

F. W. HUMBARGER & D. J. FOREMAN.

PRESSURE PUMP.

APPLICATION FILED NOV. 19, 1907.

Patented Mar. 22, 1910.

3 SHEETS—SHEET 1.

952,617.

Fig. I.

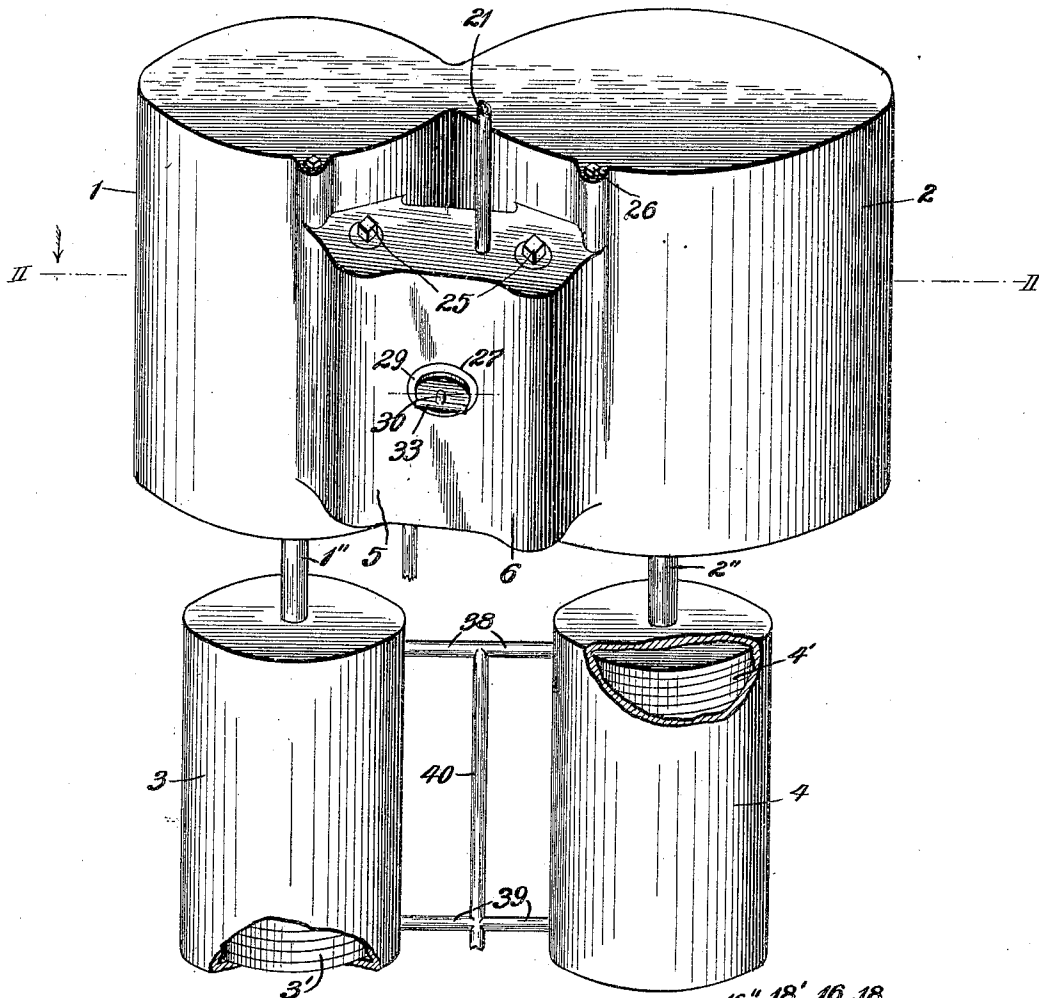


Fig. VIII

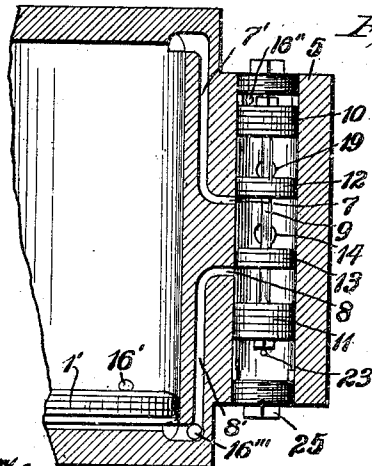
