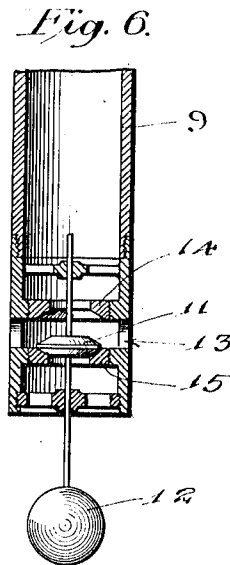
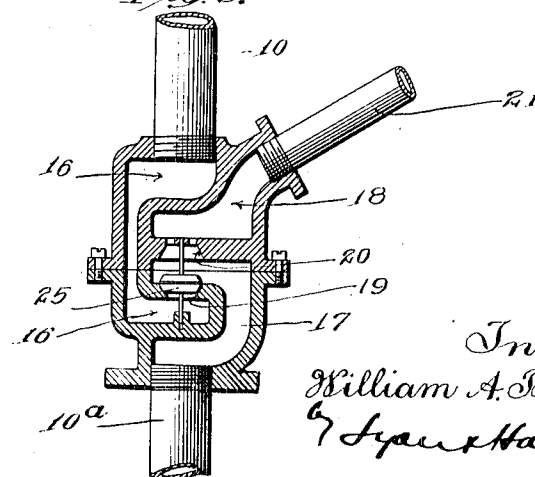
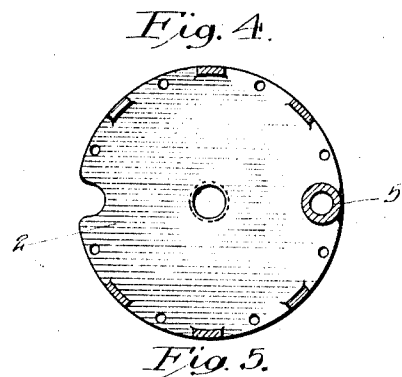
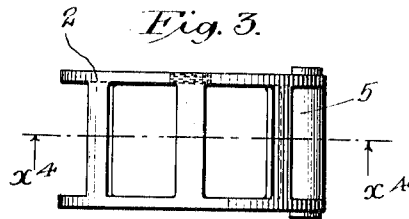
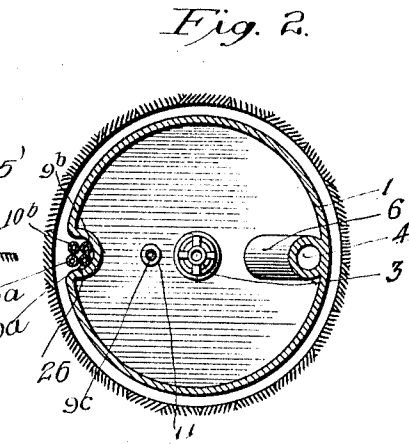
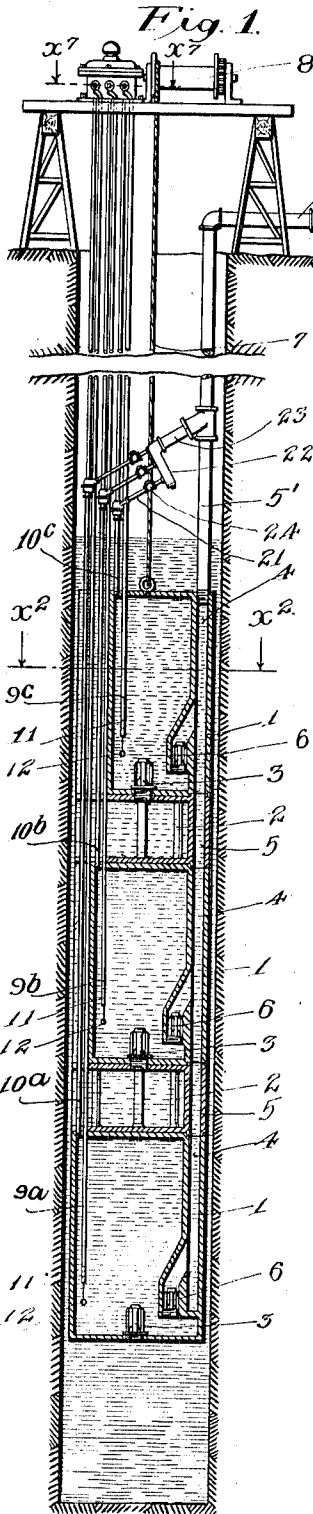


