No. 641,896. Patented Jan. 23, 1900.

H. C. SERGEANT.

VALVE OPERATING DEVICE FOR COMPRESSORS.

(Application filed July 14, 1899.)

(No Model.) 2 Sheets—Sheet 1.

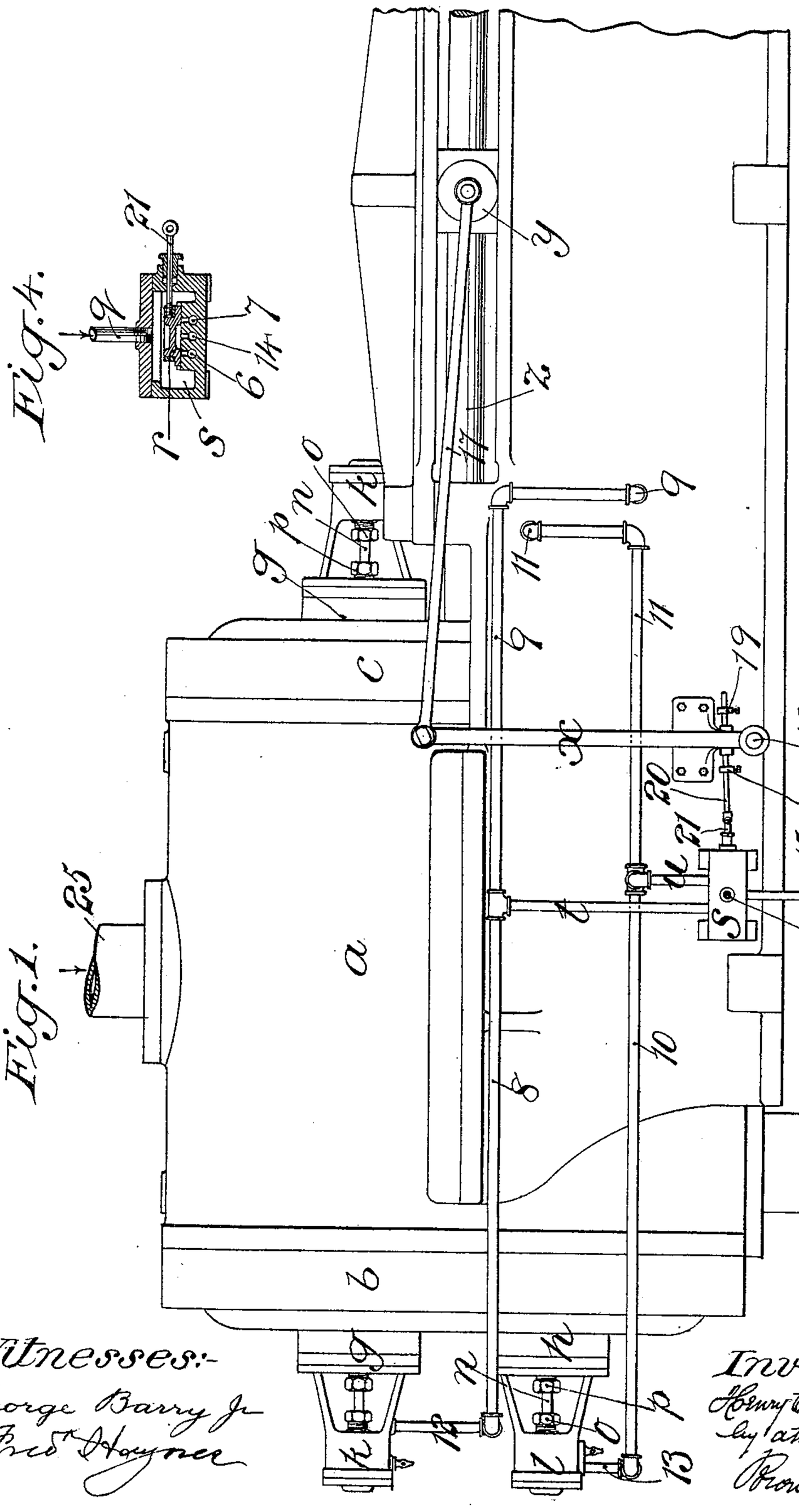

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Fig. 3.

