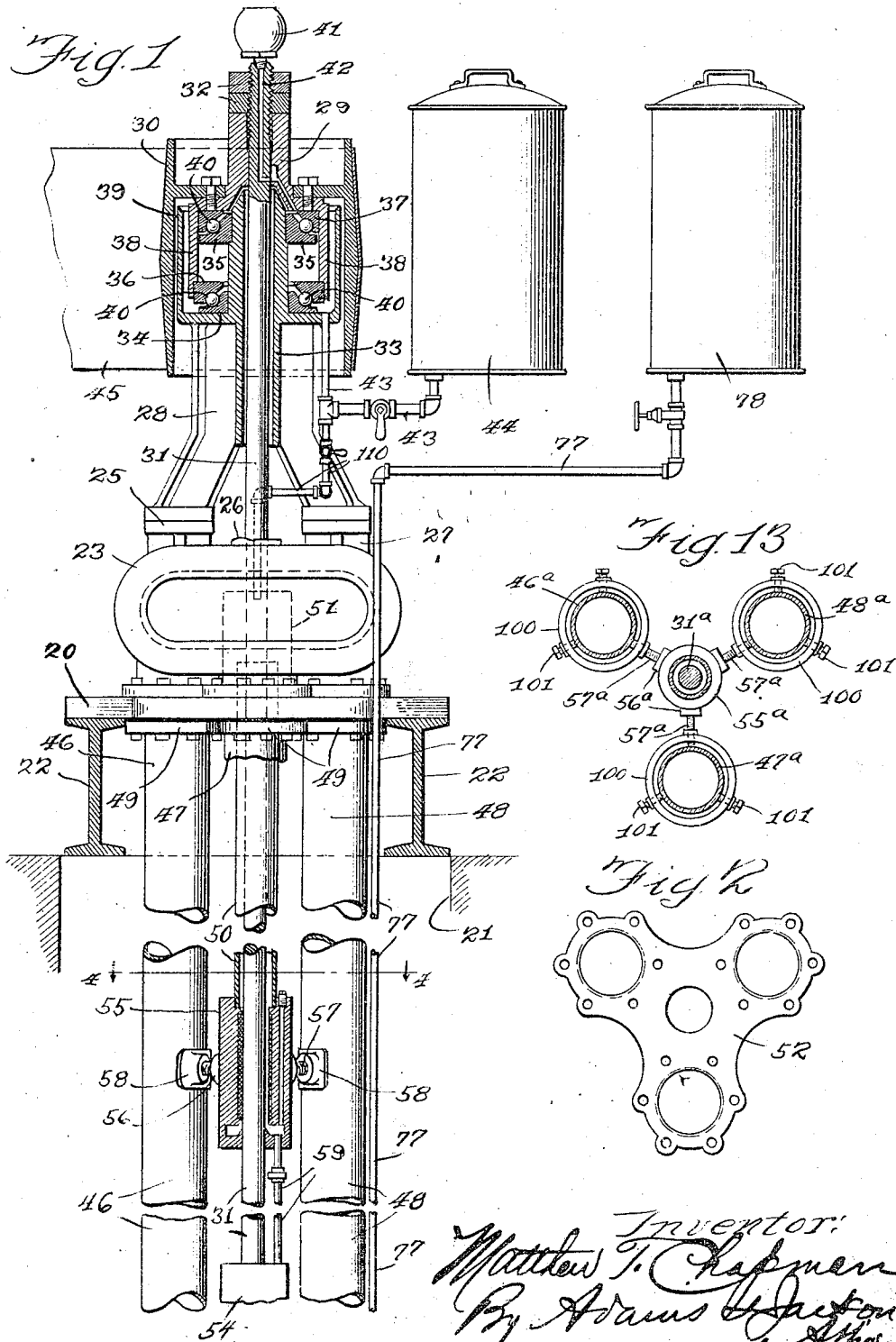


M. T. CHAPMAN.
 ROTARY DEEP WELL PUMP.
 APPLICATION FILED OCT. 6, 1916.

1,266,552.

Patented May 21, 1918.