W. A. BRUTON.
PUMPING SYSTEM.
APPLICATION FILED MAR. 19, 1913.

1,096,597.

Patented May 12, 1914.

2 SHEETS—SHEET 1.



Witnesses:
Gully of usson
L. E. Schiller

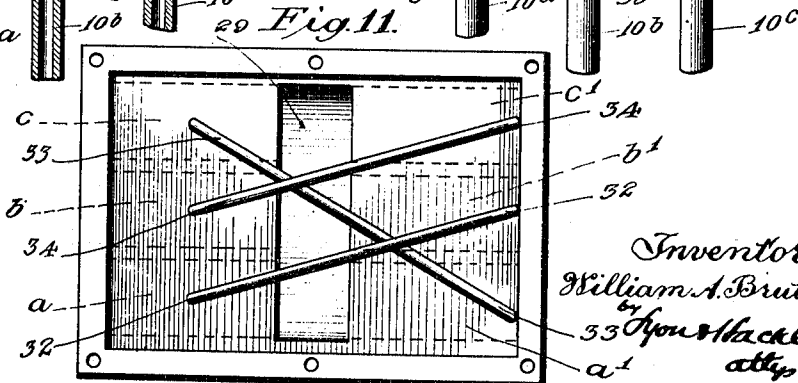
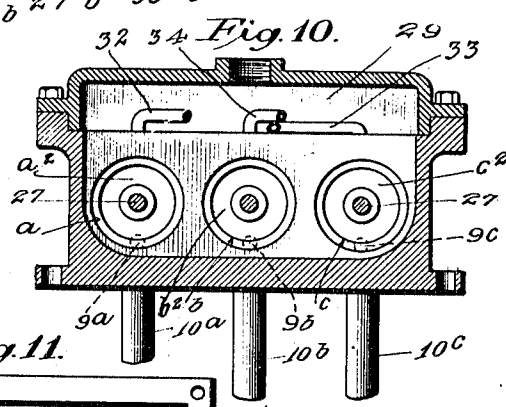
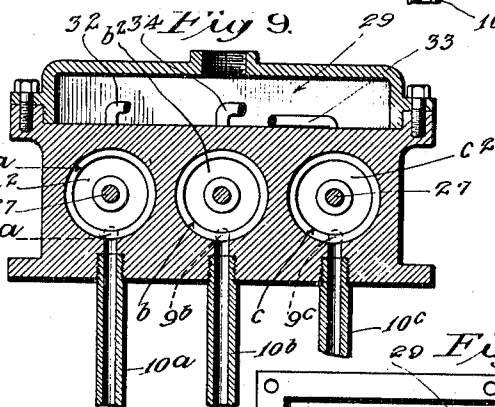
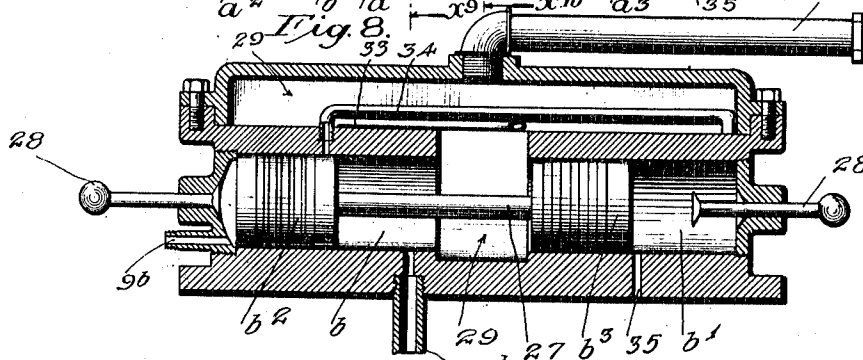
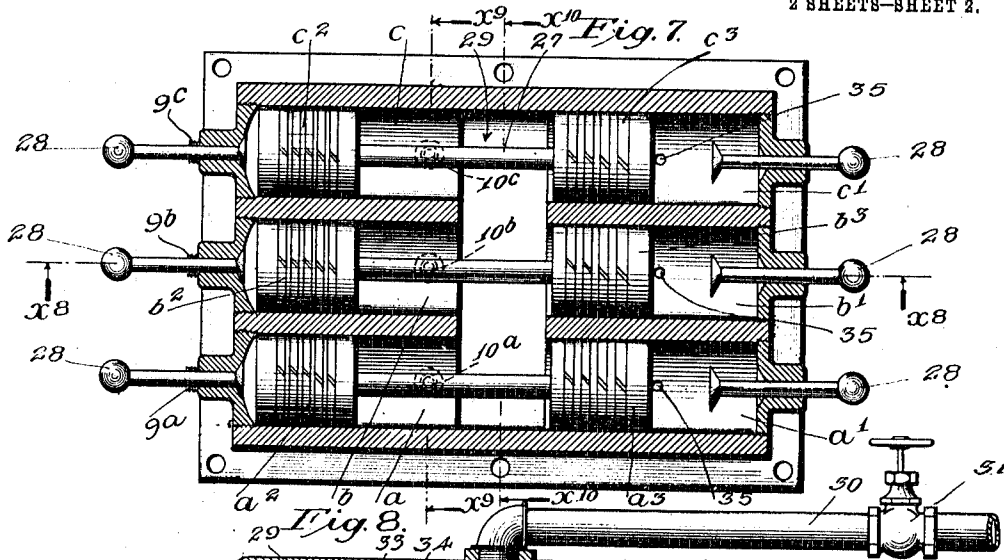
Inventor:
William A. Bruton
by James Hackley
attys.

