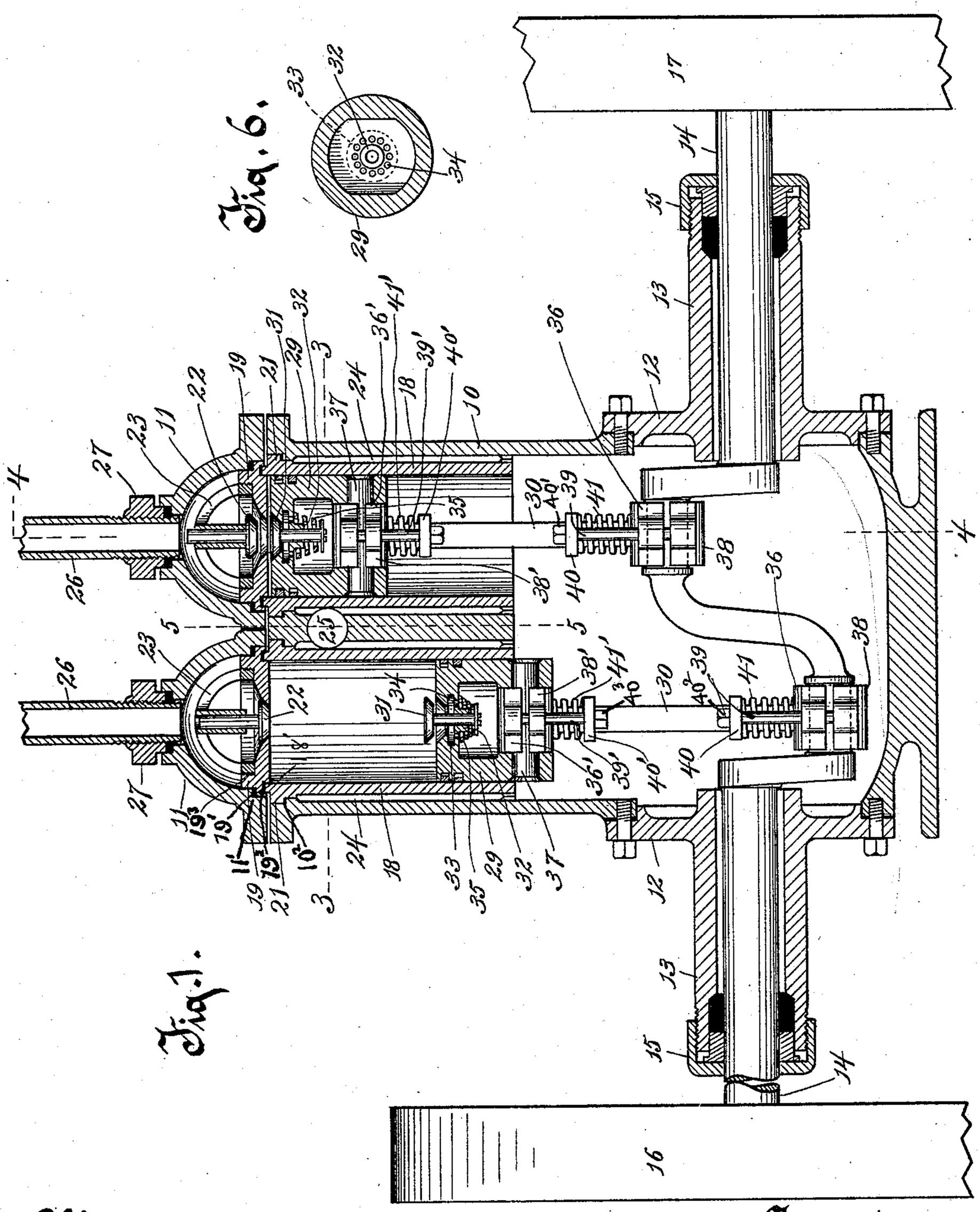
(No Model.) 3 Sheets—Sheet 1.

F. O. PIERSON.

COMPRESSOR FOR REFRIGERATING MACHINES.

No. 578,499. Patented Mar. 9, 1897.



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(No Model.) 3 Sheets—Sheet 2.

