No. 699,570.

Patented May 6, 1902.

G. W. RHINE.

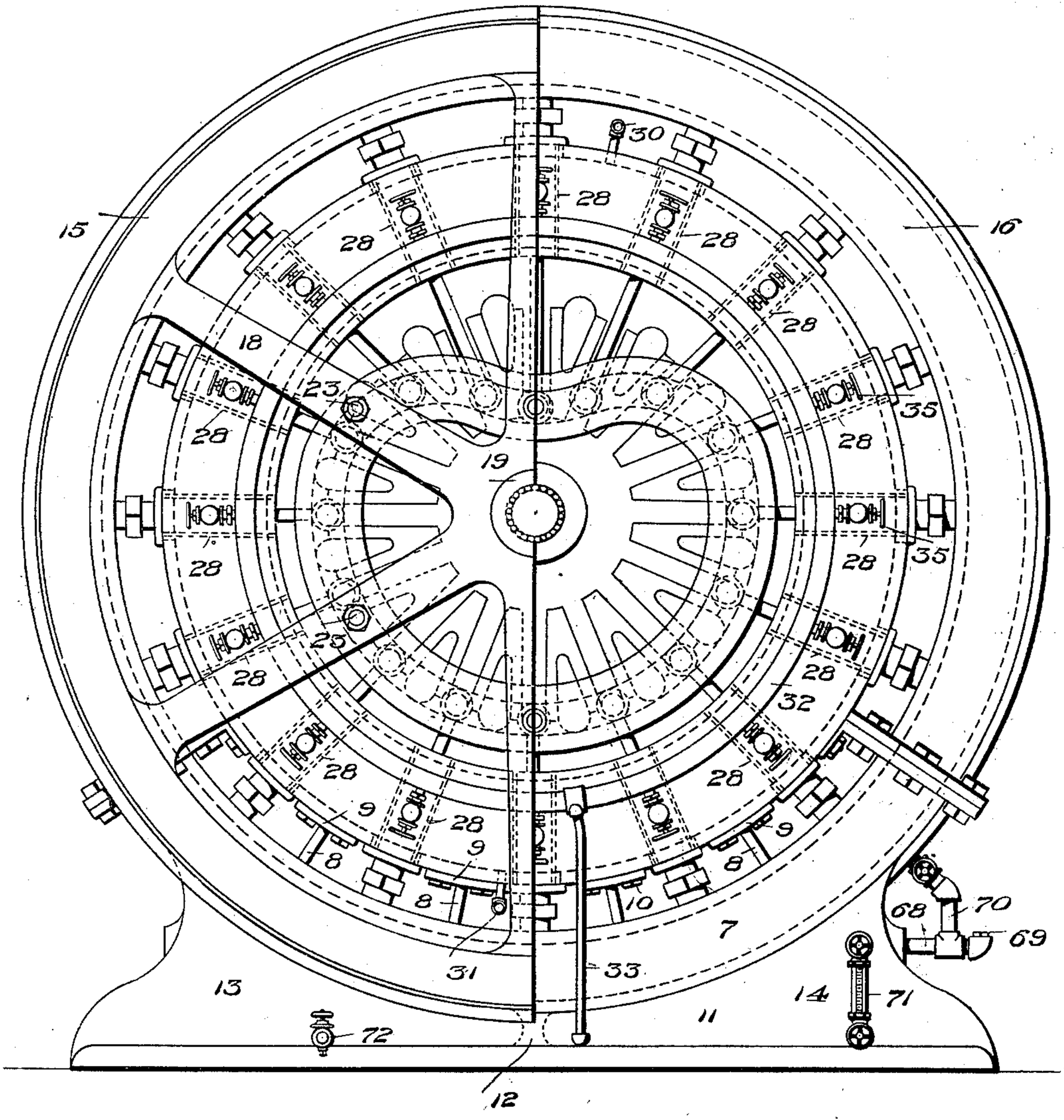
AIR COMPRESSOR.

(Application filed Jan. 8, 1902.)

(No Model.)

3 Sheets—Sheet 1.

Fig. 1.



Witnesses
F. D. McCleary.
[illegible]

Inventor
George W. Rhine
by Jas. L. Skidmore
his Attorney.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 699,570. Patented May 6, 1902.