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2 SHEETS-SHEET 2.



Witnesses:
Gully Fusso,
John H. Allen.

Inventor
William A. Bruton
By J. H. Hackley
att'y

UNITED STATES PATENT OFFICE.

WILLIAM A. BRUTON, OF SAN DIMAS, CALIFORNIA.

PUMPING SYSTEM.

1,096,597.

Specification of Letters Patent.

Patented May 12, 1914.

Application filed March 19, 1913. Serial No. 755,560.

To all whom it may concern:

Be it known that I, WILLIAM A. BRUTON, a citizen of the United States, residing at San Dimas, in the county of Los Angeles and State of California, have invented a new and useful Pumping System, of which the following is a specification.

This invention relates to a pumping system wherein compressed air is utilized as the lifting element instead of mechanical devices, and the invention has for its object to reduce the cost of pumping, reduce the cost of construction of the pumping apparatus, and raise a maximum amount of water with a given amount of air.

A further object of the invention is to use two or more cylinders, so that while one is discharging, the other is filling and a continuous flow of the material being pumped is thereby secured.

A further object is to provide for the removal of all air from the cylinder after the liquid has passed out of the cylinder and to utilize such air to assist in lifting the column of liquid.

A further object is to provide means for restricting the inflow of air, making it possible to reduce the rate of filling of the cylinders to a point corresponding with the capacity of the well, which is an advantage over jet systems which require a certain amount of air for their operation. In the present invention the air acts as an elastic cushion to prevent sudden closing of the valves and, therefore, prolongs the life of the valves and avoids accident thereto.

The governing valves are balanced pistons which can not move of themselves and it is impossible for them to be moved except in regular order, which is determined by the location of the ports. No springs, gears, cams, etc., are employed, each valve being controlled by the others, and no outside power is required to operate the valves.