4 SHEETS—SHEET 1.

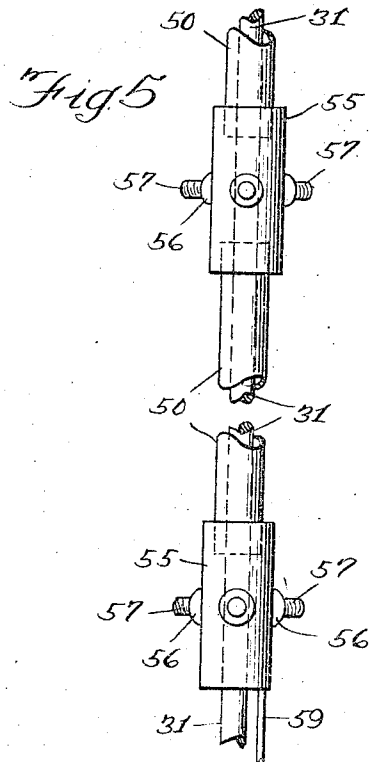
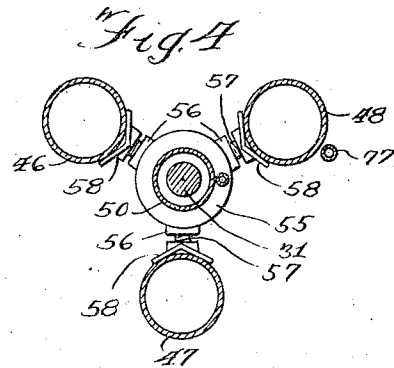
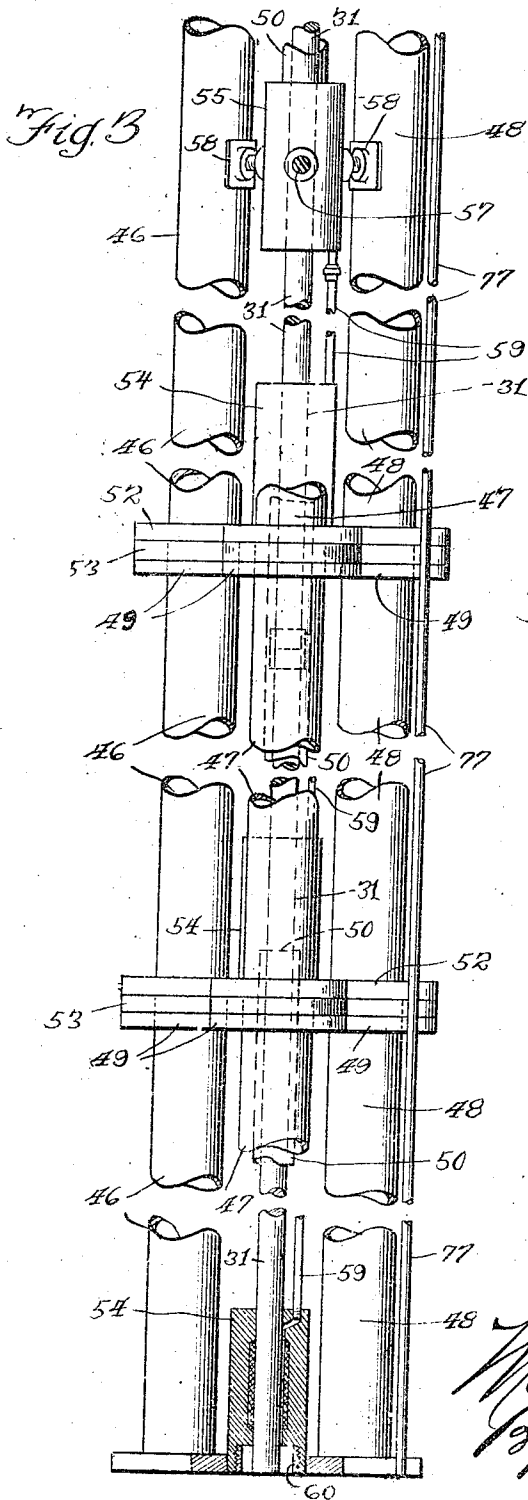