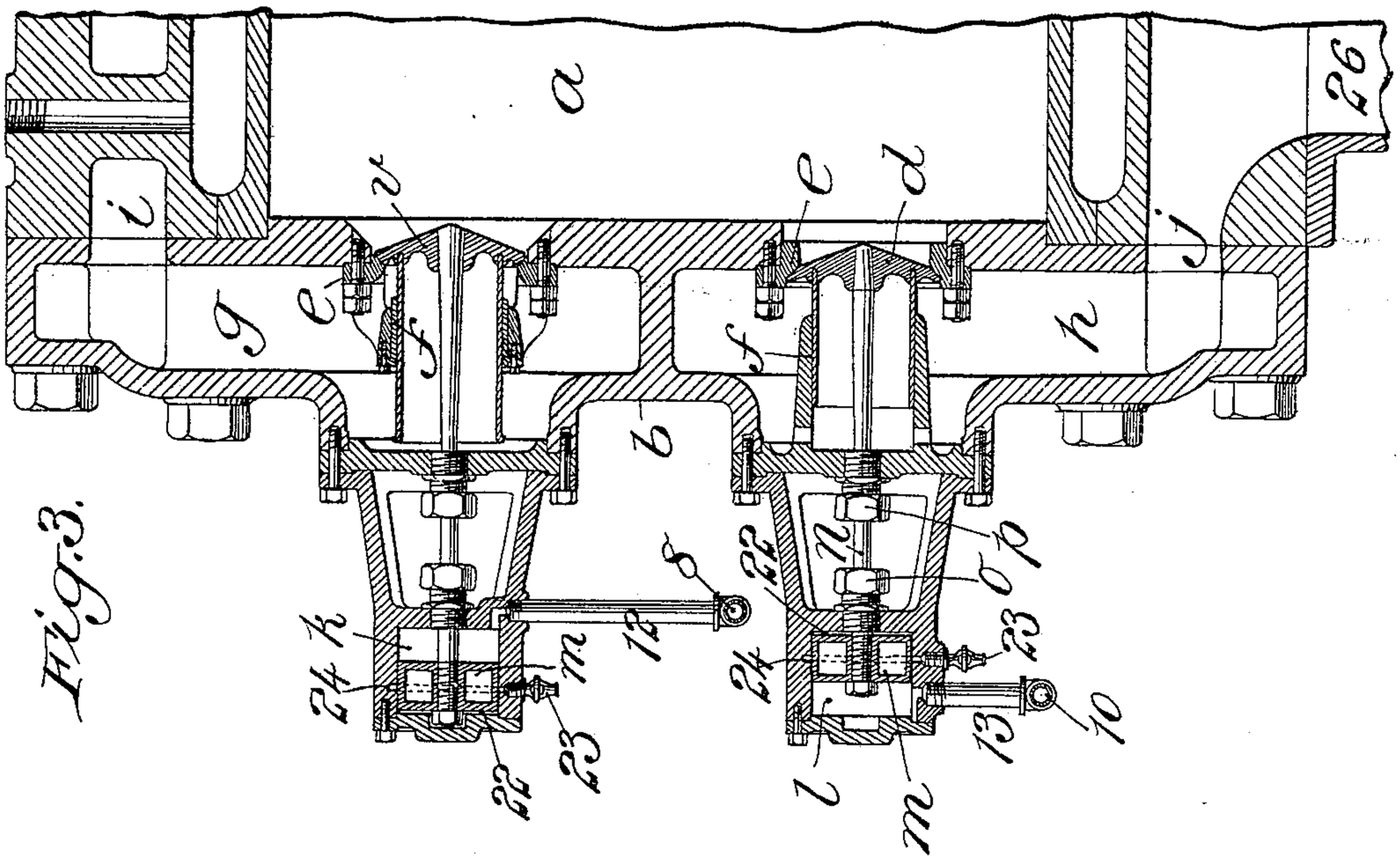