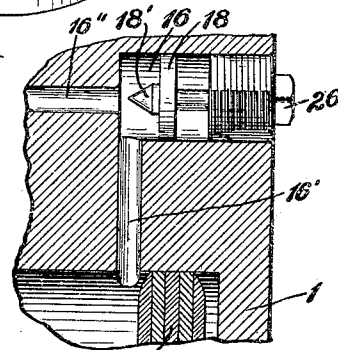


Fig. IX



WITNESSES:

E. A. Cahill.  
Myrtle M. Jackson.

INVENTORS.  
F. W. Humbarger & D. J. Foreman.

BY Arthur C. Brown  
ATTORNEY.

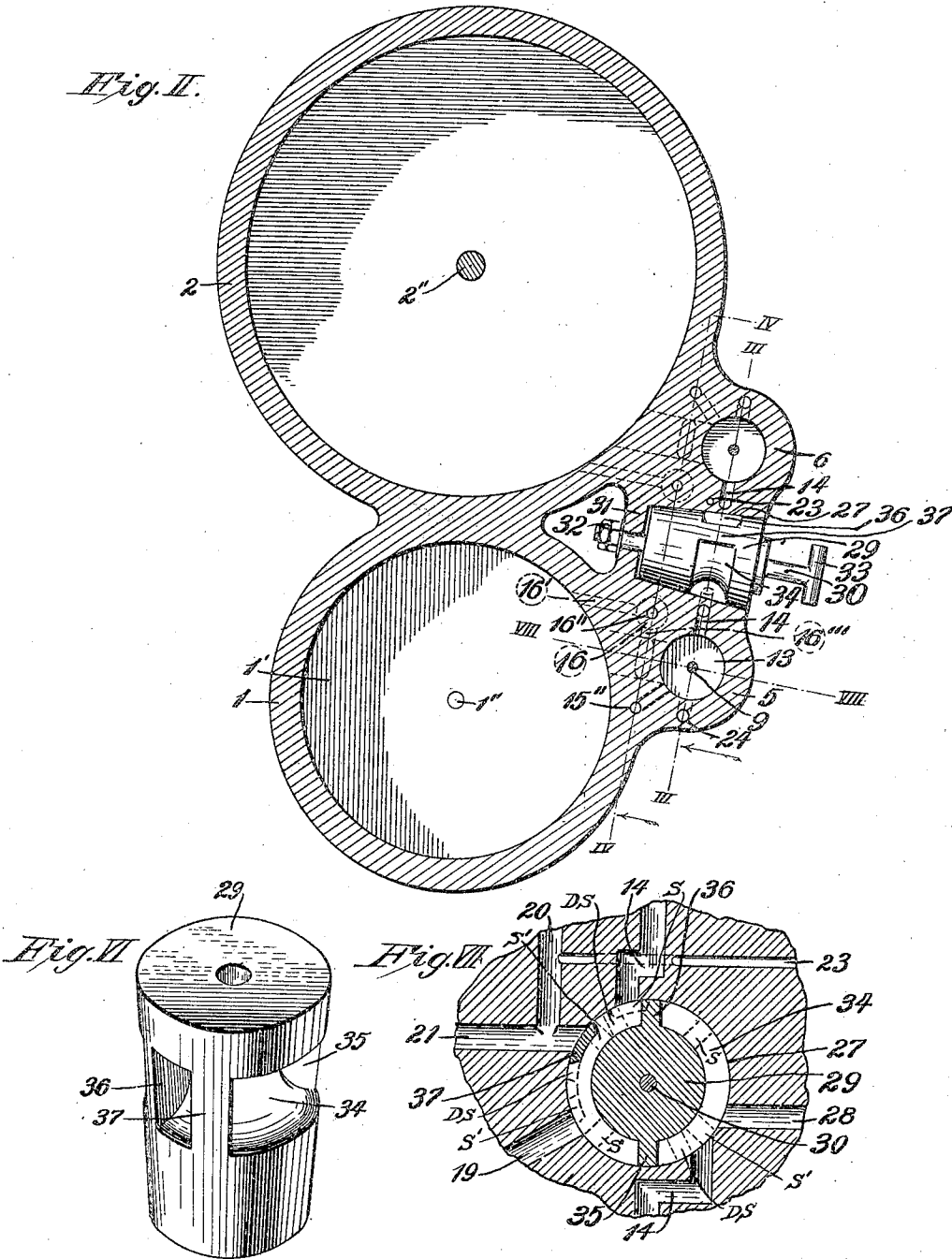
F. W. HUMBARGER & D. J. FOREMAN.  
PRESSURE PUMP.