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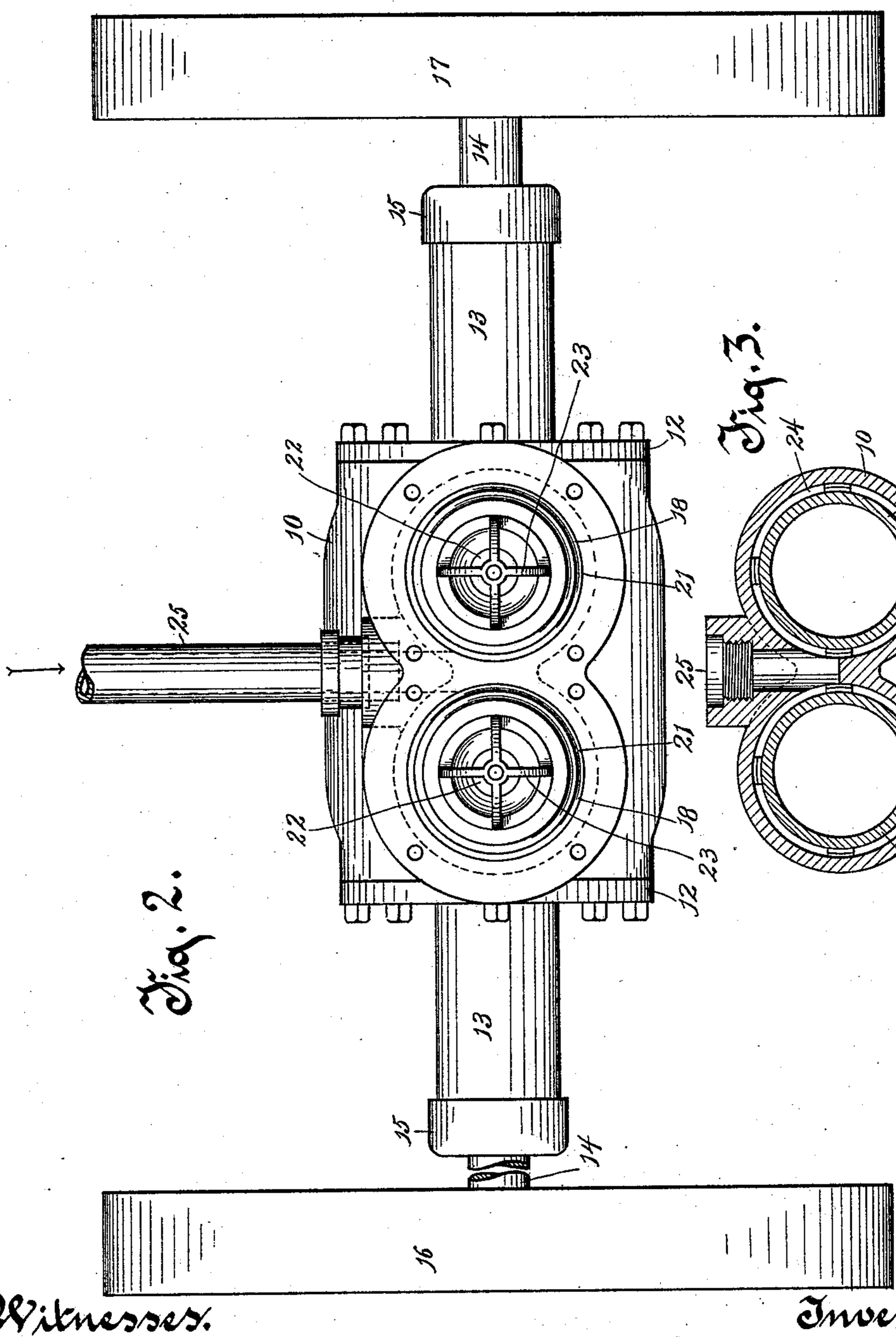

Fig. 2.

Fig. 3.

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(No Model.) 3 Sheets—Sheet 3.

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Fig. 4.