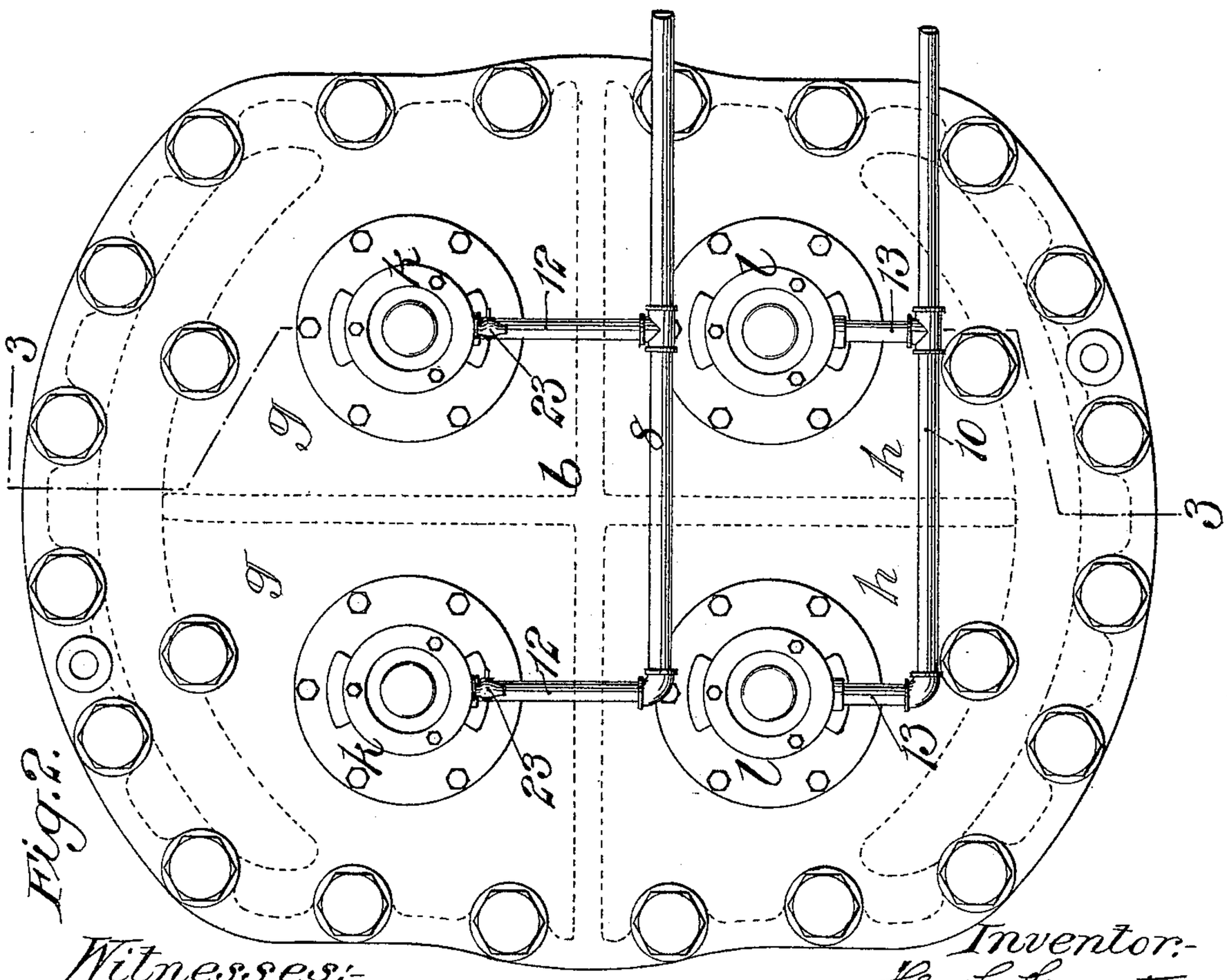


