No. 898,389. PATENTED SEPT. 8, 1908.

F. W. PARSONS.

AIR COMPRESSOR.

APPLICATION FILED JAN. 7, 1905.

3 SHEETS—SHEET 1.

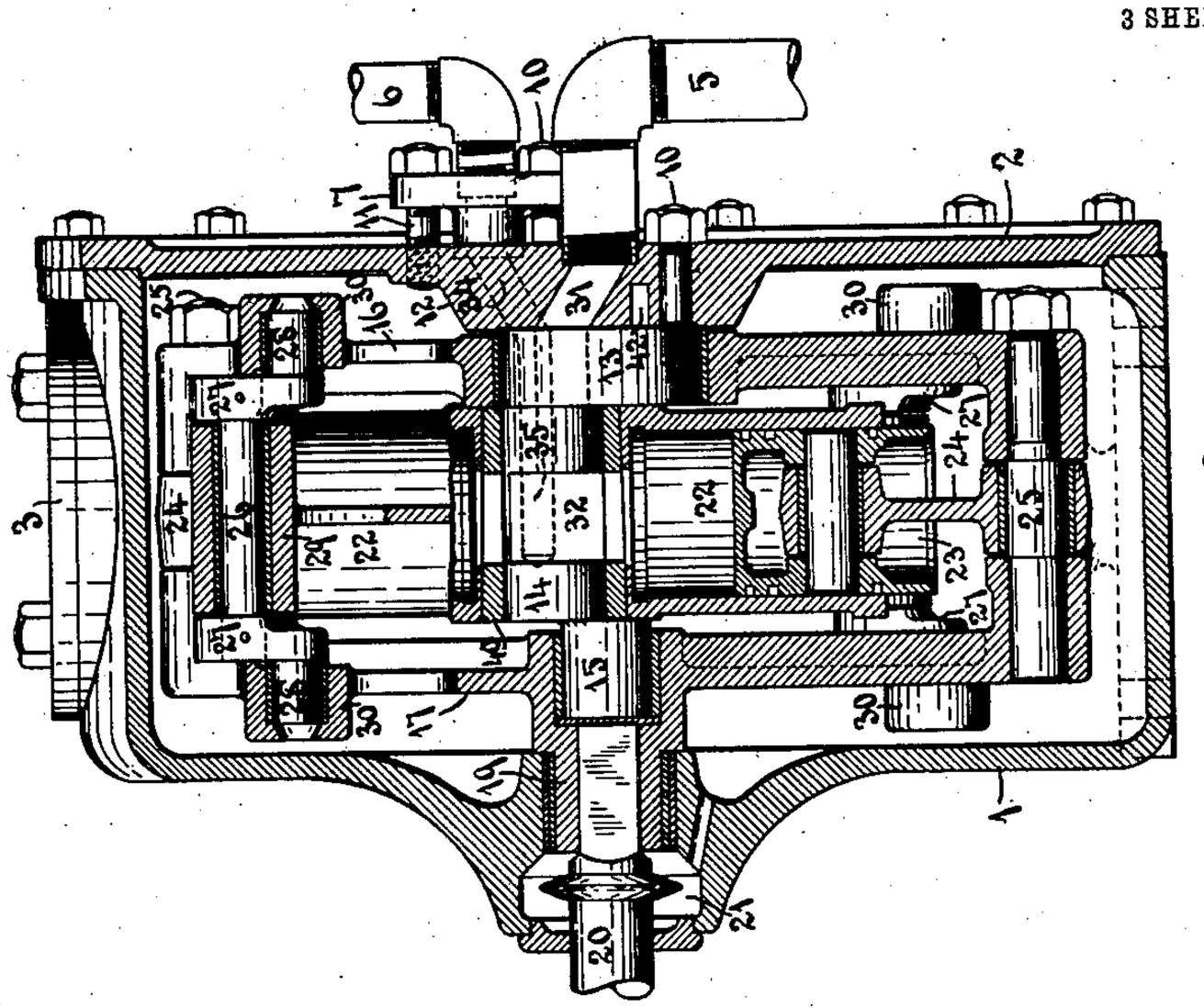

Fig. 2.