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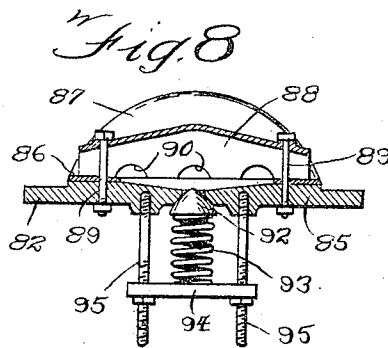
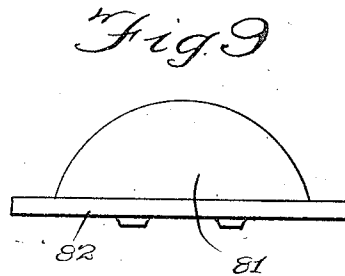
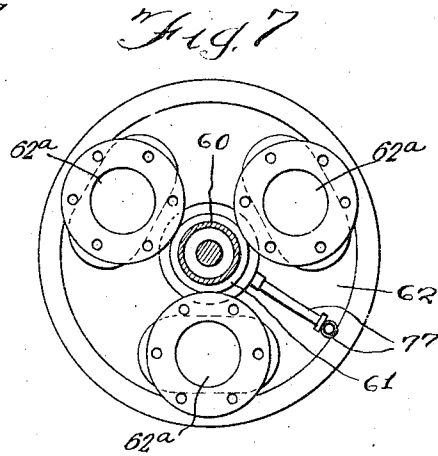
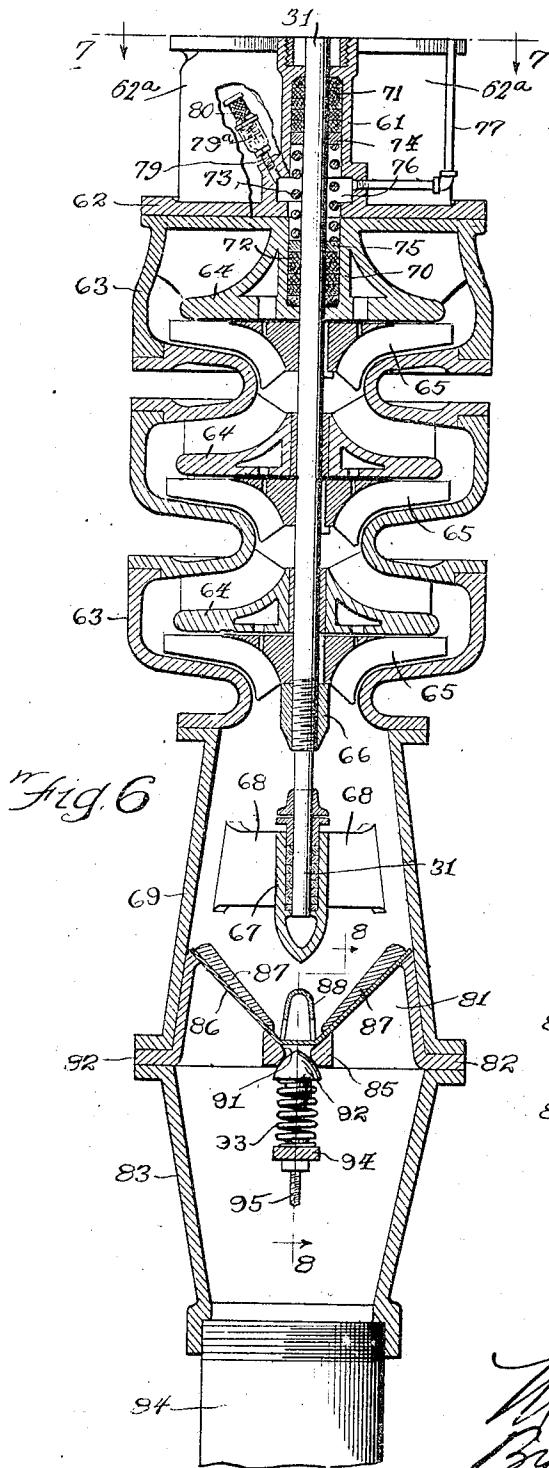


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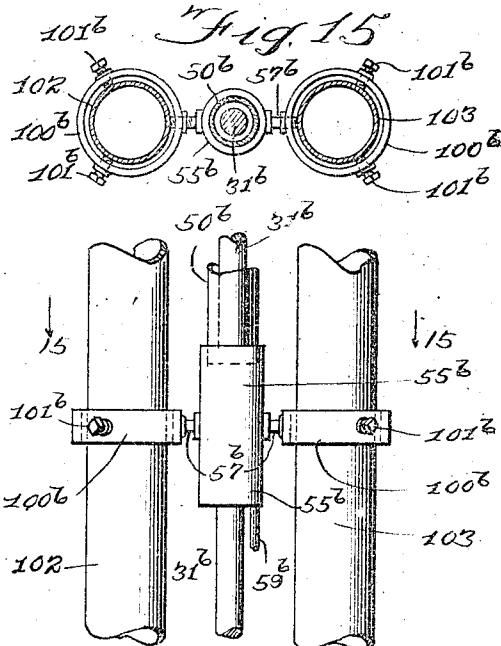
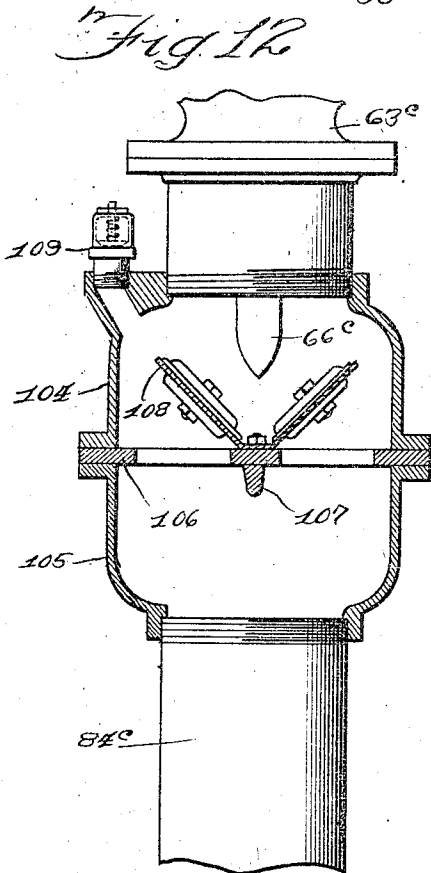
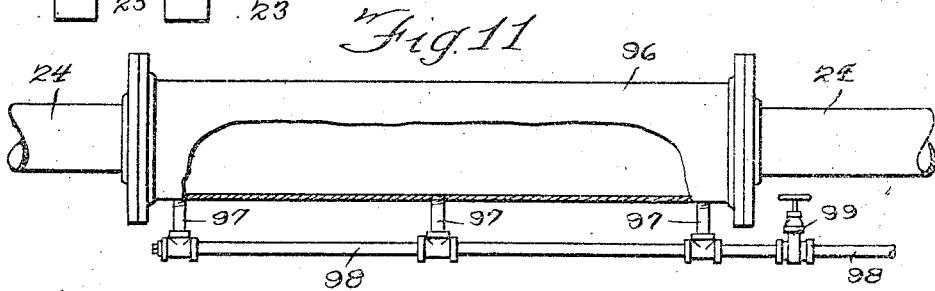
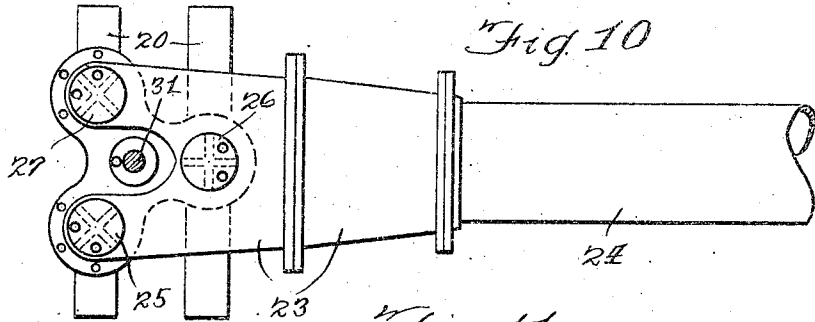