Other advantages will be brought out in the following description.

Referring to the drawings: Figure 1 is a vertical section through a well equipped with my system. Fig. 2 is an enlarged section on line x^2-x^2 , Fig. 1. Fig. 3 is a side elevation of the spacing cage. Fig. 4 is a section on line x^4-x^4 , Fig. 3. Fig. 5 is a vertical section through the air return valve. Fig. 6 is a vertical section through the valve at the lower end of a governor pipe. Fig. 7

is a horizontal section on line x^7-x^7 , Fig. 1. Fig. 8 is a section on line x^8-x^8 , Fig. 7. Fig. 9 is a section on line x^9-x^9 , Fig. 7. Fig. 10 is a section on line $x^{10}-x^{10}$, Fig. 7. Fig. 11 is a plan view of the valve chest with the cover removed.

In carrying out my invention I employ a plurality of cylinders which are immersed in the liquid to be pumped, the depth of immersion being such that the liquid will readily flow into the cylinders. In the present instance I have shown three cylinders 1, but it should be understood that a greater or less number may be employed if desired. The cylinders 1 are spaced apart by spacing cages 2, shown in detail in Figs. 3 and 4, and their purpose is to space the cylinders apart so that liquid can flow into the space between the cylinders and thereby enter the cylinders through valves 3, one of which is located in the bottom of each cylinder. Each valve 3 is an ordinary ball check valve. Each cylinder is provided along its side wall with a conduit 4 and the spacing cages are provided with conduits 5 which join the conduits 4 and thus provide a continuous passage extending throughout the series of cylinders. A liquid discharge pipe 5' is attached at the upper end of this conduit and leads to the point where the liquid is to be discharged.

The conduit 4 in each cylinder has a branch inlet valve 6 through which liquid may pass from the cylinder into the conduit 4. This valve is of the ordinary ball check type. The cylinders 1 are supported by a cable 7 which may be operated by a windlass 8 at the top of the well.

Communicating with each cylinder is a governor pipe and an air inlet pipe. The governor pipes 9^a, 9^b, 9^c extend into the interior of the cylinders to a point near the bottom thereof, while the air inlet pipes 10^a, 10^b, 10^c only extend to the upper corner of the cylinder. Thus where three cylinders are employed, there will be three governor pipes 9 extending into the respective cylinders and three air inlet pipes extending to the three cylinders, all six pipes leading to the top of the well. At the lower end of each governor pipe 9 is an automatic valve 11 shown in detail in Fig. 6, the position of which is controlled by a float 12.

13 designates an air inlet passage into the valve and 14 is the valve seat.

15 designates a support for the valve, but does not have the function of effecting any closure, for the valve has two positions, one of which is when it is closed against the seat 14, preventing entrance of air into the governor pipe 9, and the other position being open, allowing entrance of air through port 13 into the governor pipe 9, the valve when open merely resting upon the support 15. The position of the valve is determined by the float 12 which rises and falls according to the level of liquid in the cylinder 1.

In each air inlet pipe at a point above the cylinders is a transfer valve shown in detail in Fig. 5, there being a valve seat 19 between chambers 16 and 17 and a valve seat 20 between chambers 17 and 18. Chamber 17 communicates constantly with the lower pipe section 10^a, the chamber 16 constantly communicates with the upper pipe section 10, while the chamber 18 communicates with a branch pipe 21 which leads to a header 22, the latter being connected by pipe 23 with pipe 5'. A check valve 24 is employed in each pipe 21. A valve 25 operates between the two seats 19 and 20 and is capable of closing against either seat according to the direction in which it receives pressure as will be explained.

In order to give room for the passage of the governor pipes 9^a, 9^b, 9^c and air inlet pipes 10^a, 10^b, 10^c, the two upper cylinders are formed with longitudinal grooves 26 in their side wall as clearly shown in Fig. 2. These grooves are made deep enough to accommodate the pipes which must pass the upper cylinders 1. The groove in the middle cylinder 1 may be of the same depth for convenience in manufacture, although it only need be deep enough to receive the two pipes which pass from the lower cylinder 1.