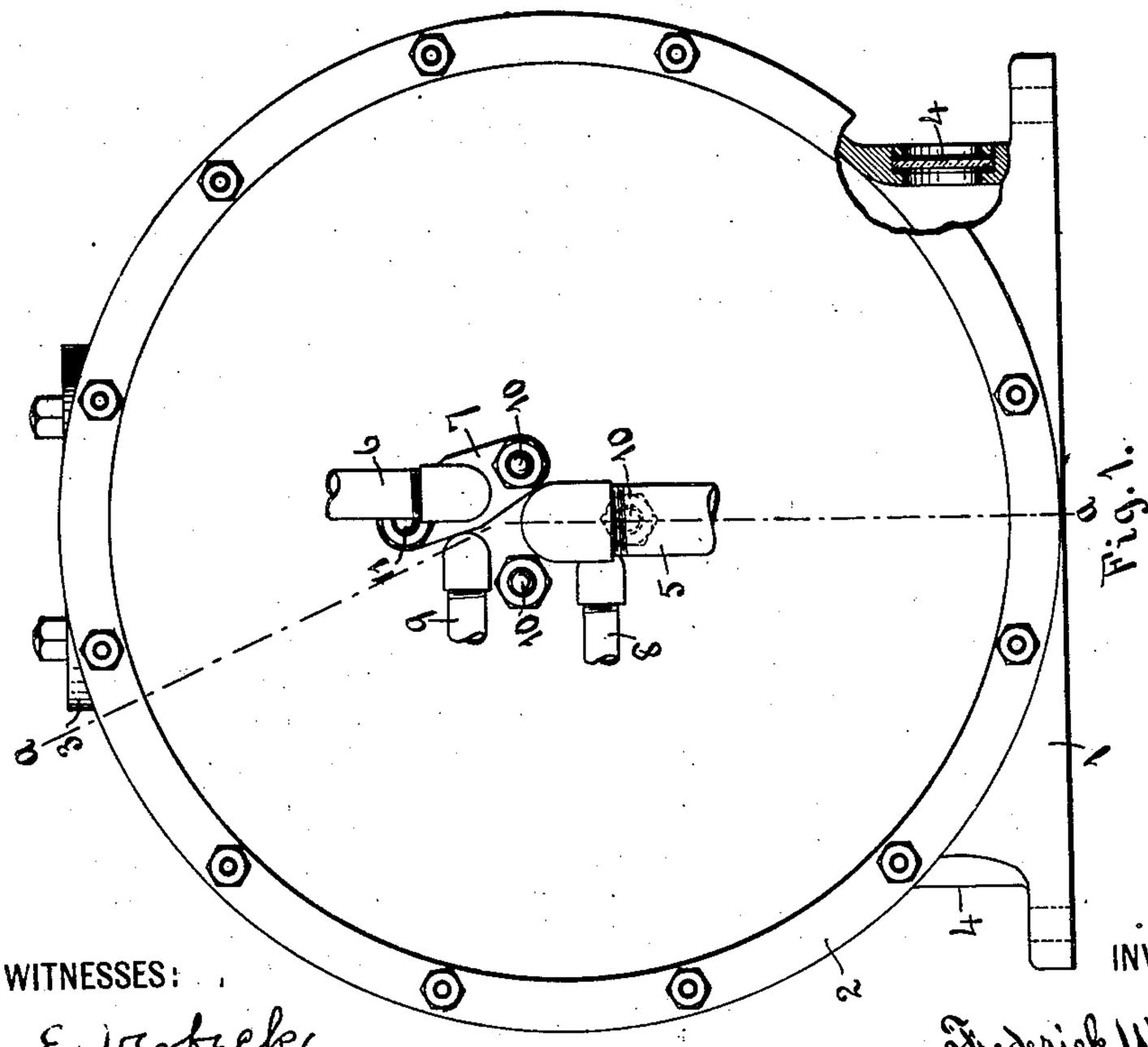

Fig. 1.