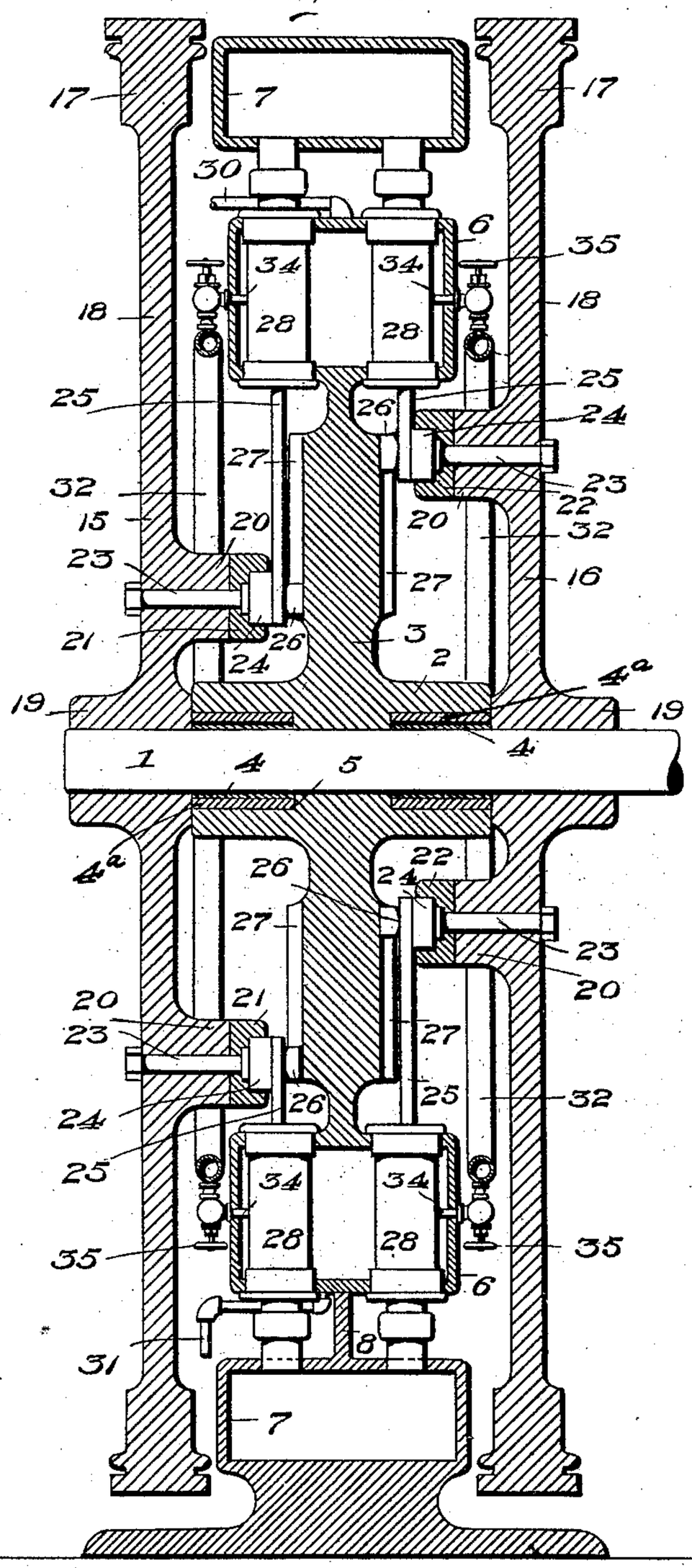
G. W. RHINE.

AIR COMPRESSOR.

(Application filed Jan. 8, 1902.)

(No Model.) 3 Sheets—Sheet 2.

Fig. 2.



Witnesses
F. O. McCleary.

Inventor
George W. Rhine
by Jas. L. Skidmore
his Attorney.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 699,570. Patented May 6, 1902.

G. W. RHINE.

AIR COMPRESSOR.

(Application filed Jan. 8, 1902.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 3.

