

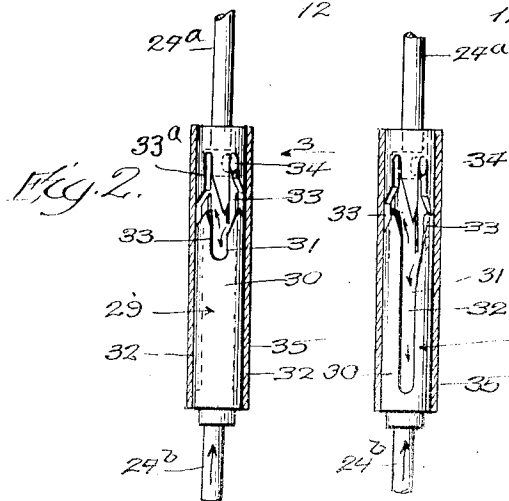
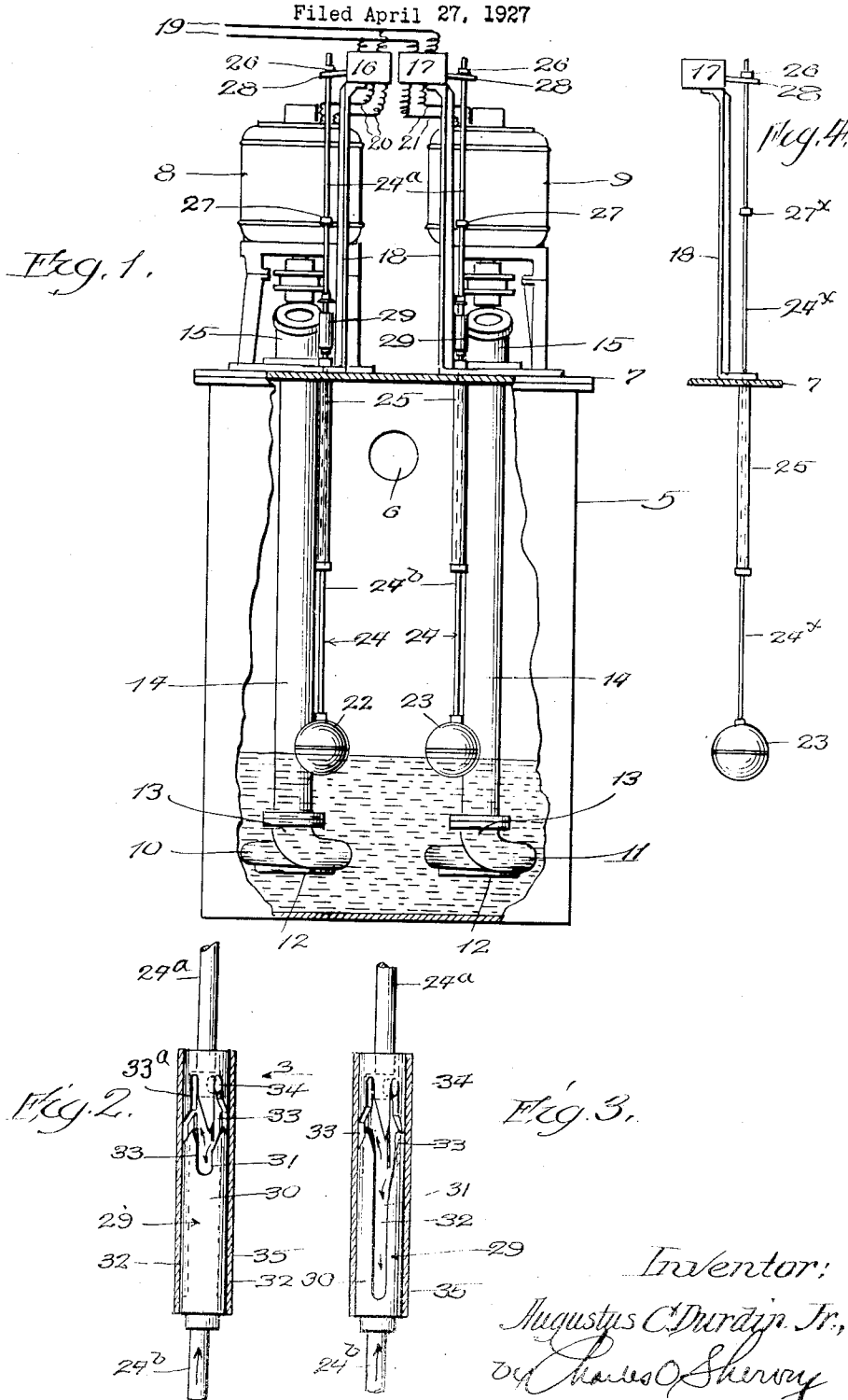
April 17, 1928.