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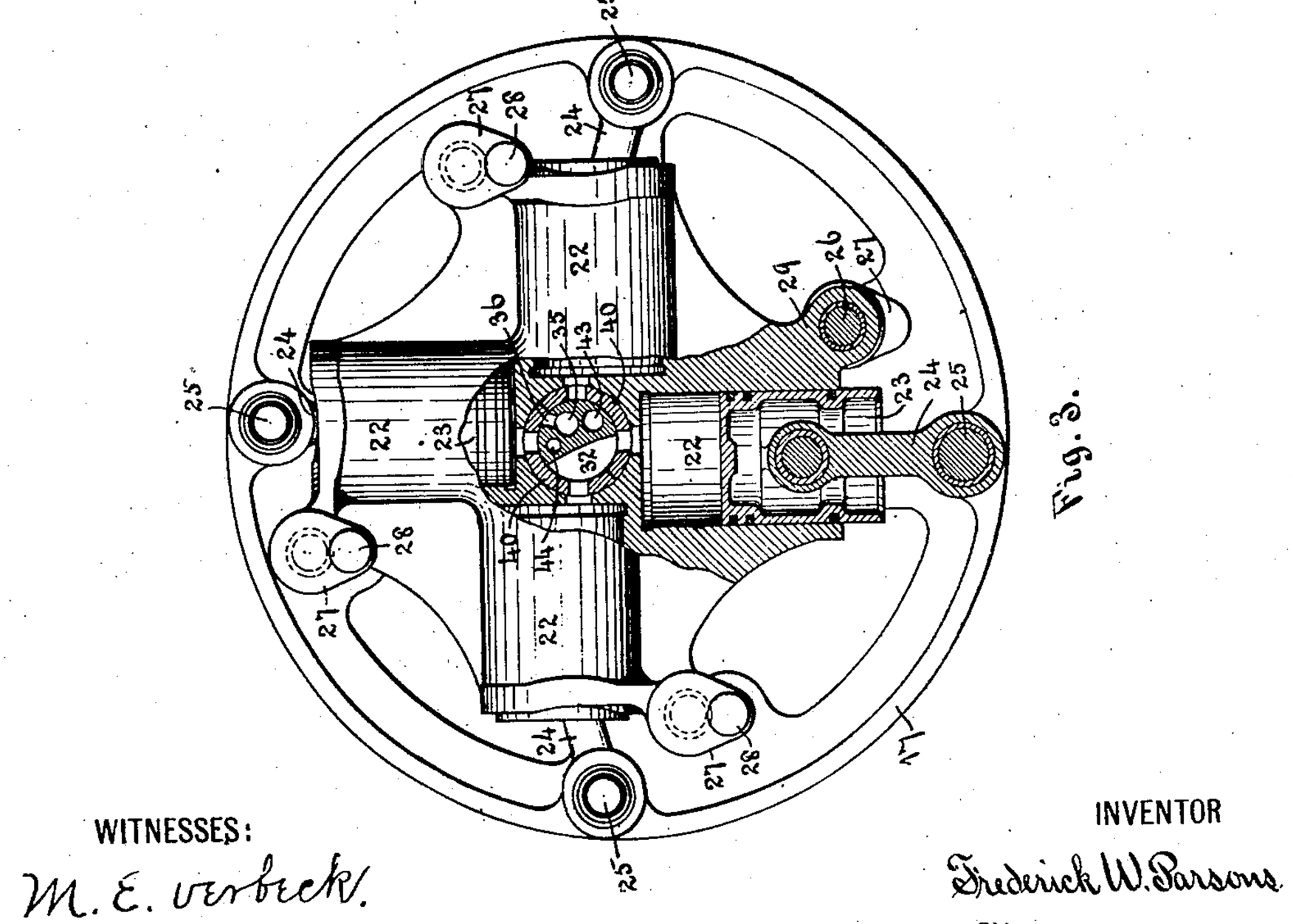

Fig. 3.

