

No. 686,181.

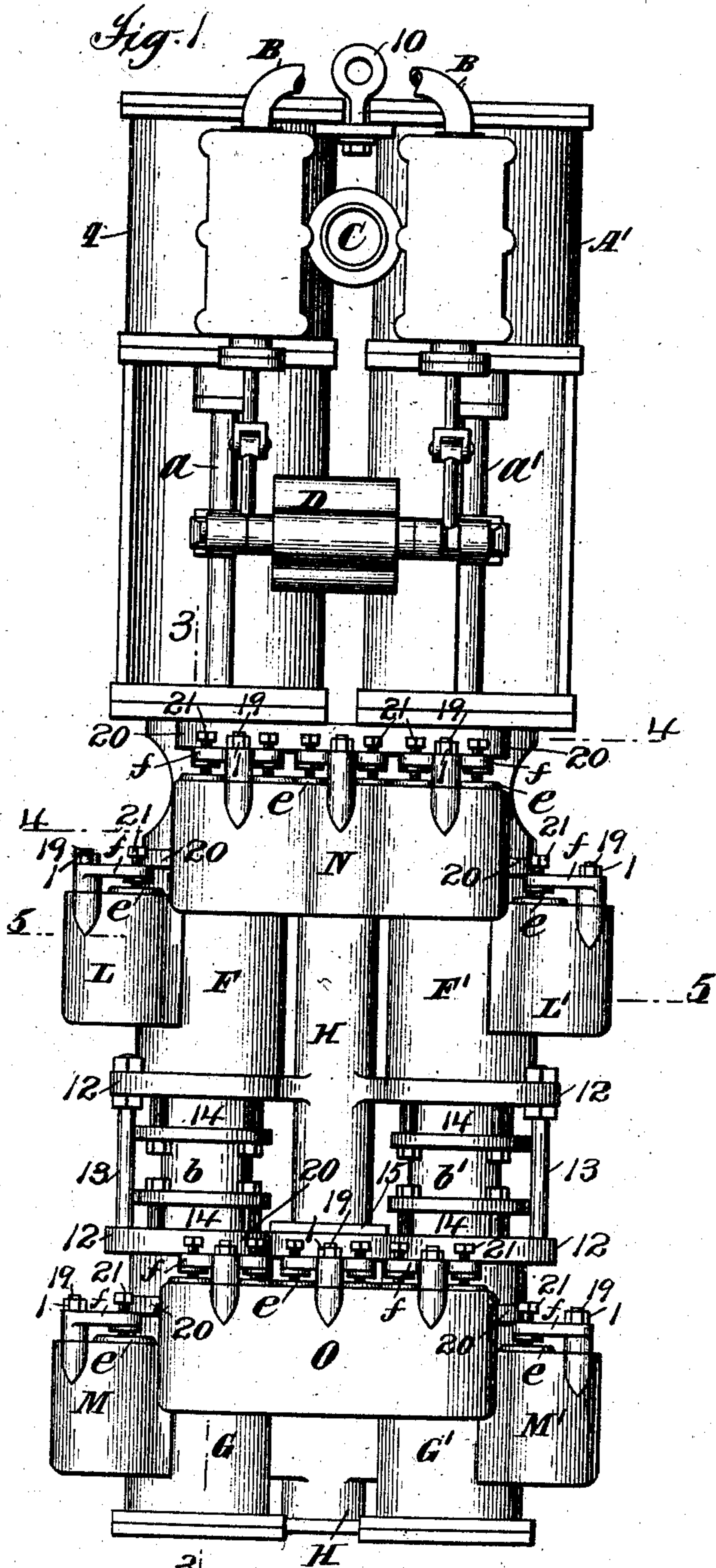
C. C. WORTHINGTON.
PUMP.

Patented Nov. 5, 1901.