1,666,873

A. C. DURDIN, JR

DUPLEX PUMPING APPARATUS

Filed April 27, 1927



29

Inventor:
Augustus C. Durbin, Jr.,
by Charles O. Sherway
his Atty

UNITED STATES PATENT OFFICE

AUGUSTUS C. DURDIN, JR., OF CHICAGO, ILLINOIS, ASSIGNOR TO CHICAGO PUMP COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

DUPLEX PUMPING APPARATUS.

Application filed April 27, 1927. Serial No. 187,008.

This invention relates to duplex pumping apparatus and its principal object is to provide automatically controlled companion pumps that operate alternately or in regular sequence, but are capable of being automatically set into action so as to operate in unison. In many situations it is desirable to have two pumps for ejecting liquids from a well, cistern, tank or other receptacle, one of the pumps operating at a time and in alternate manner, but capable of being set into action so as to operate in unison in case the capacity of one pump is not sufficient to discharge the liquid as rapidly as it accumulates. Another object of this invention is to provide automatic means, controlled by the rise of liquid in the receptacle, for starting the pumps alternately under normal conditions, and acting to start both pumps in case the inflow to the receptacle exceeds the capacity of one pump.

With these and other objects and advantages in view, this invention consists in pumping apparatus embodying a pair of pumps operating to eject liquids from a well, cistern, tank or other receptacle and having automatic means controlled by the rise and fall of water in the well, cistern, tank or other receptacle for alternately starting one of the pumps to thereby eject the liquid and then stopping the pump, and for starting both pumps in the event that abnormal conditions arise and then stopping both pumps when the receptacle has been emptied. The invention further consists in the several novel features hereinafter fully set forth and claimed.

The invention is clearly illustrated in the drawing accompanying this specification, in which:

Fig. 1 is a side elevation partly broken out of duplex pumping apparatus embodying a simple form of the present invention; Fig. 2 is a view partly in vertical section and partly in side elevation of a control device employed for alternating the action of the pumps; Fig. 3 is a view partly in vertical section and side elevation of the device seen in Fig. 2 looking in the direction of the arrow 3, and Fig. 4 is a side elevation of a float rod and switch, which may be used as a substitute for one of the float rods shown in Fig. 1.

Referring to said drawing, the reference character 5 designates a receptacle which

may be in the form of a tank, well, cistern or other reservoir, having an inlet opening 6 through which liquids empty into the receptacle. The receptacle is shown as provided with a cover 7 on its upper end, and on said cover are mounted two electric pump motors 8, 9, to each of which is connected a centrifugal pump 10, 11, connected to or contained in the receptacle 5 near the bottom thereof. The pumps have their inlet ends 12 opening into the interior of the receptacle and their discharge ends 13 are connected with discharge pipes 14 which may extend up through the top or cover 7 of the receptacle and are provided with fittings 15 on their upper ends which may be connected to suitable conduits or discharge pipes (not shown) for conveying away the liquid which is pumped out of the receptacle 5.

Each electric pump motor is controlled by an electric switch 16, 17 which may be mounted upon standards or other supports 18 mounted on the cover 7. The electric conductor wires 19 from the source of supply lead to the switches 16, 17 and conductor wires 20, 21 run from the switches to the pump motors 8, 9. The electric switches 16, 17 are automatically operated and the level of the liquid, which accumulates in the receptacle, controls the operation of the switches. In accordance with the present form of the invention, I use floats 22, 23 one for each electric switch, which floats are mounted on float rods 24 that extend up through guide ways 25 supported from the cover and the upper ends of said float rods have buttons or collars 26, 27, secured thereon and arranged to engage with the switch levers 28 of the electric switches 16, 17, one of the buttons 27 at a time being arranged to engage its associated switch lever when the liquid in the receptacle reaches a predetermined high level and thereby close the switch for the associated motor. The buttons 26 are arranged to engage the switch levers when the liquid in the receptacle reaches a low level and thereby open any closed switch.