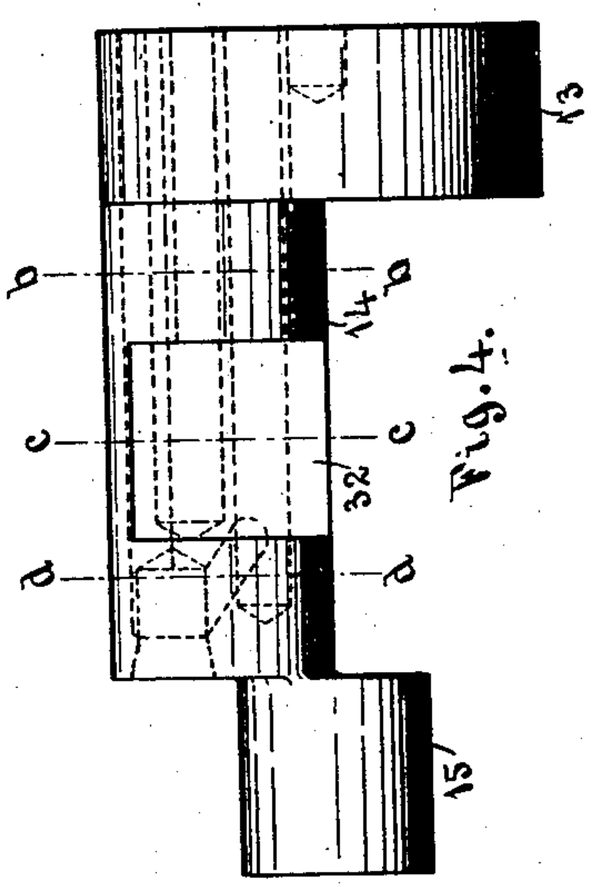

Fig. 4.

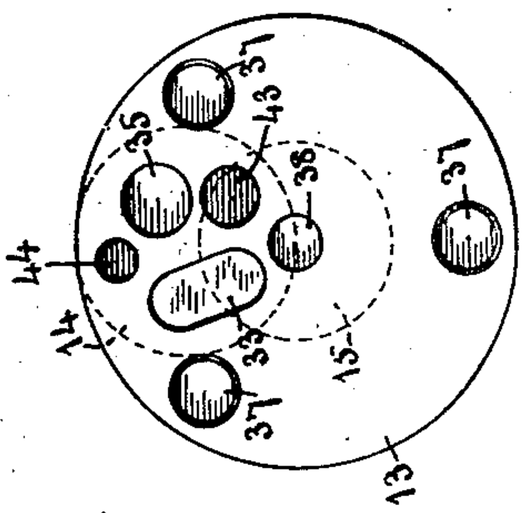

Fig. 5.

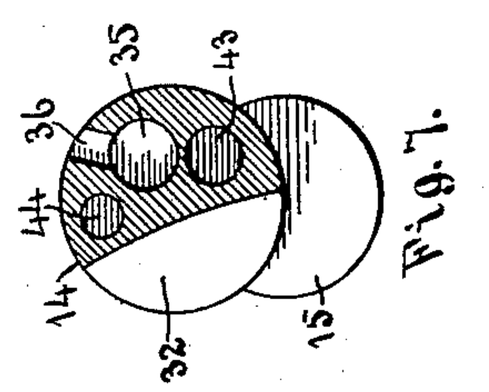

Fig. 7.

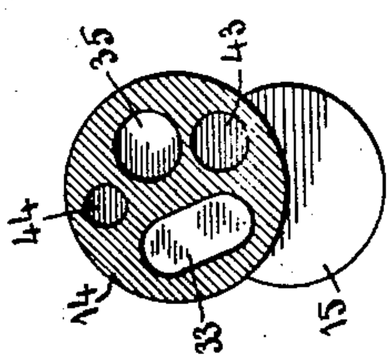

Fig. 6.

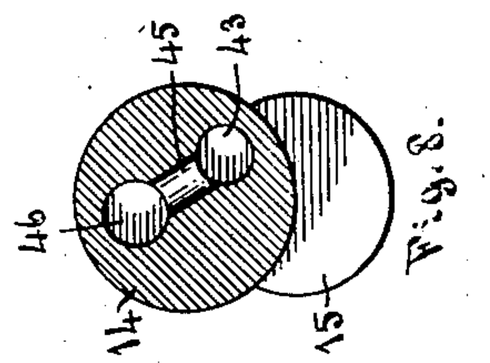

Fig. 8.

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3 SHEETS—SHEET 3.