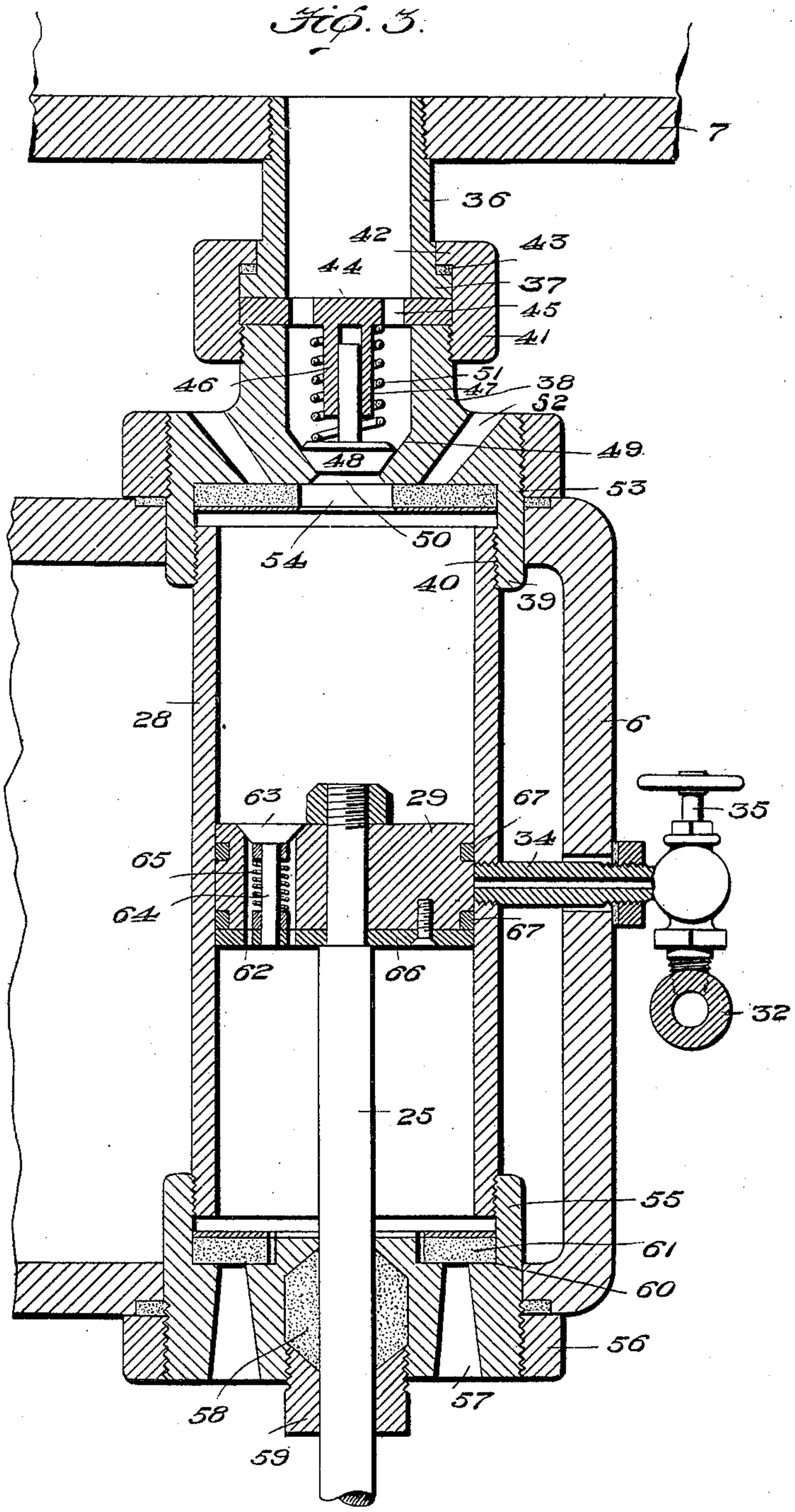
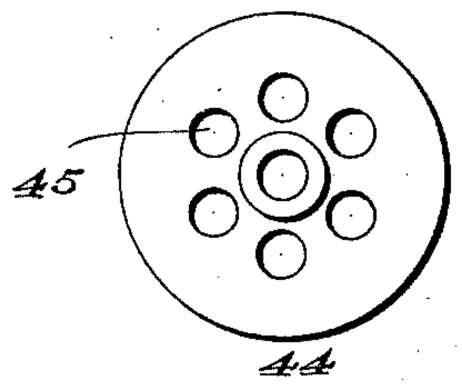


Fig. 4.



Witnesses
F. D. McCleary.

Inventor
George W. Rhine
by Jas. L. Skidmore
his Attorney.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

GEORGE W. RHINE, OF ALTOONA, PENNSYLVANIA.

AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 699,570, dated May 6, 1902.

