flow from said pipes, power actuated pistons in said pipes, means carried adjacent said tank for operating said power pistons simultaneously in opposite directions, cylinders connected to said pipes, a shuttle piston in each of said cylinders, mechanism mechanically connecting said shuttle pistons together to move said shuttle pistons simultaneously in opposite directions in unison with said power pistons and the fluid flow in said pipes, a companion intake pipe for each of said cylinders, communicating means connecting each of said cylinders with its companion intake pipe, communicating means connecting said companion intake pipes with the alternate of said cylinders

at an elevation above said first mentioned communicating means in a manner whereby said intake pipes for portions of their lengths constitute by-passes to transfer fluid flow from one of said cylinders to another of said cylinders and respectively through said column pipes.

5. A pump as defined in claim 4, wherein check valves are carried in each of said last mentioned communicating means to control fluid flow therethrough, and a check valve is carried by each of said first mentioned communicating means to admit fluid flow into the first mentioned communicating means from a point exteriorly thereof.

6. A pump of the class described comprising a pair of fluid containing column pipes, a tank connected to and communicating with said pipes for receiving fluid therefrom, power actuated pistons in said pipes, means carried adjacent said tank for operating said power pistons simultaneously in opposite directions, cylinders connected to said pipes, a shuttle piston in each of said cylinders, mechanism mechanically connecting said shuttle pistons together to move said shuttle pistons simultaneously in opposite directions in unison with said power pistons and the fluid flow in said pipes, a companion intake pipe for each of said cylinders, a communicating means between each of said cylinders and its companion intake pipe, an intake check valve for each of said communicating means, an intake check valve for each companion intake pipe to prevent return fluid flow from said companion intake pipes, ports connecting said companion intake pipes with the alternate of said cylinders at an elevation above said communicating means in a manner whereby said intake pipes for portions of their lengths constitute by-passes to transfer fluid flow from one of said cylinders to another of said cylinders and respectively through said column pipes, and a check valve in each port to prevent reverse fluid flow into said cylinders.

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