In order that the pumps may operate alternately a control device 29 is provided for one or both float rods 24, which control device is constructed and arranged to provide for a long stroke and short stroke for the upper end of each float rod, whereby dur-

ing the long stroke of the float rod a switch will be closed and during the short stroke the switch will remain open. By properly setting the two control devices 29, only one
 5 pump at a time will be started each time that the liquid in the receptacle reaches a predetermined high level and the pumps, therefore, will be started alternately. The exact construction of the control devices 29
 10 is immaterial to this invention broadly considered and the simple one illustrated has been shown for the purpose of illustration only. A complete description of the construction and operation of the control devices is found in my co-pending application
 15 for patent on means for operating electric switches and other mechanism, filed December 29, 1926, under Serial No. 157,856. Briefly, each control device illustrated, comprises a cylindrical member 30 (see Figs.
 20 2 and 3) having a continuous guide way or groove 31 formed in its annular wall and containing long sections 32 and short sections 33 in which travel pins or lugs 34. Each float rod is made of two sections 24^a,
 25 24^b and the cylindrical grooved member 30 is secured upon one end of the float rod section 24^b. The float rod section 24^a extends into the hollow of the cylindrical grooved member 30 and has the pins 34 secured upon
 30 its lower end. During the reciprocation of a float rod the pins travel alternately through the short and long sections of the groove. A sleeve 35 is preferably provided around the grooved cylindrical member 30
 35 so as to completely enclose the same.

In the operation of the apparatus, and assuming the grooved member 30 of one control device be in the position seen in Fig. 2
 40 with the float rods at the lower limit of their stroke. At this time the grooved member 30 of the other control device is in the position seen in Fig. 3. During the upward movement of the lower float rod section 24^b (Fig. 2) and cylindrical grooved
 45 member 30, the short section 33 of the groove passes up along the pin 34 without affecting the upper float rod section 24^a until the lower end of the short section 33 of the groove is reached whereupon the pin 34 is
 50 engaged by the lower end of the groove and the upper float rod section is thereupon moved upward sufficiently to cause the button or collar 27 to engage its associated
 55 switch lever 28 when the level of the liquid in the receptacle reaches a predetermined high level, and the pump controlled by the associated control device, is thereby set into operation. At the same time the other float
 60 rod is also lifted but remains ineffective for the purpose of closing its switch. As the liquid is being discharged from the receptacle, both floats and their float rods descend, and during the downward movement
 65 of the lower section of the float rod which is

being described, the pin 34 enters the short section 33^a of the continuous groove, and when the upper end of the groove engages with the pin 34 the upper section of the float
 70 rod is carried down, thereby opening the switch again when the low level is reached in the receptacle. On the next upstroke of the same float rod, the long section 32 of the continuous groove receives the pin 34 and the upper float rod section remains unaf-
 75 fected by the upper movement of the lower float rod section until the lower end of the long section of the groove engages the pin 34 whereupon the upper float rod section is raised if the float rod continues to move up-
 80 ward as it will if the inflow to the receptacle is greater than the capacity of the other pump which is now ejecting the liquid therefrom. The two control devices 29 are set so that when both float rods are at the lower
 85 ends of their strokes, the pin 34 of one control device enters the short section of the continuous groove when the float rods are lifted, whereas the pin 34 of the other float rod enters the long section of the groove. 90
 The result is that the float rod (of which the pin enters the short section of the continuous groove) lifts the upper section of the float rod sufficiently, at the high level of the liquid, to close the switch to one motor,
 95 thereby starting the associated pump, whereas the other float rod (of which the pin enters the long section of the groove) does not move the upper section thereof sufficiently at the high level to close the switch to the
 100 other motor, so that the associated pump remains idle during the operation of the first mentioned pump. If, however, the liquid continues to rise above the high level, faster than it can be discharged by the one pump,
 105 then the inactive float rod is lifted far enough to close the switch of the idle pump motor, thereby starting it and causing both pumps to operate in unison, and as the liquid is discharged both float rods and their
 110 floats descend until the low level is reached, whereupon both switches are opened and pump motors are stopped.

The automatic, alternate operation of the pump motors, and their operation in unison
 115 may be obtained with the use of a control device 29 on one float rod only, the other float rod 24^{*} (see Fig. 4) being unprovided with a control device. In such case the button or collar 27^{*} on the float rod 24^{*} is placed at a
 120 position on said float rod slightly higher than the corresponding button 27 on the float rod containing the control device. It should be placed a distance above the button 27 on the other float rod equal to approx-
 125 imately half the distance between the lower ends of the short and long sections of the cylindrical slotted member 29. With this arrangement the operation of the apparatus is precisely the same as that accomplished with
 130

the two control devices. When the pin 34 rides in the short section 33 of the groove 31, the button 27 on the float rod 24 engages the switch lever and trips the switch before the button 27* reaches its associated switch lever. On the other hand when the pin 34 rides in the long section of the groove, the button 27* on the float rod 24* engages its associated switch lever and trips that switch before the button 27 on the other float rod engages its associated switch lever. When the water level rises above the predetermined one for tripping one switch, both buttons act as before and trip both switches.