Fig. 14

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UNITED STATES PATENT OFFICE.

MATTHEW T. CHAPMAN, OF AURORA, ILLINOIS, ASSIGNOR TO THE AMERICAN WELL WORKS, OF AURORA, ILLINOIS, A CORPORATION OF ILLINOIS.

ROTARY DEEP-WELL PUMP.

1,266,552.

Specification of Letters Patent.

Patented May 21, 1918.

Application filed October 6, 1916. Serial No. 124,141.

To all whom it may concern:

Be it known that I, MATTHEW T. CHAPMAN, a citizen of the United States, and a resident of Aurora, in the county of Kane and State of Illinois, have invented certain new and useful Improvements in Rotary Deep-Well Pumps, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to rotary deep well pumps the rotary water-raising element or elements of which are designed preferably to be located below the normal level of the water in the well. The leading object of this invention is to provide a new and improved form of connecting means for the several discharge-pipes, each of which is made up of united sections, through which discharge-pipes the water is forced out of the well, and also an improved arrangement and construction of bearings and inter-bracing means for the rotary pump shaft and the several discharge-pipes. I accomplish this object by the means illustrated and herein-after particularly described, although it will be understood that, except as specified in some of the claims, I do not intend to limit myself to the exact constructions, and arrangements shown. That which I believe to be new and desire to cover by this application is set forth in the claims.

In the drawings,—

Figure 1 is a side view, partly in section, showing the form and arrangement of the parts of my improved pumping mechanism located at or near the surface;

Fig. 2 is a top view of one of the plates employed for connecting the plurality of water discharge pipes together;

Fig. 3 is a downward continuation of the parts shown in Fig. 1;

Fig. 4 is a cross-section taken on line 4—4 of Fig. 1;

Fig. 5 is a detailed view showing the arrangement of two or more bearings for a single length of water discharge pipe, and the means for supporting such bearings;

Fig. 6 is a downward continuation of the parts shown in Fig. 3, being a central vertical section through the pump casing and the parts immediately below the casing, a portion of one of the discharge conduits that leads from the pump casing being broken away to show the valved nipple therein;

Fig. 7 is a horizontal cross-section taken on line 7—7 of Fig. 6;

Fig. 8 is a vertical central cross-section taken on line 8—8 of Fig. 6;

Fig. 9 is a side view of the shell shown in Fig. 8 as seen from the right in Fig. 6;

Fig. 10 is a top view of the horizontally-extending water discharge casing located at the surface;

Fig. 11 is a side view of my improved sand-trap to which the water passes from the water discharge casing shown in Fig. 10;

Fig. 12 is a central vertical section through a modified form of check-valve immediately below the pumping element, illustrating also a modified form of relief-valve;

Fig. 13 is a view similar to Fig. 4, but showing a modified form of pipe-centering and bracing means;

Fig. 14 is a side view of a modified form of water discharge piping comprising two vertical water discharge pipes in lieu of the three pipes shown in the principal form of mechanism; and

Fig. 15 is a horizontal cross-section taken on line 15—15 of Fig. 14.

Referring to Figs. 1 to 11 in which corresponding parts are indicated by the same reference characters,—

20 indicates a base plate supported at the top of a well or pit 21 upon I-beams 22. Mounted upon the plate 20 and suitably secured thereto is a water discharge casing 23 (see Fig. 10) to the outer end of which is secured in any suitable manner a horizontally-extending water discharge pipe 24. The water discharge casing 23 is divided into three sections at the point where it is joined to the base plate 20, as is best shown in said Fig. 10. Rising from the casing 23 are three standards 25—26—27 to which is connected a standard 28, upon the upper end of which is revolvably mounted a hub 29 about which is removably secured a pulley 30. The hub 29 has adjustably connected to it the upper end of a shaft 31, the adjustment of the shaft being secured through the medium of nuts 32 mounted by means of screw-threads upon the upper end of the shaft.