Fig. 2.



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UNITED STATES PATENT OFFICE.

HENRY C. SERGEANT, OF WESTFIELD, NEW JERSEY, ASSIGNOR TO THE INGERSOLL-SERGEANT DRILL COMPANY, OF NEW YORK, N. Y.

VALVE-OPERATING DEVICE FOR COMPRESSORS.

SPECIFICATION forming part of Letters Patent No. 641,896, dated January 23, 1900.

Application filed July 14, 1899. Serial No. 723,777. (No model.)

To all whom it may concern:

Be it known that I, HENRY CLARK SERGEANT, a citizen of the United States, and a resident of Westfield, in the county of Union and State of New Jersey, have invented a new and useful Improvement in Means for Operating the Valves of Compressors for Air or other Gaseous or Aeriform Bodies, of which the following is a specification.

According to this invention the inlet-valves and discharge-valves have their closing movements effected in a positive manner and so quickly that they are allowed to remain wide open until the piston has arrived within an extremely short distance from the end of its stroke.

I will first describe, with reference to the accompanying drawings, as much of a horizontal compressor as is necessary to illustrate my invention, and will afterward point out the novelty in claims.

Figure 1 represents a side elevation; Fig. 2, a face view of the back cylinder-head on a larger scale than Fig. 1; Fig. 3, a section of the said cylinder-head in the line 3 3 of Fig. 2, and Fig. 4 a horizontal sectional view of a valve which will be hereinafter explained.

Similar letters and numerals of reference designate corresponding parts in all the figures.

a designates the compressor-cylinder, having in each of its heads *b c* the inlet and discharge valves *v* and *d*, of which there may be one or more of each, two of each being shown. The inlet-valves *v* are in the upper part of the cylinder and the discharge-valves in the lower part thereof, as shown in Fig. 3. The said valves are all shown as of a well-known puppet kind, closing into seats *e* and fitted with tubular guides *f*. They and their seats are represented as arranged, as is common, in separate inlet-boxes *g* and discharge-boxes *h*, formed within the cylinder-heads and communicating, respectively, through passages *i j* along the sides of the cylinder *a* with the inlet-pipe 25 and discharge-pipe 26 of the compressor.

For each of the inlet-valves *v* there is attached to its respective cylinder-head *b* or *c*, outside of its respective box *g*, the cylinder *k* of a fluid-pressure motor, the purpose of which is only that of closing the valve. This cylinder is independent of or has no direct communication with the compressor-cylinder *a*. For each of the discharge-valves *d* there is a similar cylinder *l*. These motor-cylinders severally contain pistons *m*, connected with the stems *n* of their respective valves, the said stems passing through stuffing-boxes *o p* on the valve-boxes *g h* and motor-cylinders *k l*, respectively. The cylinders *k l* are supplied with compressed air or gas for operating on their pistons to close the valves from any suitable source—as, for example, the receiver into which the compressor delivers through a pipe *q* (see Figs. 1 and 4) under the control of an induction and eduction valve *r* in a chest *s*, whose ports 6 7 communicate, respectively, through pipes *t u* and branches 8 9 10 11 12 13 with the said cylinders *k l* and from whose port 14 an exhaust-pipe 15 leads to the atmosphere. The branches 8 9 of the pipe *t* and those 10 11 of the pipe *u* lead toward opposite ends of the cylinder *a*. The branch 8 of the pipe *t* has two subbranches 12, which lead, as shown in Figs. 1, 2, and 3, to the inner ends of the cylinders *k* of the inlet-valves *v* of the back cylinder-head *b*, and the branch 10 of the pipe *u* has subbranches 13, which lead to the outer ends of the cylinders *l* of the discharge-valves *d* of the same head. The other branches 9 11 of the pipes *t u* have communication by subbranches (not shown) with the cylinders of the valves in the front cylinder-head *c* in a manner precisely the reverse of what has just been described with reference to the back cylinder-head *b*—that is to say, the branch pipe 9 has subbranches leading to the outer ends of the cylinders *l* of the discharge-valves of the front head *c* and the branch pipe 11 has subbranches leading to the inner ends of the cylinders *k* of the inlet-valves of said head *c*. The several subbranches above described from the branch pipes 9 11, though not shown, may be well understood by reference to Figs. 2 and 3

when it is stated that the subbranches of the pipe 11 are like the subbranches 12 of the pipe 8 and the subbranches of the pipe 9 are like those 13 of the pipe 10.

The induction and eduction valve for controlling the induction and eduction of the compressed air or gas to and from the valve-cylinders *k l* for closing the valves may be of any suitable kind. The valve *r*, Fig. 5, herein represented for the purpose, is an ordinary three-port D slide-valve. The motion necessary to be imparted to said valve just before the completion of the stroke of the compressor-piston may be imparted through any suitable connection with said piston or the engine which drives the compressor, so as to be controlled by such engine, but is represented (see Fig. 1) as imparted through a lever *x*, which works on a fixed fulcrum 16 and is connected by a rod 17 with the cross-head *y* of the compressor-piston rod *z*, the said lever acting alternately on tappets 18 19 on a rod 20, connected with the stem 21 of said valve *r*. Before explaining the operation of this controlling-valve *r* and the closing pistons *m* of the inlet and discharge valves *v d* I will first mention that the opening of the said valves may take place automatically as the piston moves in either direction, as is common to puppet-valves in air-compressors.