The apparatus is useful for pumping liquid into a tank in place of ejecting it therefrom. In such cases the inlets to the pumps are connected with the source of supply, and the discharge ends are connected with the tank, and the floats and float rods placed in the tank. The switches are merely inverted so that upward movement of the float rods acts to open the switches when the tank is filled, and downward movement of the float rods acts to close the switches when the tank is empty.

From the above it is evident that the apparatus is entirely automatic in operation and requires no attention except the usual care for the motors and other mechanism. It dispenses with the necessity of an attendant manually setting any control devices for alternately operating the pumps. The apparatus is very efficient in operation and because of the alternate operation of the pumps the wear and tear thereon is not so great and one pump is always sure of operation in case a high water level is reached and under extraordinary circumstances both pumps are automatically set into operation. While the invention has been shown and described in connection with two centrifugal pumps it is to be understood that the invention is not limited to centrifugal pumps, neither is it limited to pumps contained in the receptacle. Furthermore, although the means for closing the switches has been shown and described as comprising float operated mechanism, other equivalent switch operating means may be substituted which will operate under the influence of the pressure or vacuum in a closed tank, receptacle or chamber to open and close the switches.

More or less variation of the exact details of construction is possible without departing from the spirit of this invention; I desire, therefore, not to limit myself to the exact form of the construction shown and described, but intend, in the following claims, to point out all of the invention disclosed herein.

I claim as new, and desire to secure by Letters Patent:

1. A duplex pumping apparatus the combination of a receptacle and a pair of auto-

matically controlled, alternately operating, motor driven pumps for ejecting liquids from said receptacle, the control means for said pumps being governed by the rise and fall of liquid in said receptacle.

2. In duplex pumping apparatus, the combination of a receptacle and a pair of automatically controlled, alternately operating, motor driven pumps for ejecting liquids from said receptacle, the control means for said pumps being governed by the rise of liquids to a predetermined level to start the pumps alternately, and being governed by a rise of the liquids above said predetermined level to start both pumps.

3. In duplex pumping apparatus, the combination of a receptacle, a pair of alternately operating, electric motor driven pumps for ejecting liquids from said receptacle, and starting and stopping mechanism for each pump motor, controlled by the level of the liquids in the receptacle, said starting and stopping mechanisms operating to start the motors in alternate sequence at succeeding predetermined high water levels in the receptacle.

4. In duplex pumping apparatus, the combination of a receptacle, a pair of alternately operating, electric motor driven pumps for ejecting liquids from said receptacle, and starting and stopping mechanism for each pump motor, controlled by the level of the liquids in the receptacle, said starting and stopping mechanisms operating to start the motors in alternate sequence at succeeding predetermined high water levels in the receptacle and to start an idle pump motor at a predetermined higher water level in the receptacle.

5. In duplex pumping apparatus, the combination of a receptacle, a pair of electric motor driven pumps for ejecting liquids from said receptacle, electric switches, one switch for each motor, and float controlled switch actuating mechanism for each switch, each including a lost motion device, and operating, under the rise of liquids in said receptacle, to start the pump motors in alternate sequence at succeeding predetermined high water levels in the receptacle.

6. In duplex pumping apparatus, the combination of a receptacle, a pair of electric motor driven pumps for ejecting liquids from said receptacle, electric switches, one switch for each motor, and float controlled switch actuating mechanism for each switch, each including a lost motion device, and operating, under the rise of liquids in said receptacle, to start the pump motors in alternate sequence at succeeding predetermined high water levels in the receptacle and to start an idle pump motor at a higher water level than said predetermined one.

7. In duplex pumping apparatus, the combination of a receptacle, a pair of electric

motor driven pumps, having their pumping elements contained in said receptacle, and adapted to eject liquids therefrom, and automatic starting and stopping mechanism for each pump motor, comprising an electric switch, and a float controlled and operated switch actuating mechanism, including an alternately operating lost motion device, whereby said switch actuating mechanisms operate to start the pump motors in alternate sequence at succeeding predetermined high water levels in the receptacle.