The standard 28 comprises a sleeve 33 which is out of contact with the shaft 31, the shaft 31 and the hub 29 being supported by means of anti-friction bearings supported by said sleeve. Such anti-friction bearings

comprise bearing-rings 34—35 supported by the standard 28 and other bearing-rings 36—37 mounted in a sleeve 38 depending from the hub 29 about the sleeve 33 and within a sleeve 39 rising from the standard 28. The oppositely-disposed portions of the bearing-rings in which the raceways for the balls 40 are cut are obliquely disposed whereby such bearings are adapted to take care of both the downward pressure and the lateral pressure, as will be readily understood. An oil cup 41 is provided at the upper end of the shaft communicating with a central duct 42 which conducts oil from the cup to the upper bearing. Oil is also adapted to be conducted to the bearings by a pipe 43 leading from the lower end of a suitable tank 44 by which oil may be fed to the sleeve 39, the space between the sleeve 39 and the sleeve 33 being substantially filled with oil if desired.

The pulley 30 in the construction shown is adapted to be driven by means of a belt 45 which in turn is driven from any suitable source of power. If desired the pulley 30 may be removed from the hub 29 and any other suitable driving means may be substituted, this being accomplished without disturbing the support for the shaft 31 and the oiling means for such support.

46, 47 and 48 indicate water discharge pipes provided at their upper ends with collars 49 secured thereon by means of screw-threads, such collars 49 being secured to the under face of the base plate 20 immediately below the three separate sections of the discharge casing 23 so as to provide communication between the said pipes and the water discharge casing. 50 indicates a casing about the shaft 31 secured by means of screw-threads at its upper end in a suitable screw-threaded opening through the base plate 20, a bearing 51 for the shaft 31 being secured by means of screw-threads upon the protruding upper end of the shaft casing 50.

Pipes 46, 47 and 48 are to be of a uniform length,—they may be 16 or 20 feet in length, more or less,—but must be of a uniform length. Then the three pipes are screwed into plate 52 at their lower ends. The upper end of each pipe has a separate flange 49 screwed to each; then they are placed into a machine and machined true and centrally for the alinement of shaft 31; then the flange 53 is connected to said flanges.

I may omit the plate 53 for reducing the expense and use any other substitute for shipment. In that case the flange 52 will bolt direct to 49. The pipes are then shipped from the factory in sets of threes ready to be joined together by means of bolts or other suitable fastening devices.

The plate 53 in each instance is provided with a screw-threaded opening at its cen-

tral point adapted to receive the upper end of a screw-threaded casing 50, upon the upper protruding end of which is provided a bearing 54 for the shaft 31.

Other bearings for the shaft 31 are provided between the ends of the several sections of the water discharge pipes, the number of such bearings depending upon the length of such sections, a bearing being provided preferably every five or six feet. As is best shown in Fig. 1, the intermediate bearings 55 are supported by the casing 50 being connected thereto by means of screw-threads. Each of the bearings 55 (see Fig. 4) is provided with bosses 56 on its sides in which are mounted by means of screw-threads short pins 57 upon the outer ends of which are mounted brackets 58 which are adapted to engage the pipes 46—47—48 for spacing such pipes in position relative to each other. As is shown in Fig. 5, when more than one bearing 55 is employed between the adjacent bearings 54, a second length of casing 50 is secured by means of screw-threads to the lower end of the uppermost one of such intermediate bearings 55, depending downward therefrom to the next bearing 55 for properly supporting it in position. As is best shown in Figs. 1 and 5, the lowermost one of the intermediate bearings 55 for each length of the pipes 46, 47 and 48 has depending from it a small pipe 59 in lieu of a casing 50 surrounding the shaft, such pipe 59 connecting at its lower end to the bearing 54 immediately below, as shown in Figs. 1 and 3.

The lowermost bearing 54 for the shaft 31 just above the pumping means down in the well is secured by means of a short threaded sleeve 60 to the upper end of a sleeve 61 cast as a portion of a member 62 that is provided with three separate conduits 62^a as clearly shown in Fig. 7 by which the water is carried from the pump casing 63 to the water discharge pipes 46, 47 and 48. The pump casing 63 is formed in sections, as is well understood in the art, being provided with cap plates 64 fixed in position therein directly above runners 65 which are fixedly secured upon the shaft 31. A nut 66 below the lowermost runner 65 holds such runner in position relative to the shaft. A bearing 67 of any suitable type for the lowermost end of the shaft 31 is secured in position by webs 68 centrally of a casing member 69 immediately below the pump casing 63. The uppermost cap plate 64 comprises a sleeve 70 in alinement with the sleeve 61. The sleeves 61 and 70 are provided with packing means 71—72, respectively, between which is mounted a coiled spring 73, metal plates 74—75 being interposed between the ends of the spring and the packing means. A recess 76 is provided near the lower end of the sleeve 61, which