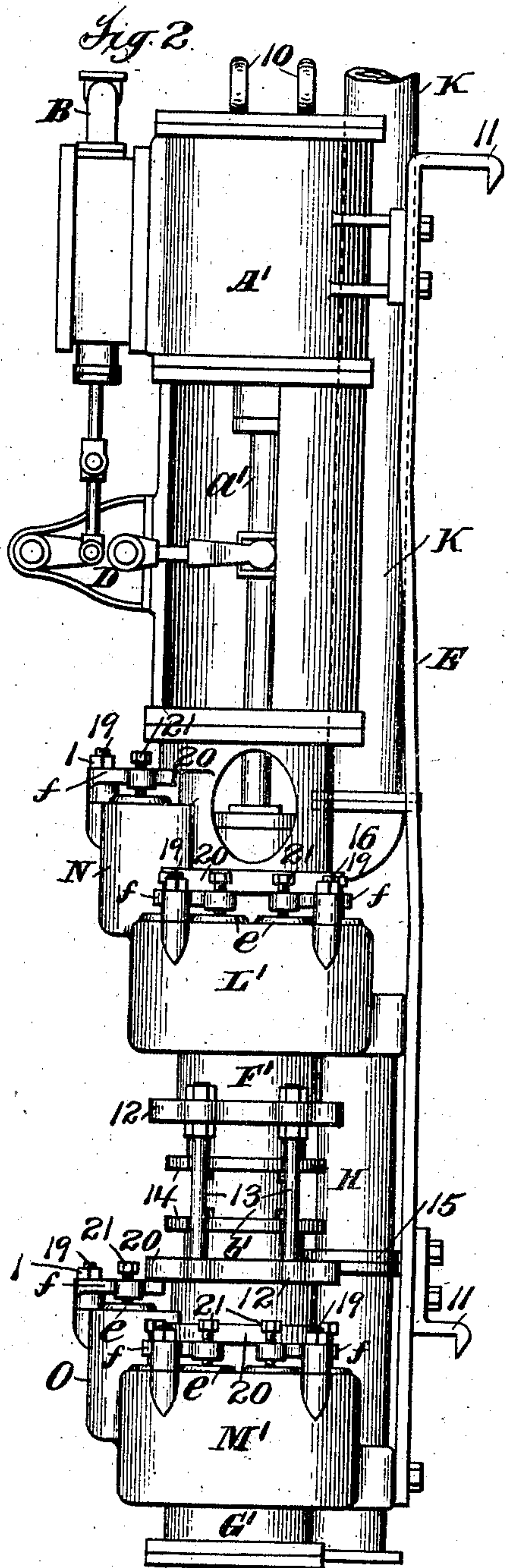
(Application filed June 21, 1898.)

(No Model.)

2 Sheets—Sheet 1.



Attest:
Geo. H. Bott
T. F. Kehoe.



Inventor:
Charles C. Worthington
By Philip R. Phelps, Attorney

Atty.