At the upper end of the pipes is the governor valve mechanism shown in Figs. 7 to 11 inclusive, and comprising three pairs of cylinders *a*, *a*¹, *b*, *b*¹ and *c*, *c*¹. Sliding in these cylinders are piston valves *a*², *a*³, *b*², *b*³, *c*², *c*³, each of these pairs of pistons being connected by a piston rod 27. In the outer end of each cylinder is a push rod 28 which may be manually operated to start a pair of pistons into operation when it is desired to cause the pump to operate.

Above the cylinders is an air chest 29 to which the supply of compressed air is introduced by a pipe 30, the rate of inflow being regulated by a valve 31. A pipe 32 places the cylinder *a* in communication with the cylinder *b*¹, a pipe 33 places the cylinder *a*¹ in communication with the cylinder *c*, and the pipe 34 places the cylinder *b* in communication with the cylinder *c*¹. The governor pipe 9^a leads to the end of cylinder *a*, the governor pipe 9^b leads to the end of cylinder *b* and the governor pipe 9^c leads to the end of cylinder *c*. The air inlet pipe 10^a leads to

the bottom of cylinder *a*, the air inlet pipe 10^b leads to the bottom of cylinder *b*, and the air inlet pipe 10^c leads to the bottom of cylinder *c*. Each of the cylinders *a*¹, *b*¹ and *c*¹ have air exhaust ports 35.

In operation, compressed air is admitted to the air chest 29 and to start the pump into action, one of the push rods 28 is operated to push the valves *a*², *a*³ into position shown in Fig. 7, thereby permitting air to pass directly from valve chest 29 into the space between the cylinders and thence into the air inlet pipe 10^a. In the meantime it will be understood that on account of the cylinders 1 in the well being immersed in the liquid, that liquid will have entered all of said cylinders through their check valves 3 and practically filled the cylinders. Before pushing the valves *a*², *a*³ into the position shown in Fig. 7, the valves *b*², *b*³ and *c*², *c*³ are both moved into the opposite position from that shown in Fig. 7, so that the valves *b*², *c*² stand directly over and close the air inlet pipes 10^b and 10^c with the result that compressed air from the chest 29 passes only into the air inlet pipe 10^a. This air passes down the air inlet pipe 10^a and passes from chamber 16 of the transfer valve into the chamber 17, its pressure lifting valve 25 from seat 19, inclosing the valve against seat 20 so that this air is prevented from passing into chamber 18 and from escaping through pipe 21, so that this air continues downward from chamber 17 into pipe 10^a and out from the end thereof into the upper part of the lower cylinder 1 and accumulates in cylinder 1 and presses down upon the liquid therein and forces the liquid to raise valve 6 and pass into the conduit 4, valve 3 preventing outward passage of liquid. Air continues to force liquid out of cylinder 1 in this manner and as the level of liquid in cylinder 1 lowers, the float 12 descends, as soon as the level of liquid has fallen to a definite point and opens valve 11, whereupon the air in the lower cylinder passes from that cylinder through port 13 into the lower end of governor pipe 9^a and ascends therein directly to the end of cylinder *a* and acting against valve *a*² moves the same to the right so that valve *a*² stands over the end of air inlet pipe 10^a and prevents the further entrance of air into pipe 10^a, whereupon the air which remains in the lower cylinder 1 and in the air inlet pipe 10^a below the transfer valve passes from chamber 17, valve 25 having dropped against seat 19, into chamber 18 and thence through pipe 21 and past check valve 24 into pipe 5', entering the column of upwardly moving liquid and assisting in the upward movement thereof.