8. In duplex pumping apparatus, the combination of a receptacle, a pair of electric motor driven pumps, having their pumping elements contained in said receptacle, and adapted to eject liquids therefrom, and automatic starting and stopping mechanism for each pump motor, comprising an electric switch, and a float controlled and operated switch actuating mechanism, including an alternately operating lost motion device, whereby said switch actuating mechanisms operate to start the pump motors in alternate sequence at succeeding predetermined high water levels in the receptacle and to start an idle pump at a higher water level than said predetermined one.

9. In duplex pumping apparatus, the combination of a liquid receiving receptacle and a pair of automatically controlled, alternately operating, motor driven pumps operating to pump the liquid entering said receptacle, and motor controlling means for starting and stopping said pumps alternately, said motor controlling means being governed by the rise and fall of liquid in said receptacle.

10. In duplex pumping apparatus, the combination of a receptacle, a pair of alternately operating, electric motor driven pumps for operating in conjunction with said receptacle, and starting and stopping mechanism for each pump motor, controlled by the level of the liquid in the receptacle, said starting and stopping mechanisms operating to start the motors in alternate sequence at succeeding predetermined water levels in the receptacle.

11. In duplex pumping apparatus, the combination of a receptacle, a pair of electric motor driven pumps operating in conjunction therewith, and automatic starting and stopping mechanism for each pump motor, comprising an electric switch, and a float controlled and operated switch actuating mechanism, including an alternately operating lost motion device in at least one of said switch actuating mechanism, whereby said switch actuating mechanisms operate to start the pump motors in alternate sequence at succeeding predetermined water levels in the receptacle.

12. The combination of several pumps, opening in the same source of supply and capable of operating in a regular sequence,

automatic pump starting and stopping mechanism therefor, and automatic sequence control means associated with said pump starting and stopping mechanism and having an element whereby first one pump is started while another is quiescent and whereby said other pump is started while the first mentioned one is quiescent.

13. The combination of a receptacle, two alternately operable pumps, each opening to said receptacle, automatic pump starting and stopping mechanism for said pumps, and automatic sequence control means associated with said pump starting and stopping mechanism, and having an element whereby first one pump is started while the other pump is quiescent and whereby said other pump is started when the first mentioned one is quiescent.

14. The combination of a receptacle, several pumps opening to said receptacle and capable of operating in a regular sequence, automatic pump starting and stopping mechanisms for said pumps, and automatic sequence control means associated with said pump starting and stopping mechanisms and having an element whereby first one pump is started while another is quiescent and whereby said other pump is started while the first mentioned one is quiescent.

15. The combination of a receptacle, two pumps, each having one end opening to said receptacle, automatic pump starting and stopping mechanism for said pumps, and automatic sequence control means whereby the pumps are started in alternate sequence.

16. The combination of a receptacle, two pumps, each having one end opening to said receptacle, automatic pump starting and stopping mechanism for said pumps, and automatic sequence control means whereby the pumps are started in alternate sequence, said sequence control means having an element whereby the alternate sequence of operation of the pumps is changed under abnormal conditions.

17. The combination of several pumps opening to the same source of supply and operable in sequence and automatic pump starting and stopping mechanism therefor, including automatic sequence control means, operated by said pump starting and stopping mechanism.

18. The combination of two alternating operable pumps, opening to the same source of supply, automatic pump starting and stopping mechanism therefor, and automatically operating control means for starting said pumps alternately in a regular sequence and stopping the operating pump.

19. A combination of several pumps opening to the same source of supply, said pumps being operable in sequence, automatic pump starting and stopping mechanism therefor, and automatically operating sequence control

5 trol means associated with said pump starting and stopping mechanism for starting said pumps in sequence under normal conditions, said pump starting and stopping mechanism including automatic means for changing the sequence of operation under abnormal conditions.

10 20. In a pumping system, the combination of several pumps opening to the same source of supply, said pumps being operable in sequence, automatic pump starting and stopping mechanism for each pump, each pump starting and stopping mechanism having an active and an inactive position, the
15 pump starting mechanism for one of the pumps only being in active position at any given time to thereby start and stop its

associated pump under normal conditions in the system, and the pump starting and stopping mechanism being arranged to start 20 and stop the several pumps in a predetermined sequence under normal conditions.

21. The combination of several automatically controlled mechanisms operating on the same source and capable of operating in a 25 regular sequence, automatic starting and stopping mechanism therefor, and automatic sequence control means associated with said starting and stopping mechanisms and having an element whereby first one mechanism 30 is started while another is quiescent and whereby said other mechanism is started while the first mentioned one is quiescent.

AUGUSTUS C. DURDIN, JR.