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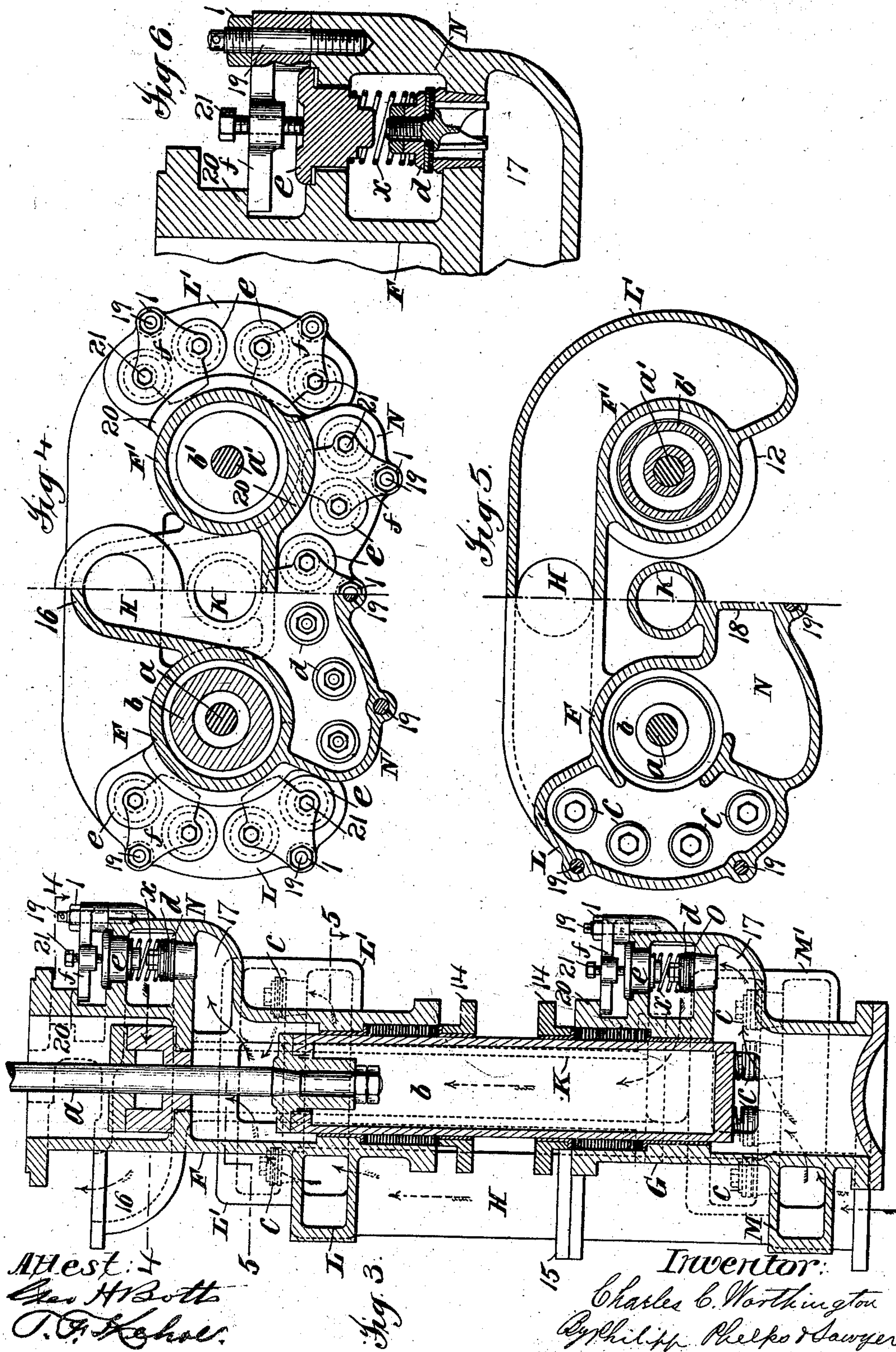
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(No Model.)

2 Sheets—Sheet 2.



Attest:
Chas H Both
T. F. Kehoe.

Inventor:
Charles C. Worthington
By Philip Phelps Sawyer
Atty

UNITED STATES PATENT OFFICE.

CHARLES C. WORTHINGTON, OF IRVINGTON, NEW YORK.

PUMP.

SPECIFICATION forming part of Letters Patent No. 686,181, dated November 5, 1901.

Application filed June 21, 1898. Serial No. 684,087. (No model.)

To all whom it may concern:

Be it known that I, CHARLES C. WORTHINGTON, a citizen of the United States, residing at Irvington, county of Westchester, and State of New York, have invented certain new and useful Improvements in Pumps, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

10 This invention relates to an improved pump, which is preferably a vertical pump and adapted especially for use as a sinking-pump in mining operations, where it is often necessary to sink a deep small shaft, the especial objects of the invention being to provide a pump of this class which shall be of great strength and high power and large valve area, while at the same time very small in cross-section, and to secure these results with all the working parts, and especially the valves, readily and conveniently accessible for repair or replacement. The quick and convenient repair of any one of the valves is of very great importance in such constructions, as the constant and efficient working of such pumps is frequently essential to prevent flooding of the mine, and the stoppage of the pump for more than a small period of time is likely to result in throwing out of work the entire mine apparatus and force of operatives on account of such flooding.

30 A further object is to reduce to a minimum the number of loose parts and avoid the use of small loose parts—such as bolts, nuts, &c.—liable to be dropped in opening the valve-chambers for access to the valves, which is particularly objectionable in such sinking-pumps, as the part is likely to fall down the shaft and be lost, resulting in stoppage of the pump until the part can be replaced.

40 While the broader features of the invention may be embodied in a single-cylinder pump, I have aimed especially to provide a duplex pump of such form and construction that the high power and capacity required in such sinking-pump shall be secured without substantially increasing the space occupied in the mine-shaft by a single-cylinder pump of equal power and capacity; and the invention consists in part of features of construction in duplex pumps.