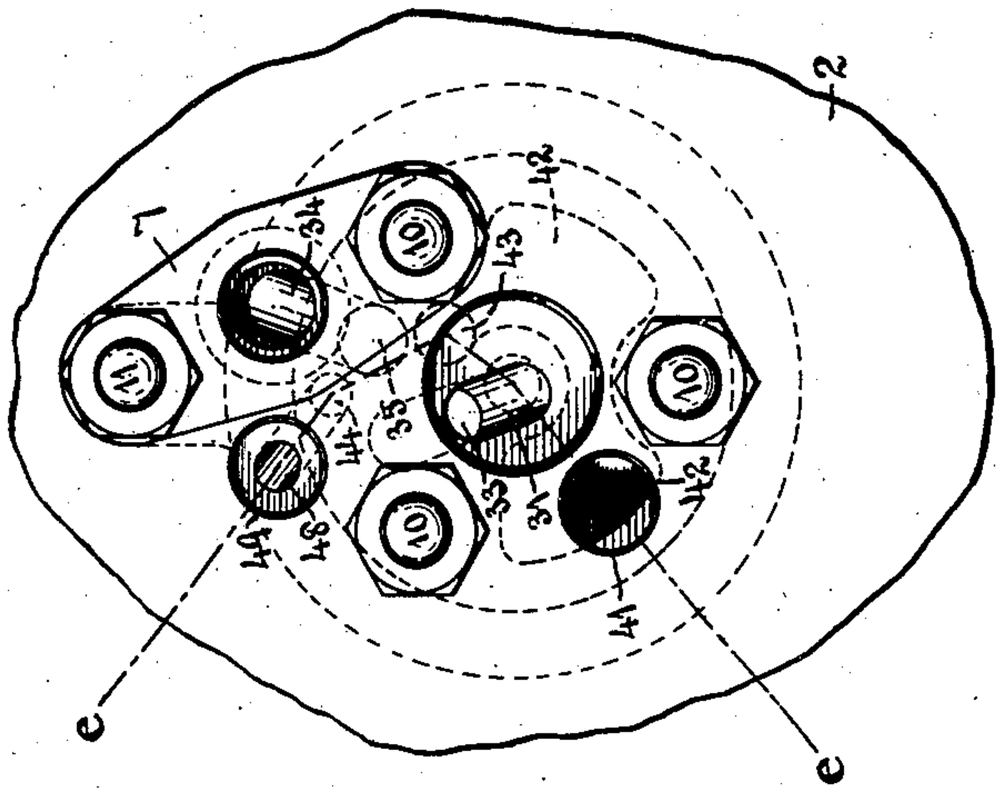

Fig. 10.