952,617.

APPLICATION FILED NOV. 19, 1907.

Patented Mar. 22, 1910.

3 SHEETS—SHEET 2.



WITNESSES:

E. A. Cahill.  
Myrtle M. Jackson.

INVENTORS:  
F. W. Humbarger & D. J. Foreman.  
BY  
William C. Brown  
ATTORNEY.

F. W. HUMBARGER & D. J. FOREMAN.  
PRESSURE PUMP.

952,617.

APPLICATION FILED NOV. 19, 1907.

Patented Mar. 22, 1910.

3 SHEETS—SHEET 3.

Fig. III.

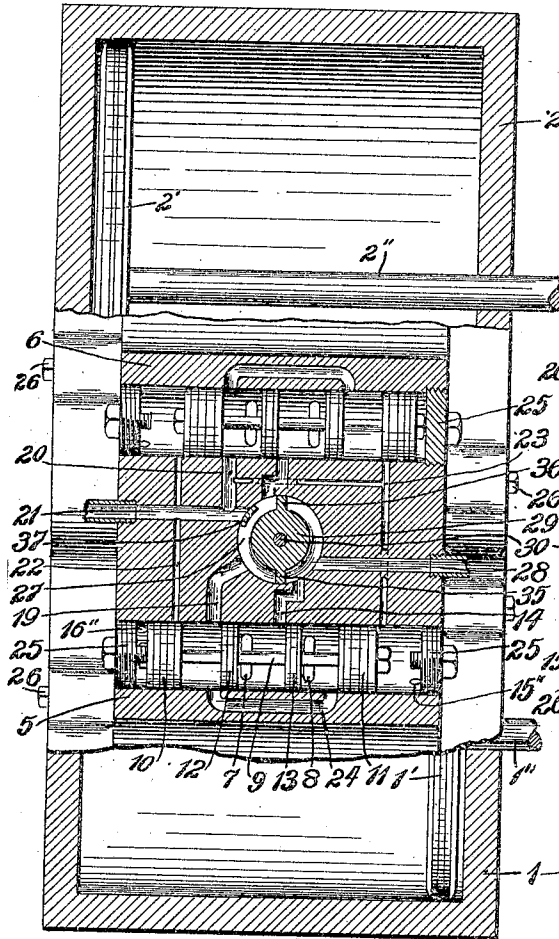
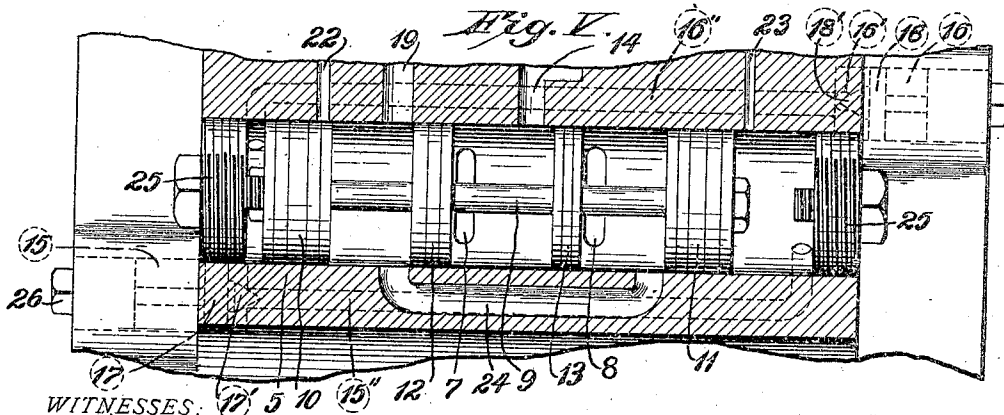
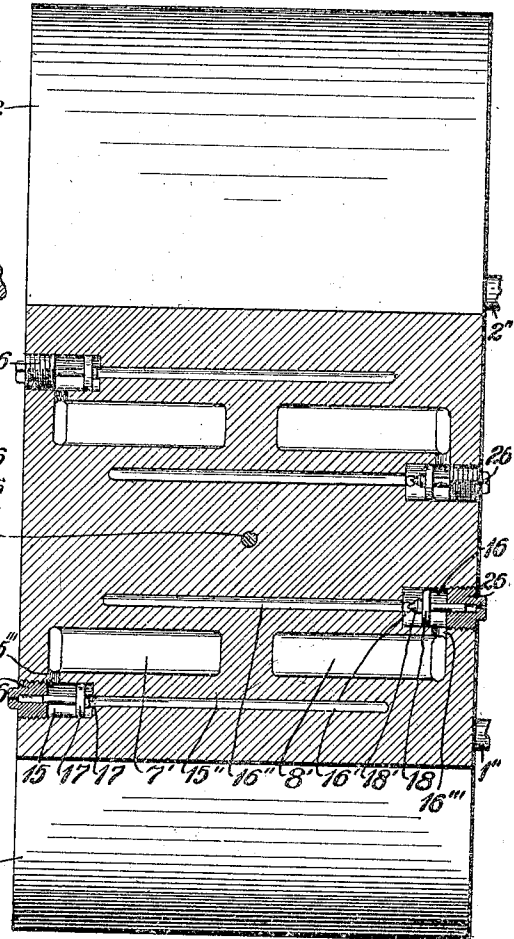


Fig. IV.



WITNESSES:

E. A. Cahill.  
Myrtle H. Jackson.

INVENTORS.  
F. W. Humbarger & D. J. Foreman.  
BY  
Arthur C. Brown.  
ATTORNEY.

# UNITED STATES PATENT OFFICE.

FREDERICK W. HUMBARGER, OF HERRINGTON, AND DAVID J. FOREMAN, OF KANSAS CITY, KANSAS.

## PRESSURE-PUMP.

952,617.

Specification of Letters Patent. Patented Mar. 22, 1910.

Application filed November 19, 1907. Serial No. 402,802.

*To all whom it may concern:*

Be it known that we, FREDERICK W. HUMBARGER and DAVID J. FOREMAN, citizens of the United States, residents of Herrington, in the county of Dickinson and State of Kansas, and Kansas City, in the county of Wyandotte and State of Kansas, respectively, have invented certain new and useful Improvements in Steam-Pumps; and we do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the numerals of reference marked thereon, which form a part of this specification.