As a full understanding of the invention

can best be given by a detailed description of a construction embodying the same, such a description will now be given in connection with the accompanying drawings, showing all the features of the invention as applied in their preferred form, and the features forming the invention will then be specifically pointed out in the claims.

60 In the drawings, Figure 1 is a front elevation of a construction showing all the features of the invention as applied in their preferred form to a duplex sinking-pump. Fig. 2 is a side elevation of the same. Fig. 3 is a vertical section of the pump end on the line 3 of Fig. 1. Figs. 4 and 5 are cross-sections on respectively the broken lines 4 and 5 of Figs. 1 and 3. Fig. 6 is a detail central section of one of the force-valves and valve-caps therefor.

70 Referring to said drawings, the upper or steam end of the pump is similar in construction to pumps now well known and has the steam-cylinders A A' on opposite sides, with the steam-induction pipe B and exhaust-pipe C, which are arranged so as to lie within the cross-sectional area of the cylinders and valve-chests and with the usual cross-over valve movement D for actuating the steam-valves of the cylinders from the piston-rods a a', the steam-valves on each side being operated from the piston-rod of the opposite side, as usual in such duplex engines. The pump is shown as provided with the supports 10 at the top of the steam-cylinders for suspending the pump by cables and as provided on its rear side with the bar E, secured to the steam and water ends, and provided with hooks 11 for supporting the pump from the cross-timbers of the mine-shaft.

80 Referring now to the water end of the pump, in which the features forming the present invention are embodied, upon opposite sides of the pump corresponding to the steam-cylinders A A' are water-cylinders, which, as shown, are made separately for opposite ends of the pumps, there being upper and lower cylinders F G and F' G' on opposite sides of the pump, in which cylinders work the double-acting plungers b b', secured to the respective piston-rods a a'. The upper and lower cylinders F G and F' G' on opposite sides carry and are preferably formed integral with the respective suction and force chambers of

the pump, so that the pulsation, suction; and force chambers for the opposite ends of the pump form separate integral constructions, and preferably the two sides of the pump at each end are formed integral, as shown. The cylinders for the opposite ends of the pump, with their suction and force chambers, are shown as secured together by flanges 12 and bolts 13, formed on the respective parts, and the upper pump ends F F' are secured by flanges to the cradles of the steam end, as usual. The plungers b b' are shown as packed outside and between the pump ends in a common manner with the packing-glands 14.

The suction-main H extends vertically from the foot of the pump upward on the rear side of the pump opposite the space between the pump-cylinders and is preferably formed, as shown, in two parts connected by flanges 15, its opposite ends being preferably formed integral with the upper and lower pump ends. The force-main K is arranged between the lower pump-cylinders G G' and runs upward between the pump-plungers from the lower force-chambers to the upper pump-cylinders F F', connecting with the upper force-chamber, and from the upper force-chamber the force-main K passes outward from between the cylinders on the rear side by a bend 16 and then upward in line with and above the suction-main H, so that the suction and force mains lie in the same planes on the rear side of the pump and within the area of a circle of such diameter as is required for the pump-cylinders and valve-chambers, as shown in Figs. 4 and 5. The portion of the force-main K that extends between the pump-plungers on opposite sides of the pump is preferably formed integral with one of the pump ends and detachably secured to the other pump end, being shown as integral with the upper pump end, or it may be made in two parts, as in the case of the suction-main H, so that the pump ends may readily be separated.

Referring now to the valve-chamber and valve construction, L L' and M M' are the suction-chambers for the opposite sides and ends of the pump, and N O the force-chambers for opposite ends of the pump, the suction-chambers L L' and M M' being arranged on the outer sides of the cylinders and in planes below the force-chambers N O and the force-chambers N O extending across the front side of the pump opposite the suction and force mains H K. Each of the suction-chambers L L' and M M' is provided with a series of suction-valves c, shown as of a common form, these valves being arranged about the plunger and connecting the suction-chambers with the pulsation-chambers 17, which extend outward from the pump-cylinders proper, so as to occupy the upper part of the projection formed by the suction-chambers L L' and M M'. Four suction-valves are shown in each chamber; but it will be understood that this number may be varied.