recess is connected by means of a pipe 77 with a tank 78 adapted to contain clean water. Water from the tank 78 is thus fed to the recess 76 serving to assist the spring 5 73 in holding the packing tight within the sleeves and serving to keep such packing wet so as to be serviceable for excluding the water being pumped from the bearing 54 immediately above the sleeve 61. Should 10 the supply of water through the pipe 77 fail at any time, clean water from the supply being pumped may be furnished through a short pipe or nipple 79 that is located in one of the conduits 62^a, such nipple being 15 clearly shown by the breaking away in Fig. 6 of a part of the wall of that conduit. This nipple communicates with the recess 76, the entrance of water to the nipple being through a screen or filter 80 carried at 20 the upper portion of such nipple. Below such screen or filter is provided a downwardly-opening valve 79^a which is normally kept closed by the pressure of the water in the supply pipe 77 so that the clean water 25 supplied to the recess 76 from the tank 78 will not be allowed to escape, but which valve will open when the supply from such tank fails and admit water from the stream being forced up through such conduit—such 30 water, however, being cleared of sand, as will be understood, on account of passing through the screen or filter 80.

Within the lower end of the casing 69 is mounted a shell 81 which is held in position 35 by means of an outwardly-extending flange 82 which extends between the casing 69 and the downwardly-extending casing 83, to the lower end of which the water suction pipe 84 is connected. The shell 81 is provided 40 with a cross-bar 85 upon which is mounted a double-leaved valve 86 which is in the form of a flexible diaphragm of any suitable type provided with plates 87 fixed thereto for holding it in position. The diaphragm 86 is held in position by an inverted 45 U-housing 88 which is held in position by means of suitable bolts 89 passing through the bar 85. The sides of the housing 88 are provided with suitable openings 90, and at 50 its center the bar 85 is provided with an opening 91 adapted to be closed by a valve 92 which is held yieldingly in closing position by means of a spring 93, the lower end of which is supported by a cross-bar 94 ad- 55 justably held in position relative to the cross-bar 85 by means of screw-threaded pins 95. As best shown in Fig. 11, the pipe 24 has interposed in it a short section of pipe 96 of a larger size having small pipes 60 97 leading downward from its lowermost portion, such pipes 97 opening into a small pipe 98 provided with a valve 99, this arrangement being for the purpose of clearing sand from the water as hereinafter de- 65 scribed.

In Fig. 13 which shows a modification of the structure shown in Fig. 4, corresponding parts are indicated by the same reference characters, but with the addition of an exponent "a." In this construction the pins 70 57^a, instead of being adapted to screw into brackets 58, screw into rings or collars 100 which surround the water discharge pipes, being provided with set screws 101 by which they are adjustable relative to the pipes. 75 By the constructions shown in Figs. 4 and 13, the pump shaft is adapted to be adjusted relative to the water discharge pipes to secure proper alinement of such shaft.

In Figs. 14 and 15, which show another 80 modification, corresponding parts are indicated by the same reference characters but with the addition of an exponent "b." In this construction two water discharge pipes 102 and 103 are used in lieu of the three- 85 pipe construction of the remaining figures, the construction here shown employing the adjusting means such as that shown in Fig. 13 in lieu of the type shown in Fig. 4.

In Fig. 12 is shown a modified form of 90 mechanism at the bottom of the pump casing. In this construction a two-part casing 104—105 is secured below the pump casing 63^c, the members 104—105 supporting between them a plate 106 upon a cross-bar 95 107 of which is mounted a two-leaved valve 108 of any suitable type adapted to close downward to prevent the escape of water downward through the suction pipe 84^c. A spring-seated upwardly opening valve 109 100 is provided in communication with the casing member 104 providing relief for the water above the valve 108 as hereinafter described.

With the shaft 31 being driven by means 105 of the pulley 30, or in any other suitable manner, the runners 65 are rotated, serving to cause the water to rise through the suction pipe 84 past the valve 86 whence it is forced upward through the water discharge 110 pipes 46, 47 and 48 and discharged through the discharge head 23. A suitable supply of clean water is supplied through the pipe 77 from the tank 78 to the packing means 71 and 72, serving to prevent the water being 115 pumped from passing upward about the shaft to the bearing 54 immediately above the runners. At the same time a suitable supply of oil is fed to the anti-friction bearings located within the pulley 30, such 120 supply of oil coming from the cup 41 and the tank 44. Oil is delivered from the tank 44 also to the upper end of the bearing 51 through a pipe 110 branching from the pipe 43. Any excess of oil from the cup 41 flow- 125 ing past the bearings within the pulley 30, together with such oil as is admitted to the pipe from the tank 44, passes downward through the pipe 110 for lubricating the bearing 51 and on downward past the bearing 130

51 through the casing 50 to the bearing 55 immediately below the bearing 51. The oil passing through the lowermost bearing 55 for any length of pipes 46, 47 and 48 is conducted by the pipe 59 to the bearing 54 immediately below. The oil is thus conducted from the cup 41 and the tank 44 downward by steps through the various bearings and through various lengths of casings 50 and 59 to the bearing 54 immediately above the pump runners.