Our invention relates to steam pumps, and has for its principal object to provide a device of that class which may be used as a single simple, a double simple, or a compound pump, and to accomplish that object with a mechanism which is simple and economical both in construction and operation. A further object is to provide the improved details of structure which will presently be fully described and pointed out in the claims, reference being had to the accompanying drawings forming part of this specification, in which like reference numerals refer to like parts throughout the several views and in which:—

Figure I is a perspective view of a pump constructed according to our invention, showing its application to an ordinary air compressor. Fig. II is a cross sectional view on the line II—II, Fig. I. Fig. III is a sectional view partly on the line III—III, Fig. II. Fig. IV is a sectional view on the line IV—IV, Fig. II. Fig. V is an enlarged view of one of the piston valve cylinders with its piston valves, the former being in central longitudinal section. Fig. VI is an enlarged detail view of the diverting plug. Fig. VII is a cross sectional view of same, showing the location of the steam inlet and exhaust ports. Fig. VIII is a vertical sectional view on the line VIII—VIII, Fig. II. Fig. IX is an enlarged sectional view of the connection between the pilot valve and steam cylinder.

To accomplish the objects heretofore

noted, we provide two pressure cylinders and valve sets, each of which is adapted for operation independently of the other, together with a steam diverting mechanism by means of which steam is delivered to either cylinder independently of the other, to both simultaneously, or to one of the cylinders and through it to the other, the flow of the steam being controlled and the piston valves actuated in a manner presently described.

Referring more in detail to the drawings:—1 designates a high pressure cylinder and 2 a low pressure cylinder, which for convenience are preferably cast in a single piece. Working in cylinders 1 and 2 are the pistons 1'—2', having the rods 1''—2'', which project through the cylinder heads and enter the air compressors 3—4, where they carry suitable pistons 3'—4'. Carried by and preferably formed integral with cylinders 1—2 are the piston valve cylinders 5—6, the parts of which, as well as their connections with the steam cylinders, are identical; for which reason one only (the high pressure parts) will be described in detail, although such description relates equally to both. In cylinder 5 are the discharge ports 7—8 opening into conduits 7'—8', which lead respectively to the top and bottom of the chamber in cylinder 1 and enter the cylinder at such points that steam flowing therethrough may act on the respective faces of the piston 1'. Within cylinder 5 is the rod 9, on each end of which is mounted piston valves 10—11, and which carries the intermediate piston valves 12—13; there being a steam inlet port 14 opening into the variable chamber inclosed between the pistons 12—13, and the latter being so arranged on their rod that but one of the discharge ports 7—8 is in communication with the inlet chamber at the same time.

Located on each side and at opposite ends of the piston valve chamber, and recessed in cylinder 5, are the small valve chambers 15—16, each of which is connected at its inner end, with the adjacent end of the chamber in cylinder 1 by a channel 15'—16', and at the same end with a conduit 15''—16'', which extends through the valve cylinder body to and opens into the opposite end

of the main valve chamber behind the respective pistons 10—11; the channels 15'—16' opening into the chamber in cylinder 1 in such position that they are uncovered by the main piston 1' as such reaches the adjacent end of its stroke. Slidably mounted and fitting snugly within chambers 15—16, are the heads 17—18, carrying the needle valves 17'—18', which are adapted to fit within the respective channels 15'—16' to control the flow of steam therethrough. Valves 17—17' and 18—18' are pilot valves.

15 15'—16' designate channels leading from the ends of the piston valve chamber to the small valve chambers 15—16, which they enter on the sides of heads 17—18 opposite the needle valves.

19 designates an exhaust port, which in the high pressure valve cylinder leads to the diverting plug, which will presently be described, and 20 a similar port leading from the low pressure valve cylinder to the final exhaust 21.

22—23 designate exhaust ports leading from near the ends of the valve cylinders to the main exhaust, but one of such ports being open at the same time, and then when the valves are at the end of the stroke opposite such inlet, the other being closed by the piston 10 or 11, according to the position of the pistons.

24 designates a conduit which forms a constant connection between the chambers formed by the pistons 10—12 and 11—13 to form a constant connection between both of such chambers and the exhaust 19.

25 are screw plugs, which close the ends of the respective cylinders, which may be removed in case repairs are necessary, and 26 are similar plugs which close the ends of the pilot valve chambers 15—16.