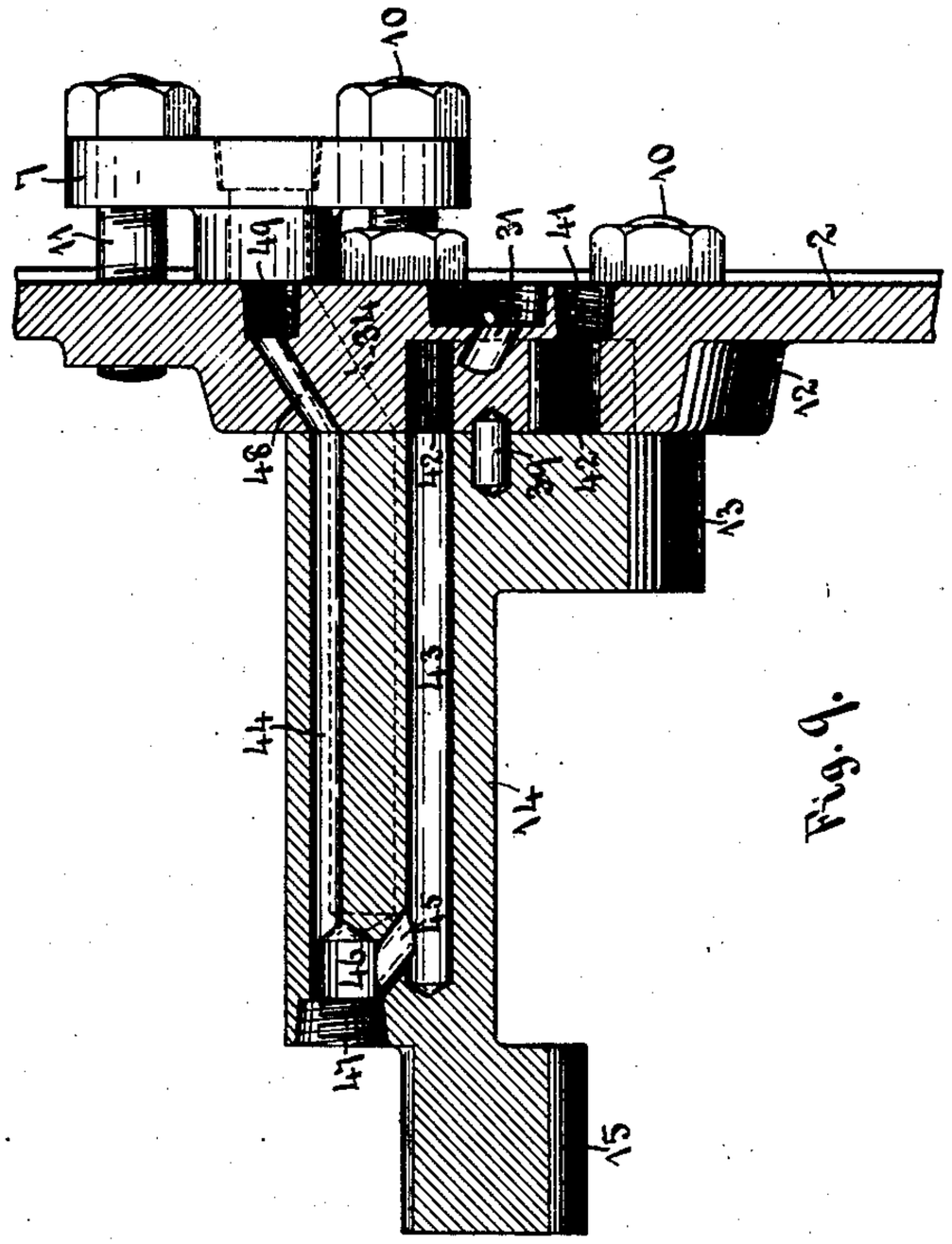

Fig. 9.

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UNITED STATES PATENT OFFICE.

FREDERICK W. PARSONS, OF TARRYTOWN, NEW YORK, ASSIGNOR TO INGERSOLL-RAND COMPANY, OF NEW YORK, N. Y.

AIR-COMPRESSOR.

No. 898,389. Specification of Letters Patent. Patented Sept. 8, 1908.

Application filed January 7, 1905. Serial No. 240,016.

To all whom it may concern:

Be it known that I, FREDERICK W. PARSONS, a citizen of the United States, residing at Tarrytown, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Air-Compressors, of which the following is a specification.

The object of this invention is to utilize an engine of the rotary reciprocating piston type for air compressing purposes, and to so construct the compressor as to attain a large compressing power in proportion to the cylinder areas and the stroke of the piston.

A further object is to improve the construction of this type of engine for the purpose in view: and a final object is to provide means for cooling the shaft about which the compressing cylinders rotate.

I attain my objects by means of the arrangement and construction of the compressor as illustrated in the accompanying drawings, in which—

Figure 1 represents an exterior side elevation of a compressor embodying my improvements; Fig. 2, a section of the same on the line *a—a* in Fig. 1; Fig. 3, a side view of the running parts of the compressor removed from the casing, with parts shown in medial transverse section, and with one of the side frames removed; Fig. 4, a side view of the cylinder and side frame bearings, which are formed in one piece; Fig. 5 an end view of the same; Figs. 6, 7, and 8, transverse sections respectively on the lines *b—b*, *c—c*, and *d—d*, in Fig. 4; Fig. 9, a sectional view, on line *e—e* in Fig. 10, of the casing head and bearings, showing the circulating passages for the cooling fluid; and Fig. 10, a side elevation of a portion of the casing head, showing the suction and discharge openings, and the inlet and outlet for the cooling fluid.

Like numerals designate like parts in the several views.

The casing for the compressor consists of a cylindrical shell, 1, provided with feet for attaching it to a supporting base. The casing at one side is closed by a head 2, and at the top is provided with a removable cap 3, by which oil may be introduced into the casing, observation port holes being provided at the lower side of the casing, at 4, through which the level and condition of the oil may be ascertained. The air is drawn into the compressor through the suction pipe 5, and discharged through the pipe 6, said discharge pipe for convenience in assembling the parts, being screwed into a coupling piece 7, which is secured in place by means of stud-bolts 10 and 11. The circulating pipes for the cooling fluid are indicated at 8 and 9.