Application filed January 8, 1902. Serial No. 88,856. (No model.)

To all whom it may concern:

Be it known that I, GEORGE W. RHINE, a citizen of the United States, residing at Altoona, in the county of Blair and State of Pennsylvania, have invented certain new and useful Improvements in Air-Compressors; and I 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 figures of reference marked thereon, which form a part of this specification.

My invention relates to air-compressors of the class which employ a series of pumps comprising cylinders arranged radially and pistons for delivering the compressed air to an annular chamber; and the primary object of the invention is to provide a machine or apparatus of the character indicated of greatly-increased efficiency and capacity.

A further object of the invention is to provide an air-compressor having a number of separate but coacting pump cylinders and pistons with improved means for effecting the reciprocation of the pistons and for cooling the cylinders and pistons.

A still further object of the invention is to improve the general construction and details of air-compressors with the view of operating the maximum number of compressing-pistons from a single rotary shaft and providing a well-balanced machine in a simple compact structure.

The improved apparatus consists of a stationary disk having a central hub, compressing cylinders and pistons arranged on opposite sides of the vertical center of the disk, a shaft extending loosely through said hub, revoluble wheels fixed upon said shaft at opposite sides of the disk, and means for operating the pistons by the revolution of the wheels.

The invention also consists of a stationary disk having a central hub, air-pumps arranged on opposite sides of said disk, and an annular air chamber or reservoir surrounding the disk into which air is delivered from all of the pumps.

The construction of the improved machine will be fully described hereinafter in connection with the accompanying drawings, which form part of this specification, and its distinguishing characteristics and novel features will be defined and specifically set forth in the appended claims.

In the drawings, Figure 1 is a side elevation of an air-compressor embodying the invention, partly cut away. Fig. 2 is a central vertical section of the same. Fig. 3 is a central longitudinal section, on an enlarged scale, of one of the air-pumps employed; and Fig. 4 is a bottom plan of the guide-plate of one of the pump-cylinders.

The reference-numeral 1 designates a revoluble shaft extending loosely through the hub 2 of a stationary disk 3. The hub 2 constitutes the shaft-bearing, and the ends of the bore of the hub are circumferentially enlarged to receive antifriction-rollers 4, inclosed in sleeves 4^a, as shown in Fig. 2, the inner ends of said rollers being held by internal annular shoulders 5 of the hub, while their outer ends abut against the revoluble wheels hereinafter referred to fixed upon the shaft 1 on opposite sides of the hub. Connected integrally with the periphery of the disk 3 is a hollow annular casing 6, serving as a support for the pump-cylinders and also as a water-chamber therefor.

7 designates a hollow annular air-chamber surrounding the casing 6 and secured thereto by a series of radial arms 8, each having at its inner end a bracket or plate 9, formed with openings for bolts 10. Connected to the lower portion of the air-chamber 7 or formed integral therewith is a hollow base 11, divided centrally by a vertical partition 12 to form an air-space 13 and an oil-reservoir 14.

Fixed upon the shaft 1, one at each end of the hub 2, are two concentric wheels 15 and 16, each comprising a rim 17, spokes 18, and a hub 19. The spokes of each wheel are formed on their inner sides with bosses 20, to which are secured oppositely-disposed grooved cams 21 and 22 by means of bolts 23. The grooves of the cams 21 and 22 face inward to receive rollers 23, revolubly secured to the inner ends of piston-rods 25. Upon the axial support of each of the rollers 24, on the opposite side of the piston-rod from said rollers 24, is mounted a guide-roller 26, supported within a vertical guideway 27 on the adjacent side of the disk 3.

The pump-cylinders 28 are arranged in par-

allel pairs on opposite sides of the vertical center of the disk 3, and the couplings of said cylinders are fitted within openings formed in the inner and outer peripheral surfaces of the casing.

Upon each of the piston-rods 25 is secured a piston 29, said pistons working within the cylinders, as illustrated in Fig. 3.

The space within the casing 6 not occupied by the cylinders is filled with water, which is supplied through an inlet-pipe 30 at the upper side of the casing and escapes through an outlet-pipe 31 at the lower side thereof, and the cylinders are thus cooled.

At each side of the casing 6 and concentric therewith is supported a circular oil-pipe 32, connected by feed-pipes 33 with the oil-reservoir 14 and by inlet-pipes 34 with the interior of the several cylinders 28, suitable needle-valves 35 controlling the passage of oil to the cylinders. The oil is fed in by the use of a force-pump or under any other suitable pressure, such as hereinafter described, whereby lubrication of the pumps is thus conveniently and effectively provided for.