When valves *a*², *a*³ are moved to the right as before described, as soon as valve *a*² moves past the left hand end of pipe 32,

the compressed air which is behind the valve a^2 passes through pipe 32 into the cylinder b^1 behind the valve b^3 and pushes valve b^3 and valve b^2 to the left, so that valve b^2 uncovers air inlet pipe 10^b , whereupon compressed air passes from the valve chest 29 down the air inlet pipe 10^b into the intermediate cylinder 1 and forces the liquid out of that cylinder in a manner similar to the removal of liquid from the lower cylinder, and as soon as the liquid has been removed from the intermediate cylinder, the float 12 having allowed valve 11 to open, admits compressed air to the governor pipe 9^b and this air rises and passes to the left end of cylinder b and moves valves b^2 and b^3 to the right, closing air inlet 10^b , and as soon as the left end of pipe 34 is uncovered by valve b^2 , compressed air passes from behind valve b^2 , through pipe 34 into cylinder c^1 , behind valve c^3 and moves the latter to the left, together with valve c^2 , thus uncovering air inlet 10^c and permitting compressed air to pass from the valve chest 29 down through pipe 10^c into the upper cylinder 1 where the liquid is displaced as in the previous cylinders, and after it has been displaced, the float 12 opens valve 11 and permits the air from the upper cylinder 1 to pass up through the governor pipe 9^c to the left end of cylinder c and thereupon pushes valves c^2 and c^3 to the right, thereby closing air inlet 10^c and as soon as the left end of pipe 33 is uncovered by piston c^2 , the air passes through pipe 33 into cylinder a^1 behind valve a^3 and moves valve a^3 and valve a^2 to the left, thereby uncovering air inlet pipe 9^a , whereupon the cycle of operation is completed and recommenced.

It will be noted that while one cylinder is being emptied of its liquid, the other two cylinders are filling. The result is that practically a continuous flow of liquid is delivered.

What I claim is:

1. A pumping system comprising a plurality of submerged cylinders, a governor pipe and an inlet pipe extending into each of the cylinders, a discharge conduit, communicating with each of the cylinders and extending to the point of discharge, and valve means for controlling the entrance of compressed air to the air inlet pipes, said valve means being controlled by air conveyed from the cylinders through the governor pipes to said valve means, valve means at an intermediate point of the air inlet pipes for admitting compressed air from said pipes to said discharge conduit.

2. A pumping system comprising a plurality of submerged cylinders, a governor pipe and an inlet pipe extending into each of the cylinders, a discharge conduit communicating with each of the cylinders and extending to the point of discharge, and

valve means for controlling the entrance of compressed air to the air inlet pipes, said valve means being controlled by air conveyed from the cylinders through the governor pipes to said valve means, spacing cages between said cylinders, and conduits formed in the spacing cages communicating with the discharge conduit of the cylinders.

3. In a pumping system a plurality of pairs of valve cylinders, a pair of connected valves in each pair of valve cylinders, an inlet pipe extending to one cylinder of each pair of cylinders, a governor pipe extending to one cylinder of each pair of cylinders, a plurality of submerged cylinders, said inlet pipes and governor pipes extending into the respective submerged cylinders, one cylinder of each pair of said valve cylinders being connected by a pipe with an opposing cylinder of another pair of cylinders for transferring air to the latter cylinder to actuate the valve therein, each of the latter cylinders having an exhaust port for the exhaust of such air after the valve in that cylinder has been actuated.

4. In a pumping system a plurality of pairs of valve cylinders, a pair of connected valves in each pair of valve cylinders, an inlet pipe extending to one cylinder of each pair of cylinders, a governor pipe extending to one cylinder of each pair of cylinders, a plurality of submerged cylinders, said inlet pipes and governor pipes extending into the respective submerged cylinders, one cylinder of each pair of said valve cylinders being connected by a pipe with an opposing cylinder of another pair of cylinders for transferring air to the latter cylinder to actuate the valve therein, each of the latter cylinders having an exhaust port for the exhaust of such air after the valve in that cylinder has been actuated, and means for manually operating each of said valves to start the system in operation.