Each of the force-chambers N O is provided

with a series of force-valves d, shown as of the same common construction as the suction-valves c, these valves d being arranged about the plungers and across the space between the plungers and opening from the pulsation-chambers 17 to the force-chambers N O, from which the water is delivered through the force-main K, the pulsation-chambers occupying the lower part of the projections formed by the force-chambers N O, being divided by partitions 18 for the opposite sides of the pump, so that three of these force-valves at each end of the pump belong to and operate for each side of the pump. The pulsation-chambers are thus formed by the space between the suction-valves and the force-valves, being above the suction-valves and below the force-valves. By this construction it will be seen that the force and suction valves are arranged circularly, or substantially so, about the cylinders, so as to reduce the cross-section of the pump, and both the force and suction valves are readily accessible from the upper end of the pump and without interference with one set of valves in examining or removing the other set of valves, as they are arranged in different planes longitudinally of the cylinders. In Figs. 4 and 5 is well illustrated the small compact form of the pump end, all the parts being grouped so as to bring them into a substantially circular form in cross-area and within very small dimensions. While the preferred arrangement is that shown, it is to be understood that the relative position of the suction and force valves may be reversed, while retaining many of the important features of the construction.

Referring now to the parts by which the valves are held in position and each of the valves made accessible for repair or replacement without removing large or heavy parts of the construction, the construction used in connection with all of the valves is the same, so that a single description of the valve shown in detail in Fig. 6 will apply to all, and the same references may be used for corresponding parts in connection with the different valves. The force-valve d (shown in Fig. 6) is held in place by a valve-cap e, which provides not only an abutment for the valve, but also a guide and seat for the spring x, and these caps e are held in place by covers f, which are pivotally mounted, so as to swing into position to uncover any one of the valves and permit the valve-cap to be removed for access to and removal of the valve. These covers f are pivoted on bolts 19 on the outer edge of the valve-chamber outside the valves, being shown as held thereon by nuts 1, and the inner edges of the valve-covers f work under flanges or a continuous flange 20 on the valve-chamber inside the valves, so that they may be swung on their pivot-bolts 19 to uncover the valve-caps e. Each of the covers f is shown as covering two valve-caps e, although it will be understood that a separate cover may be used for each valve-cap, and

the covers are provided with set-screws 21, which bear upon the tops of the valve-caps *e*, so that by setting down these screws the caps are held firmly in position and the valve-covers locked by the upward pressure of their ends upon the flange 20. By loosening the bolts 21, therefore, the valve-covers *f* may be swung to the right or left for access to either one of the valve-caps *e*, held by its set-screws 21, and in replacing the parts it is necessary only to swing the valve-cover into position with its edge under the flange 20 and turn down the set-screws 21 to secure the desired pressure on the valve-caps and lock the covers *f* in position.

The construction of a valve-cover with two valves will be found most convenient and compact; but a separate valve-cover may be used for each valve or a single valve-cover may be used for more than two valves, if preferred, although the latter construction will be objectionable where compactness is desired on account of increasing the size of the valve-chamber or the necessity for giving the cover a considerable movement outside of the valve-chamber for access to the middle valves covered thereby. With a valve-cover for two valves, as shown, the number of parts is reduced and the construction simplified and cheapened over a separate valve-cover for each valve, while at the same time the valve-cover need not be swung substantially outside of the area of the valve-chamber for the purpose of access to either of the two valves covered thereby, which is important in mine-pumps and elsewhere as reducing the cross-sectional space in the shaft required for access to the pump-valves, so that the size of the pump relatively to the mine-shaft may be increased over what would otherwise be permissible.

While the general construction of the pump shown, with the opposite ends of the pump formed separately and an integral end forming the cylinders for both sides of the pump, is preferred and forms a specific feature of the invention, it will be understood that the broader features of the invention may be embodied in other constructions. It is to be understood, also, that modifications may be made by those skilled in the art in the form and arrangement of parts in the constructions shown without departing from the invention.

What I claim is—

1. A pump having a suction-valve chamber and a force-valve chamber extending circumferentially of the pump-cylinder and series of suction and force valves in said chambers arranged circularly about the cylinder, said suction and force valve chambers being arranged in different planes longitudinally of and transversely to the cylinder.