The water which is delivered through the discharge pipe 24 at or near the surface is delivered into the enlarged pipe section 96. By reason of the enlarged cross-section of the pipe 96, the water is adapted to flow more slowly through such pipe, giving the sand and other sediment carried by the water an opportunity to settle to the bottom of such pipe, whence it is carried out through the pipes 97 and 98, the valve 99 being kept open during the operation of the pump a sufficient amount to permit of such a flow of water therethrough as may be necessary for taking care of the sand which settles in the pipe 96.

By reason of the provision of the check-valve at the bottom of the pump casing, I am enabled to retain in the pump casing such an amount of water as may be necessary for starting the pump without priming from any other source. In order to prevent injury to the pump casing by reason of the back pressure of the water upon the sudden stopping of the pumping operation when a check-valve is used, I have provided the downwardly-opening relief-valve 92 which is adapted to open automatically when the pressure above the valve exceeds the pressure below the valve by a certain predetermined margin.

The use of a relief-valve such as that shown in Fig. 6 serves also as a means for the escape of sand from the pump casing. In many cases in newly bored wells a very high percentage of sand is pumped with the water for a considerable time, sometimes as high as thirty or forty per cent. Upon the stoppage of a pump operating in a well of this type and provided with a foot-valve, if no means were provided for the escape of the sand, the entire pump casing above the valve and a considerable portion of the lower end of the water discharge pipe or pipes would be entirely filled with the sand which would settle from the water retained in the pump when brought to a stop, making it out of the question to start the pump again into operation. By the use of such a valve as that shown in Figs. 6 and 8, the immense quantity of sand contained in the water is cleared from the casing leaving the valve 86 free to have its normal operation. This is accomplished by adjusting the spring 93 of the valve to sup-

port any desired height of water above the valve, this being effected through the adjustment of the bar 94 along the screw-threaded pins 95. When the pump is suddenly stopped or slowed down, the backward pressure of the water upon the valve 86 is relieved sufficiently by the opening of the valve 92 so as to prevent the water from bursting the pump casings or otherwise injuring the parts. If the spring 93 were set to support 20 feet of water, for example, in a well 150 feet deep, then the valve 92 would be held open until the water in the upper 130 feet of the pipes 46-47-48 flowed at a fairly slow rate through the opening 91. The sand would settle through the entire line of piping above the valve and substantially all of the sand would be washed out of the pump casing and the discharge pipes long before the water had reached the predetermined level at which the spring 93 would act to close the valve. Accordingly when the valve 92 finally closes it retains within the pump casing the desired column of clear water substantially free of sand or other sediment. By reason of this construction, when pumping has been carried on for some little time so as to carry the level of the water in the well below the runners, when the pump is stopped temporarily for any reason a quantity of water is retained within the pump casing to provide for starting the pump again into effective operation without being compelled to wait until the water rises in the well to or above one of the runners.

What I claim as my invention and desire to secure by Letters Patent, is—

1. In a deep well pump, the combination of a plurality of lines of sectional discharge piping, means for connecting said lines of piping together at the section joints, a shaft, bearings for said shaft supported by said connecting means, other bearings for said shaft between said pipe connecting means, means for adjusting said last-named bearings relative to said lines of piping for maintaining said shaft in alinement, and means actuated by the rotation of said shaft for forcing water upward through said discharge pipes.

2. In a deep well pump, the combination of a plurality of lines of sectional discharge piping, means for connecting said lines of piping together at the section joints, a shaft, bearings for said shaft supported by said connecting means, other bearings for said shaft supported from said pipe connecting means respectively but located at a distance therefrom, said last-named bearings being adjustable relative to said lines of piping for maintaining said shaft in alinement, and means actuated by the rotation of said shaft for forcing water upward through said discharge pipes.

3. In a deep well pump, the combination of a plurality of lines of sectional discharge piping, means for connecting said lines of piping together at the section joints, a shaft,

5 bearings for said shaft supported by said connecting means, means for conducting a lubricant downward to said bearings successively, said lubricant-conducting means being attached to and depending from said
10 connecting means, other bearings for said shaft between said pipe-connecting means, said last-named bearings being supported in position by said lubricant-conducting means, and means actuated by the rotation
15 of said shaft for forcing water upward through said discharge pipes.

4. In a vertical centrifugal pump, the combination of a plurality of discharge pipes for the discharge of liquid pumped, a
20 shaft extending down between said pipes, bearings for the shaft mounted between the discharge pipes and supported by connections joining said pipes, other pipes surrounding the shaft supported by said bearings, other bearings for said shaft supported
25 by said last-named pipes, and means for adjusting said last-named bearings laterally relative to said first-named pipes.