5. In a pumping system a plurality of pairs of valve cylinders, a pair of connected valves in each pair of valve cylinders, an inlet pipe extending to one cylinder of each pair of cylinders, a governor pipe extending to one cylinder of each pair of cylinders, a plurality of submerged cylinders, said inlet pipes and governor pipes extending into the respective submerged cylinders, one cylinder of each pair of said valve cylinders being connected by a pipe with an opposing cylinder of another pair of cylinders for transferring air to the latter cylinder to actuate the valve therein, each of the latter cylinders having an exhaust port for the exhaust of such air after the valve in that cylinder has been actuated, an inlet valve in each submerged cylinder, the submerged cylinders having a discharge conduit extending to the point of discharge, and valve means on each governor pipe controlled by level of liquid

in the associated submerged cylinder for regulating the admission of air to said governor pipe from said submerged cylinder.

6. In a pumping system a plurality of pairs of valve cylinders, a pair of connected valves in each pair of valve cylinders, an inlet pipe extending to one cylinder of each pair of cylinders, a governor pipe extending to one cylinder of each pair of cylinders, a plurality of submerged cylinders, said inlet pipes and governor pipes extending into the respective submerged cylinders, one cylinder of each pair of said valve cylinders being connected by a pipe with an opposing cylinder of another pair of cylinders for transferring air to the latter cylinder to actuate the valve therein, each of the latter cylinders having an exhaust port for the exhaust of such air after the valve in that cylinder has been actuated, an inlet valve in each submerged cylinder, the submerged cylinders having a discharge conduit extending to the point of discharge, a valve on each governor pipe in each submerged cylinder, and a float connected with each of said valves and supported by the liquid in the associated submerged cylinder.

7. In a pumping system a plurality of pairs of valve cylinders, a pair of connected valves in each pair of valve cylinders, an inlet pipe extending to one cylinder of each pair of cylinders, a governor pipe extending to one cylinder of each pair of cylinders, a plurality of submerged cylinders, said inlet pipes and governor pipes extending into the respective submerged cylinders, one cylinder of each pair of said valve cylinders being connected by a pipe with an opposing cylinder of another pair of cylinders for transferring air to the latter cylinder to actuate the valve therein, each of the latter cylinders having an exhaust port for the exhaust of such air after the valve in that cylinder has been actuated, an inlet valve in each submerged cylinder, the submerged cylinders having a discharge conduit extending to the point of discharge, and valve means on each governor pipe controlled by the level of liquid in the associated submerged cylinder for regulating the admission of air to said governor pipe from said submerged cylinder.

der, and a connection from each air inlet pipe to the discharge conduit.

8. In a pumping system a plurality of pairs of valve cylinders, a pair of connected valves in each pair of valve cylinders, an inlet pipe extending to one cylinder of each pair of cylinders, a governor pipe extending to one cylinder of each pair of cylinders, a plurality of submerged cylinders, said inlet pipes and governor pipes extending into the respective submerged cylinders, one cylinder of each pair of said valve cylinders being connected by a pipe with an opposing cylinder of another pair of cylinders for transferring air to the latter cylinder to actuate the valve therein, each of the latter cylinders having an exhaust port for the exhaust of such air after the valve in that cylinder has been actuated, an inlet valve in each submerged cylinder, the submerged cylinders having a discharge conduit extending to the point of discharge, valve means on each governor pipe controlled by the level of liquid in the associated submerged cylinder for regulating the admission of air to said governor pipe from said submerged cylinder, a connection from each air inlet pipe to the discharge conduit, a valve between each air inlet pipe and said connection and having two seats with three chambers two of said chambers being respectively connected with the air inlet pipe and the third chamber being in communication with said connection, said latter valve being moved against one seat to close communication with said connection during the downward passage of air through the inlet pipe, said valve being moved against this other seat by upward movement of compressed air in the inlet pipe, thereby permitting said upward moving air to pass through said connection into the discharge conduit to assist in lifting the liquid therein.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 14th day of March, 1913.

WILLIAM A. BRUTON.

In presence of—

GEORGE T. HACKLEY,
F. A. CRANDALL.