2. A pump having a suction-valve chamber and a force-valve chamber extending circumferentially of the pump-cylinder and series of suction and force valves in said chambers arranged circularly about the cylinder, said suc-

tion and force valve chambers being arranged in different planes longitudinally of and transversely to the cylinder, and a pulsation-chamber extending about the cylinder between the force and suction valves, substantially as described.

3. A pump having a suction-valve chamber and a force-valve chamber extending circumferentially of the cylinder and series of suction and force valves in said chambers arranged circularly about the cylinder, said suction and force valve chambers being arranged in different planes longitudinally of the cylinder, and suction and force pipes extending along the cylinder in planes between the force and suction valve chambers.

4. A double-acting pump having suction and force valve chambers at each end of the pump-cylinder extending circumferentially of the cylinder and series of suction and force valves in said chambers arranged circularly about said cylinder, said suction and force valve chambers being arranged in different planes longitudinally of the cylinder, and suction and force pipes extending along the cylinder in planes between the suction and force valve chambers.

5. A pump having two pump-cylinders arranged side by side, suction-valve chambers extending circumferentially of the cylinders and circularly-arranged series of valves in said chambers, force-valve chambers extending circumferentially of the cylinders in different planes longitudinally of the cylinders from the suction-valve chambers and force-valves in said chambers, and suction and force pipes extending longitudinally of the cylinders in planes between the suction and force valve chambers.

6. A double-acting pump having two pump-cylinders arranged side by side, a force-pipe extending longitudinally of and between the cylinders, force-valve chambers arranged on one side of said pipe at opposite ends of the cylinders, a suction-pipe extending longitudinally of the cylinders on the opposite side of the force-pipe from the force-chambers, and suction-valve chambers at opposite ends of the cylinders arranged in planes between the suction-pipe and force-valve chambers.

7. A double-acting pump having two pump-cylinders arranged side by side, a force-pipe extending longitudinally of and between the cylinders, force-valve chambers arranged on one side of said pipe at opposite ends of the cylinders, a suction-pipe extending longitudinally of the cylinders on the opposite side of the force-pipe from the force-chambers, suction-valve chambers at opposite ends of the cylinders arranged in planes between the suction-pipe and force-valve chambers, and an extension of the force-pipe beyond the delivery end of the cylinders in line with the suction-pipe.

8. A pump-cylinder having integral therewith a suction-chamber, as L, extending about the cylinder, a force-chamber, as N, extend-

ing about the cylinder in different planes longitudinally of the cylinder from the suction-chamber, and pulsation-chamber 17 between the suction and force chambers, substantially
5 as shown and described.

9. Two pump-cylinders arranged side by side and formed integral and having integral therewith suction-chambers, as L, L', extending about the cylinders, an integral force-
10 chamber as N extending about the cylinders between the suction-chambers and across the space between the cylinders, and pulsation-chamber 17 between the suction and force chambers, substantially as shown and de-
15 scribed.

10. Two pump-cylinders arranged side by side and formed integral and having integral therewith suction-chambers, as L, L', extending about the cylinders, an integral force-
20 chamber as N extending about the cylinders between the suction-chambers and across the space between the cylinders, pulsation-chamber 17 between the suction and force chambers, and force-pipe K between the cylinders, substantially as shown and described.
25

11. Two pump-cylinders arranged side by side and formed integral and having integral

therewith suction-chambers, as L, L', extending about the cylinders, an integral force-chamber as N extending about the cylinders
30 between the suction-chambers and across the space between the cylinders, pulsation-chamber 17 between the suction and force chambers, force-pipe K between the cylinders having an extension out of line with the portion
35 between the cylinders, and suction-pipe H in line with said extension, substantially as shown and described.

12. The combination with a valve-chamber and circular series of valves and valve-caps
40 therefor, of swinging covers each arranged to cover two valve-caps and pivoted at their outer edges to swing in either direction, flange 20 under which the inner edges of the covers move, and cap-screws 21 in said covers, sub-
45 stantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHARLES C. WORTHINGTON.

Witnesses:

ANDREW J. CALDWELL,
B. W. PIERSON.