5. In a vertical centrifugal pump, the combination of a plurality of discharge
30 pipes for the discharge of liquid pumped, a shaft extending down between said pipes, bearings for the shaft mounted between the discharge pipes and supported by connections joining said pipes, other pipes surrounding the shaft supported by said bearings, other bearings for said shaft supported
35 by said last-named pipes, means for adjusting said last-named bearings laterally relative to said first-named pipes, and means
40 for delivering oil to said second-named pipes.

6. In a vertical centrifugal pump, the combination of a plurality of discharge
45 pipes for the discharge of liquid pumped, a shaft extending down between said pipes, bearings for the shaft mounted between the discharge pipes and supported by connections joining said pipes, other pipes surrounding the shaft supported by said bearings, other bearings for said shaft supported
50 by said last-named pipes, means for adjusting said last-named bearings laterally relative to said first-named pipes, and means
55 for delivering oil to said bearings through said second-named pipes.

7. In a vertical centrifugal pump, the combination of a plurality of discharge
60 pipes for the discharge of liquid pumped, a shaft extending down between said pipes, bearings for the shaft mounted between the discharge pipes and supported by connections joining said pipes, other pipes surrounding the shaft supported by said bearings, other bearings for said shaft supported

ported by said last-named pipes, and connections between each of said last-named bearings and the one of said first-named bearings immediately below it for conducting oil from one bearing to the other.

8. In a pump of the type described for pumping fluid, the combination of a pump shaft, one or more runners carried thereby, a sectional discharge pipe, bearings for the pump shaft supported from the members by
75 which the separate sections of said discharge pipe are connected together, and means for adjusting said bearings relative to said discharge pipe for bringing said shaft into
80 alinement.

9. In a pump of the type described for pumping water, the combination of a pump shaft adjustably suspended, pump runners mounted thereon, discharge pipes suspended adjacent to said shaft, bearings for the
85 pump shaft supported by the discharge pipes at intervals therealong, and means for adjusting said bearings relative to the discharge pipes for holding said pump shaft in
90 alinement for operation.

10. In a deep well pump, the combination of a plurality of pipes arranged side by side, a plate to which said pipes are connected by screw-threads at their ends, collars mounted
95 by means of screw-threads upon the opposite ends of said pipes, a second plate secured to said collars, a shaft revolvably mounted in said plates, a pump casing communicating with the lower ends of said pipes, and means
100 actuated by the rotation of said shaft for forcing water upward through said pipes.

11. In a deep well pump, the combination of a plurality of pipes arranged side by side, a plate to which said pipes are connected by screw-threads at their ends, collars mounted
105 by means of screw-threads upon the opposite ends of said pipes, a second plate secured to said collars, bearings mounted in said plates, a shaft revolvably supported by said bearings other bearings for said shaft between
110 said first-named bearings, means for adjusting said last-named bearings relative to said pipes, a pump casing communicating with the lower ends of said pipes, and means
115 actuated by the rotation of said shaft for forcing water upward through said pipes.

12. In a deep well pump, the combination of a plurality of pipes arranged side by side in spaced relation, a shaft between said pipes, means for connecting said pipes and
120 said shaft firmly in position, a bearing within which said shaft is revolvably mounted, means for adjusting said bearing laterally relative to said pipes, a pump casing communicating with the lower ends of said pipes,
125 and means actuated by the rotation of said shaft for forcing water upward through said pipes.

13. In a deep well pump, the combination of a plurality of pipes arranged side by side

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in spaced relation, a shaft between said pipes, means for connecting said pipes and said shaft firmly in position, a bearing within which said shaft is revolubly mounted, 5 brackets adjustably mounted on said bearing and extending laterally therefrom adapted to be adjusted for varying the position of the bearing relative to said pipes, a pump casing communicating with the lower ends of said 10 pipes, and means actuated by the rotation of said shaft for forcing water upward through said pipes.

14. In a deep well pump, the combination of a plurality of pipes arranged side by side 15 in spaced relation, a shaft between said pipes, means for connecting said pipes and said shaft firmly in position, a bearing within which said shaft is revolubly mounted, 20 bosses on the sides of said bearing, pins adjustably secured by means of screw-threads in said bosses, brackets adjustably secured by means of screw-threads upon said pins and adapted to be adjusted for varying the position of the bearing relative to said pipes,

a pump casing communicating with the 25 lower ends of said pipes, and means actuated by the rotation of said shaft for forcing water upward through said pipes.

15. In a pump of the type described, the combination of a plurality of discharge-pipe 30 sections for the discharge of liquid being pumped, a shaft extending down between said pipe sections, connecting means joining said pipe sections together at one end, a 35 bearing for the shaft supported by said connecting means, a casing for the shaft extending through said connecting means and connected to said bearing and depending below said connecting means, a second set of similar pipe sections below said first-named sec- 40 tions and communicating therewith, another bearing for the said shaft, said last-named bearing being supported by the depending portion of said casing, and means on said last-named bearing for adjustably engaging 45 said second-named pipe sections.

MATTHEW T. CHAPMAN.