On the inside of the casing head, is a boss 12, against which is fastened the side frame bearing 13, by means of the three stud-bolts 10, one of these stud-bolts being made longer than the others, and utilized for securing the pipe coupling 7 in place. Projecting from the bearing 13 is the eccentric cylinder bearing 14, at the other end of which is attached the smaller side frame bearing 15; these side frame and cylinder bearings being in one piece, as shown more clearly in Figs. 4 to 9. Upon the bearings 13 and 15 are mounted the side frames 16 and 17, the hubs on these side frames being lined with bronze bushings where they are journaled on the bearings. The side frame 17 is provided with a projection on its hub 19, which is journaled in the casing head and has a squared socket to receive the end of the driving shaft 20, which passes through an oil collecting chamber 21 formed in the casing head, in order that oil working its way through the bearing for the projection 19, will be caught and conducted back into the main casing.

Mounted upon the cylinder bearing 14, are four cylinders 22, which radiate from a central hub. This hub is provided with a bronze bushing which is slightly tapered on its outside perimeter, so as to be forced into rigid engagement with the tapered bore of the cylinder hub; and, in order to assemble the parts upon the cylinder bearing, the bushing 40 is split longitudinally. The cylinder hub is bored out to a diameter which will permit it to be slipped onto the cylinder bearing over the small side frame bearing 15; after which, one-half of the bushing is slipped into place on the side of the cylinder bearing away from the bearing 15, the other half of the bushing being inserted after the cylinders have been given a half turn, so as to bring the first half of the bushing in line with the bearing 15. After the bushing has been inserted in the bore of the cylinder hub, and the ports through the bushing are brought into alinement with the ports leading into the cylinders, the bushing will be pressed into place and secured by suitable means from turning movement with relation to the

hub. When the cylinders are in motion the bearing 15 will also prevent the longitudinal displacement of the bushing by reason of its projection at one side of the cylinder bearing.

Preferably I provide the compressor with four cylinders, thereby attaining a total compression area large in comparison to the cylinder diameters. The cylinders are provided with pistons 23 of the bucket type, said pistons being coupled to the side frames 16 and 17 by means of the oscillating connecting rods 24, said rods being pivoted upon the pins 25 by which the side frames are fastened together. At one side of each of the cylinders is a bracket 29 which is bored to receive the arbor 26, at each end of which are cranks 27 provided with crank pins 28, which latter are journaled in bearing boxes 30 formed in each of the side frames 16 and 17. The bearings for the arbors 26 and crank pins 28 are provided with bronze bushings, as are also the eyes of the connecting rods 24. The crank connections may be omitted from two adjacent cylinders out of the four, if desired.

When the side frames are rotated by means of the shaft 20, the joint action of the cranks 27 and the piston connections 24 with the side frames will cause the cylinders to be rotated about the crank pin 14 and the pistons to be reciprocated within the cylinder. This arrangement of rotating cylinders and reciprocating pistons has been employed heretofore in steam and compressed air engines and nothing, therefore, is claimed by me as novel in the general features of construction.

The air is drawn into the cylinders from the suction pipe 5, by way of the passage 31, which runs at an incline from the suction pipe joint in the casing head, through the boss 12, to register with the passage 33 leading through the bearing 13 and cylinder bearing 14 to the large suction port 32. The discharge takes place by way of a narrow port 36 in the cylinder bearing, which opens into the discharge passage 35, running out from the cylinder bearing and through the bearing 13 to the inclined passage 34 in the boss 12, and finally passes out through the discharge pipe 6.

In operation, the cylinders will be rotated from right to left, as viewed in Fig. 3, the air being drawn freely into them through the large port 32, while the pistons are passing from their inner to their outer positions in the cylinders. For instance, in Fig. 3, the piston in the upper cylinder is shown at the end of its inward stroke, and ready to begin its out stroke, with the cylinder port about to be opened to the port 32. The piston in the left hand cylinder is about at mid stroke outward, and the piston in the lower cylinder is at the end of its outward stroke, with the cylinder port about to be cut off from the port 32. From this point, as the pistons are forced inward, the air will be compressed until the cylinder ports are brought into register with the discharge port 36, which is so located with reference to the suction port that the pistons will be near the end of their in strokes, when the cylinder ports are opened to the discharge. The air contained in the cylinders will therefore be at full compression when the discharge port is reached.