The construction of the pistons and the valves and couplings of the cylinders are shown in Fig. 3. The outer end of each cylinder is connected to the air-chamber 7 by a tubular coupling 36, formed with an external annular shoulder 37 and a valve-casing 38, having an enlarged internally-threaded head 39 to engage external threads 40 on the outer end of the cylinder. The outer end of the casing 38 is externally threaded to engage internal threads of a nut 41, formed with an annular lip 42 to engage the shoulder 37, a packing 43 being interposed between said lip and shoulder.

Interposed between the coupling 36 and valve-casing 38 is a disk 44, formed with a series of air-ports 43 and having an inwardly-extending tubular portion 46, serving as a guide for a valve-stem 47, carrying a beveled disk-valve 48, fitting the converged walls 49 of the valve-casing and closing the opening 50, which communicates with the adjacent open end of the cylinder 28. A coil-spring 51 surrounds the guide 46 to close the valve when the air-pressure therein is relieved.

The head 39 of the valve-casing is formed with a series of inclined air-openings 52, controlled by a disk-valve 53, held movably between the head 39 and the outer end of the cylinder and provided with a central opening 54 for the passage of air to the casing 38.

At the inner end of the cylinder 28 is a coupling 55, internally threaded to engage external threads on the cylinder and externally threaded to receive a nut 56. The coupling 55 is formed with air-ports 57 and is centrally bored to form a stuffing-box for the piston-rod 25, containing a suitable packing 58 and a gland 59. The coupling 55 is recessed to form an internal annular shoulder 60 to support a valve 61, which controls the air-ports 57.

The piston 29 is formed with an opening 62, within which works a valve 63, having a stem 64, surrounded by a coil-spring 65. The piston is provided with a packing-disk 66, of leather or like material, secured to the inner face of the piston, and also with peripheral packing-rings 67, as clearly shown in Fig. 3.

68 designates a pipe for supplying oil to the reservoir 14, closed by a filling-plug 69 and connected to the air-chamber 7 by a valved pipe 70 to provide pressure for properly distributing the oil.

An oil-gage 71 is provided for the oil-reservoir, and the chamber 13 at the base of the machine is equipped with a bleeder-valve 72 to draw off moisture or condensation from the chamber 13.

The operation of the machine constructed as above described is as follows: The shaft 1 is revolved from any suitable source of power and carries with it the wheels 15 and 16 and the cams 21 and 22. As the rollers 24 are within the grooves of the cams, the piston-rods 25 are reciprocated to force the air into the annular air-chamber 7. On the inward stroke of each piston air is drawn into the cylinder through the openings 42 of the valve-casing, the disk-valve 53 opening for this purpose. The return stroke of the piston seats the valve 53 against the ports 42 and forces the air through the openings 54 and 50 to open the valve 48 and direct the air through the ports 45 and coupling 36 to the air-chamber 7. On the outward stroke of the piston air is drawn into the cylinder through the ports 57, the valve 61 lifting for the purpose, and on the reverse or inward stroke of the piston the valve 61 is seated and the valve 63 is opened to permit the air on the inner side of the piston to pass to the opposite side thereof and thence to the air-chamber. It will be noted from the illustration in Fig. 2 that the grooved cams are so arranged with relation to each other and to the piston-rods that the piston-rods of each pair of cylinders operate alternately, so that when the piston of one cylinder of a pair is moving inward the piston of the other cylinder of the pair is moving outward, and vice versa. This insures a steady and balanced operation of the machine and a continuous forcing of air into the annular air-chamber. By means of the valve of the pipe 70 the lubricating-oil is forced into the circular pipe 32 through the feed-pipe 33 and passes thence into the cylinders through the inlet-pipes 34.

I would have it understood that the invention includes all such modifications and variations of the details of construction as may be resorted to without departing from the scope and spirit of the invention as defined in the following claims.

I claim—

1. In an air-compressor, the combination with a stationary disk, of an annular air-chamber surrounding the disk, an annular casing between the disk and air-chamber, a

series of pump-cylinders supported within the casing, a revoluble shaft extending loosely through the disk, wheels fixed upon the shaft on opposite sides of the disk grooved cams secured to the inner sides of the wheels, and pump-pistons provided with rollers adapted to travel within the grooves of the cams.