As previously stated, the high and low pressure steam cylinders are equipped with duplicate piston valve sets and connections, with the exception of the parts noted. Intermediate the piston valve sets is a plug valve chamber 27, with which the inlet port 14 and exhaust ports 19 and 21 are connected and to which a main steam feed 28 leads; the entrances to the chamber being made at determined points in order that the flow of live and exhaust steam from and to the valve plug chamber 27 may be controlled by the directing plug which we will now describe.

Fitting snugly, but adapted for revolution, within chamber 27 is a plug 29, having a rod 30 projecting longitudinally therethrough and through a flange 31 on the cylinder casting, where it is anchored by a nut 32; there being a handle 33 on the outer end of said rod by means of which the plug is turned to divert the steam into the desired channels.

Extending around the periphery of plug 29, near the middle, or in position for communication with the various intake and exhaust ports, is a groove 34, having the partition ribs 35—36, at opposite sides of the plug, for blocking the passage of steam through said groove, and provided with the bridge 37, which may close the port over which it rests while allowing steam to travel through the portion of the groove therebeneath.

38—39 designate branches which connect the air compressors with the main air conduit or supply pipe 40.

As our device will usually, or under ordinary circumstances be used as a compound pump, that is a pump using the live steam in the high pressure cylinder, and the exhaust steam in the low pressure cylinder, we have shown the diverting parts of the plugs 29 in full lines as arranged for such use, and in dotted lines for the other positions.

With the parts so arranged, and the piston and valve parts in the positions shown, the live steam is delivered to the groove in the diverting plug through conduit 28 and travels therethrough to and through the port 14 to the chamber in the high pressure valve cylinder between the pistons 12 and 13, which are at the upper end of their stroke, and the port 7 open to the chamber noted. The steam therefore travels through the piston chamber into port 7 and through the conduit 7' to the upper end of cylinder 1, which it enters and forces piston 1' to the bottom of the cylinder, the rod 1'' forcing the air piston 3' downwardly in the cylinder and compressing the air therein; the exhaust steam forced from the cylinder 1 being conducted through conduit 8', port 8, and channel 24 to the chamber between pistons 10 and 12, and from thence through the exhaust port 19 to the low pressure cylinder, as will presently be described.

When piston 1' reaches the end of its stroke it uncovers channels 16' and the live steam passes therethrough into the small valve chamber 16, thereby opening the pilot valve 18'. The live steam then passes through channel 16'' to the end of the piston valve chamber behind the piston 10, and forces said piston, together with rod 9 and the other pistons carried thereby, to the opposite end of the piston stroke, when the port 7 will be open to the exhaust chamber between pistons 10 and 12, and the port 8 open to the live steam intake chamber between the pistons 12 and 13. When the parts are in this position, the live steam enters the chamber last noted, and passes through port 8 and channel 8' to the cylinder 1, in front of piston 1', and forces said piston back to its first position; the exhaust

steam in cylinder 1 being forced through channel 7' and port 7 to the chamber between valves 10 and 12, and through the exhaust port 19 to the plug chamber 27, where it passes through the plug groove 34 to the intake 14 of the low pressure cylinder 2; the plug bridge 37 closing the exhaust port 21 to prevent the escape of the steam there-through, and the exhaust steam in the end of the valve cylinder being forced through the channel 23 to the final exhaust, and a portion of the exhaust steam from cylinder 1 passing through channel 15' to chamber 15 to force the valve 17' to its seat in channel 15'''; the action just described with reference to the live steam in the high pressure parts being repeated with the exhaust steam in the low pressure parts; the parts being duplicates, as before mentioned. After completing the travel through the low pressure valve and steam cylinders, the exhaust steam passes through channel 20 to the final exhaust 21, from which it is freed.