The closing operations effected according to my invention take place as follows: I will first suppose the compressor-piston to have very nearly completed its stroke toward the back head *b* of its cylinder. The lever *x* by its connection with said piston strikes the tappet 18 and moves the valve *r* in the same direction, opening the port 6, quickly effecting the induction of the compressed air or gas through the pipe *t* and its branches 8 and subbranches 12 to the cylinders *k* of the inlet-valves *v* in the back head *b*, and at the same time effecting a corresponding induction through the same pipe *t* and its branch 9 and subbranches to the cylinder *l* of the discharge-valves of the front head *c*. The simultaneous inductions of air or gas to the respective cylinders *k* and *l* cause the pistons of the inlet-valves in the back head *b* and the discharge-valves in the front head *c* to so move as to instantaneously close their respective valves. In like manner as the compressor-piston is completing its stroke toward the front head the lever *x* moves the valve *r* in the same direction, and the port 7 is opened to effect the induction of the compressed air or gas to the cylinders *k* of the inlet-valves *v* of the front cylinder-head and the cylinders *l* of the discharge-valves *d* in the back cylinder-head and so caused to instantaneously close all of those valves. The movement of the valve *r* in one direction to effect the induction of the compressed air to one set of cylinders *k l* also effects the eduction through their same pipes and branches from the other set of cylinders and so permits the free opening of the valves by the pressure in the cylinder *a* or discharge-boxes *h*.

The inlet and discharge valves positively operated according to this invention as above described may be kept wide open during about nine-tenths of the stroke of the compressor-piston. They may be caused to close earlier or later in the stroke by having the tappets 18 19 adjustable on the rod and setting them nearer together or farther apart.

To prevent the slamming of the valves *v d* in closing, I provide them in any suitable manner with dash-pots. In the example of my invention represented these dash-pots 22 are formed in the valve-operating cylinders *k l* themselves, those for the inlet-valves *v* being between their pistons *m* and the outer ends of their cylinders *k* and those for the discharge-valves *d* being between their pistons *m* and the outer ends of their cylinders *l*. These dash-pots are provided with petcocks 23, which are open to the atmosphere and which communicate with grooves 24, formed around the interiors of those portions of the cylinders which are involved in the dash-pots. The pistons passing these grooves in their movements for closing the valves close the communication with the atmosphere, and the air thus confined forms the cushion of the dash-pots. The action of these dash-pots may be adjusted by giving more or less opening to the petcocks 23.

What I claim as my invention is—

1. In an air-compressor, the combination of a discharge-valve and an inlet-valve at the same end of the compression-cylinder, fluid-pressure motors one for each of said valves, and an induction and eduction valve which is common to both of said motors and is controlled by the engine which drives the compressor for admitting fluid-pressure to the discharge-valve motor for closing said valve and at the same time exhausting it from the inlet-valve motor to permit the free opening of the latter valve, substantially as herein described.

2. In an air-compressor, the combination of an inlet-valve and a discharge-valve at the same end of the compression-cylinder, fluid-pressure motors one for each of said valves, and an induction and eduction valve which is common to both of said motors and is controlled by the engine which drives the compressor for admitting fluid-pressure to the inlet-valve motor for closing said valve and at the same time exhausting it from the outlet-valve motor to permit the free opening of the latter valve, substantially as herein described.

3. In a double-acting air-compressor having an inlet-valve and a discharge-valve at each end of its compression-cylinder, the combination with such several valves, of fluid-pressure motors for closing them, one of such motors for each of said valves, and a valve which is common to all of the said motors and is controlled by the engine which drives the com-

pressor for admitting fluid-pressure to the discharge-valve motor at one end of the cylinder and exhausting it from the inlet-valve motor at the same end and at the same time admitting said pressure to the inlet-valve motor and exhausting it from the discharge-valve motor at the other end of said cylinder, substantially as herein described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 7th day of July, 1899.

HENRY C. SERGEANT.

Witnesses:
FREDK. HAYNES,
GEORGE BARRY, Jr.