2. In an air-compressor, the combination with a stationary disk, of an annular air-chamber surrounding the disk, an annular casing between the disk and air-chamber, a series of pump-cylinders supported within the casing and communicating with the air-chamber, a piston and piston-rod for each cylinder, a roller on each piston-rod, a revoluble shaft extending through said disk, wheels fixed upon the shaft on opposite sides of the disk, grooved cams secured to the inner sides of the wheels to receive said rollers, means for guiding the movement of the pistons, and means for cooling the cylinders.

3. In an air-compressor, the combination with a stationary disk having radially-disposed guideways on the opposite sides of the disk, of pump-cylinders arranged on opposite sides of the vertical center of the disk, a piston and piston-rod for each cylinder, said piston-rods working in the guideways and means for reciprocating the pistons.

4. In an air-compressor, the combination with a stationary disk, of an annular air-chamber surrounding the periphery of the disk and having a lower extension forming a hollow base, an annular casing interposed between the disk and air-chamber and secured thereto, a series of air-pumps disposed radially in parallel pairs, a revoluble shaft extending loosely through the center of the disk, wheels fixed upon said shaft one at each side of the disk, a grooved cam secured to the inner side of each of said wheels, and rollers mounted upon the piston-rods of the pumps and extending into the grooves of said cams.

5. In an air-compressor, the combination with a stationary disk having a central hub, of an annular casing secured to the periphery of said disk, an annular air-chamber secured to the outer side of the casing, a series of air-pumps arranged in radial pairs and supported within the casing, a revoluble shaft extending loosely through said hub wheels mounted on said shaft, a hollow base below the air-chamber having an oil-reservoir, pipe connections between said oil-reservoir and the cylinders of the pumps and means carried by the wheels for reciprocating the pump-pistons.

6. In an air-compressor, the combination with a stationary disk having a central hub, of an annular casing secured to the periphery of said disk, an annular air-chamber secured to the outer side of the casing, a series of air-pumps arranged in radial pairs and supported within the casing, a revoluble shaft extending loosely through the hub, wheels mounted on said shaft, grooved cams carried by the wheels, rollers on the piston-rods of the pumps extending into the grooves of cams, an oil-reservoir, circular pipes connected with said reservoir, and inlet-pipes connecting the circular pipes with the pump-cylinders.

7. In an air-compressor, the combination with a stationary disk having a central hub and radially-arranged guideways, of a revoluble shaft extending loosely through said hub, wheels fixed upon said shaft one at each side of the disk, grooved cams secured to said wheels, a series of radially-disposed air-pumps supported on opposite sides of the vertical center of the disk, a series of rollers mounted on the piston-rods of the pumps and extending into the cam-grooves, and a second series of rollers on said piston-rods extending into the guideways of the disk.

8. In an air-compressor, the combination with an air-chamber, of a series of air-pumps all communicating with the air-chamber, and each comprising a cylinder open at its ends, a piston having a valved opening, and means for connecting the cylinder to the air-chamber consisting of a tubular coupling, and a valve-casing containing an automatically-closing valve, said valve-casing having air-inlet ports, controlled by a disk.

9. In an air-compressor, the combination with a stationary disk, of an annular casing secured thereto, an annular air-chamber secured to the casing, a series of radially-disposed air-pumps each comprising a cylinder open at its ends, a piston and piston-rod, means for connecting the cylinder to the casing consisting of a coupling having air-ports controlled by a valve, and means for connecting the cylinder to the air-chamber consisting of a tubular coupling and a valve-casing containing a self-closing valve, said valve-casing having air-inlet ports controlled by a disk.

10. In an air-compressor, the combination with a stationary disk having a central hub, of a revoluble shaft extending loosely through said hub, wheels fixed upon said shaft one at each side of the disk, grooved cams carried by said wheels, an annular water-casing surrounding the disk and secured thereto, pipes for supplying water to said casing, a series of air-pumps arranged radially in pairs within said water-casing, rollers mounted on the piston-rods of the pumps and extending into the grooves of the cams, and an annular air-chamber surrounding the water-casing into which all of said pumps deliver air.

In testimony whereof I affix my signature in presence of two witnesses.

GEORGE W. RHINE.

Witnesses:
E. H. FLICK,
P. M. SWANGER.