When it is desired to use the apparatus as a single pump, the plug 29 is turned to the dotted position S, when the live steam will be diverted to the high pressure cylinder, where the operation described will be performed, and the steam, when exhausting will travel through the plug groove to and out of the final exhaust 21, the plug bridge 37 covering the low pressure intake port to cylinder 2, as indicated; or the plug may be turned to the position S', when the live steam will be diverted to the low pressure cylinder, where the described operation is performed, and the exhaust steam delivered through the channel 20 to the final exhaust, the plug bridge covering channel 19, to prevent the steam from backing into cylinder 1; the low pressure parts in such case being operated under high pressure.

When it is desired to operate the device as a double simple pump, that is, operate both cylinders by live steam, or under high pressure, the diverting plug is turned to the position D S, when the live steam will be delivered to both cylinders simultaneously, and the exhausts made in the same manner as when each pump is working "simple," with the exception that the exhaust 21 is open to the plug groove, and the steam exhausted from cylinder 1 blocked from cylinder 2 by the plug rib 36.

While we have described the valve and steam pistons as traveling to their upper or lower positions, we do not wish to be understood as limiting the pump to an upright construction, as it may be operated in either upright or horizontal position.

Having thus described our invention, what we claim as new therein and desire to secure by Letters Patent is:—

1. In a compound steam pump or air com-

pressor, the combination of a valve chest located symmetrically with respect to the steam cylinders, a piston valve chamber in said chest, ports 7, 8 leading from opposite ends of one steam cylinder to said piston valve chamber, a plug valve chamber adjacent said piston valve chamber, two ports connecting said chambers, an inlet port and an exhaust port opening into the plug valve chamber, a plug valve in said chamber, for the purpose described, a steam driven piston valve in the piston valve chamber, said valve comprising four spaced piston heads rigidly connected, two pilot valves controlling ports opening into the respective ends of the piston valve chamber, means controlling the pilot valves, the two intermediate heads of the piston valve traversing the two ports 7, 8, but not traversing the ports to the plug valve, a bypass port around said intermediate valve heads, and ports leading from the piston valve chamber to a second piston valve chamber associated with the other cylinder, the sole supply of live steam to either cylinder being through said plug valve.

2. In a compound steam pump or air compressor, the combination of a valve chest having therein two piston valve chambers and a plug valve chamber midway between the former, ports 7, 8 leading from each piston valve chamber to the respective ends of the adjacent cylinder, two ports 19, 20, 14 leading from each piston valve chamber into the plug valve chamber, an exhaust port leading from atmosphere to the plug valve chamber and also to one of the ports 20, a steam supply port leading to the plug valve chamber, ports 22 connecting respective ends of each piston valve chamber to respective ends of the other piston valve chamber, steam driven piston valves in said chambers, each valve comprising four piston heads rigidly connected, pilot valves controlling said valves, means controlling the pilot valves, said ports 22 being traversed by the ends of the piston valves, and ports 7, 8 being traversed by the intermediate heads of the piston valves, but the ports 14, 19, 20 being untraversed by said intermediate heads, and a plug valve within the plug valve chamber, operating as described, the sole supply of live steam to either cylinder being through said plug valve.

3. In a steam pump, the combination with a steam cylinder having a suitable piston, of a valve cylinder having an intake, an exhaust, a plug valve controlling said inlet and exhaust and separate conduits leading to opposite ends of said steam cylinder, a rod adapted for reciprocation in said valve cylinder, pistons on said rod forming a central chamber and chambers at each end of said central chamber, said intake being adapted for constant communication with

said central chamber, said exhaust being in constant communication with one of said end chambers, and said conduits being in alternate communication with the central chamber and the adjacent end chamber upon the reciprocation of said rod and pistons, and their being a conduit connecting said end chambers, substantially as set forth.

In testimony whereof we affix our signatures in the presence of two witnesses.

FREDERICK W. HUMBARGER.  
DAVID J. FOREMAN.

Witnesses:

GEO. HORN,  
HAROLD E. RICHARDS.