The compression of the air within the cylinders will of necessity develop heat to a considerable degree, thereby causing the bearing of the cylinders to bind and cut unless some provision is made to reduce the temperature at this point. For this purpose I provide a circulation of a cooling fluid, (which may be water, or air, or other fluid,) through the cylinder bearing. This circulation is accomplished by passages connecting with the circulating pipes 8 and 9 as follows. A chamber 42 in the boss 12 communicates with the pipe 8 by way of the inlet 41, which is screw-threaded to receive the nipple connection from the elbow attached to pipe 8. The chamber 42 passes around the center of the boss, as indicated by the broken lines in Fig. 10, and communicates with the passage 43 drilled through the bearings 13 and 14, said passage 43 being in communication with a return passage 44, by way of the passages 45 and 46, the passage 46 consisting of a large bore drilled in from the end of the shaft and closed by a plug 47: the passage 45 being drilled diagonally into the passage 43, through the large bore 46. The passage 44 registers with the inclined passage 48 in the boss 12, and is terminated by a screw-threaded opening 49 to receive the nipple connection for the pipe 9. By this means a circulation in either direction may be maintained through the cylinder bearing and the main bearing disk, thereby maintaining the bearing for the cylinders in a condition sufficiently cool to provide for the free running of the compressor.

The bearing 13 is centered upon the boss 12 by means of the dowel pin 39, and is secured rigidly in place by means of the stud-bolts 10, which are screwed into the sockets 37, (see Fig. 5.), the dowel pin 39 being inserted in the central socket 38.

The casing is made oil tight, and a quantity of oil is maintained therein, which, as the compressor is rotated, is whirled about with the compressor, thereby causing all bearings to be continuously lubricated. The compressor may be driven by an electric motor in direct connection with the shaft 20, or it may be driven by power through pulleys attached to said shaft. A compressor so constructed will be especially adapted, owing to its size and power, for use in connection with the air brake systems of electric cars, and it is for use in this connection that it has

been especially designed, although I do not restrict myself to such use or application. In fact, the improvements in the cylinder and side frame bearings and connections, as herein described may be applied to advantage in compressed air engines, such as are used for the motors in portable tools, such as drills, hoists and the like. The compressor as herein shown may be converted into a motor by simply admitting compressed air to it through the pipe 6 and reversing the direction of flow through the bearings and cylinder ports.

Having thus described my improved compressor, what I claim as my invention and desire to secure by Letters Patent is—

1. The combination, with the side frames and cylinders having interconnections whereby rotary motion is imparted from one to the other, of a cylinder bearing having eccentric bearings for the side frames at each end, a hub, from which the cylinders radiate, having a bore sufficiently large to permit of its being slipped into place on the cylinder bearing over one of the end bearings, and a split bushing adapted to be inserted in said bore after the hub is in place.

2. The combination, with the side frames and cylinders having interconnections whereby rotary motion is imparted from one to the other, of a cylinder bearing having eccentric bearings for the side frames at each end, one of said end bearings being of smaller diameter than the other, a hub, from which the cylinders radiate, having a tapered bore of a diameter sufficiently large to permit of its being passed over the smaller bearing to its place on the cylinder bearing, and a tapered split bushing adapted to be inserted in said bore after the hub is in place.

3. The combination, with a pair of side frames rotating upon eccentric bearings positioned at each end of a stationary bearing, of a plurality of cylinders journaled upon said stationary bearing, pistons in the cylinders coupled to the side frames, arbors mounted in transverse bearings at the outer ends of the cylinders, cranks at each end of said arbors having pins journaled in boxes on the side frames, and ports and passages leading from the cylinders to and through the stationary bearing.

4. The combination of a plurality of cylinders mounted to rotate upon a stationary bearing, pistons in the cylinders, side frames mounted to rotate upon bearings eccentric to and at each end of the stationary bearing, cranks and pitmen connecting the cylinders and pistons respectively to the side frames, and inlet and outlet ports and passages in the stationary bearing with which ports in the cylinder register as the cylinders rotate.

5. The combination of a plurality of cylinders mounted to rotate upon a stationary bearing, pistons in the cylinders, side frames mounted to rotate upon bearings eccentric to and at each end of the stationary bearing, flexible connections between the cylinders and pistons and the side frames, a shaft attached to one of the side frames concentric with the side frame bearings, and inlet and outlet ports and passages in the stationary bearing with which ports in the cylinders register as the cylinders rotate.

In testimony whereof I have affixed my signature, in presence of two witnesses.

FREDERICK W. PARSONS.

Witnesses:

M. E. VERBECK,

A. S. DIVEN.