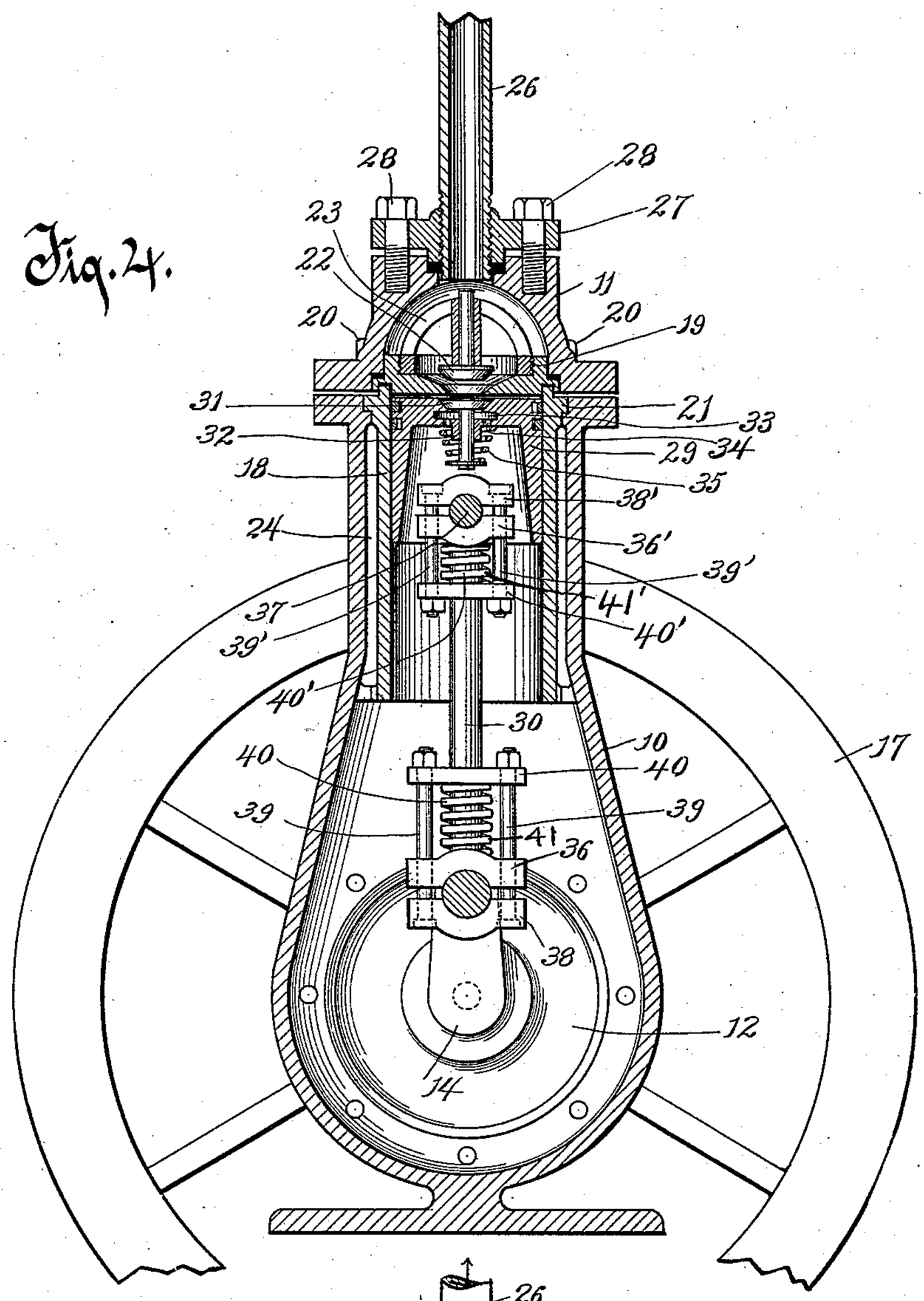
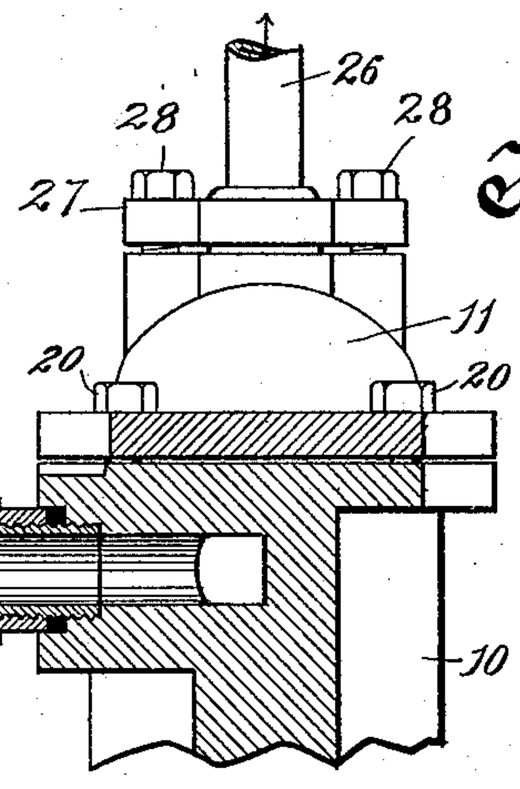


Fig. 5.



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UNITED STATES PATENT OFFICE.

FREDERICK O. PIERSON, OF OSHKOSH, WISCONSIN.

COMPRESSOR FOR REFRIGERATING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 578,499, dated March 9, 1897.

Application filed July 31, 1895. Serial No. 557,667. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK O. PIERSON, of Oshkosh, in the county of Winnebago and State of Wisconsin, have invented a new and useful Improvement in Compressors for Refrigerating-Machines, of which the following is a description, reference being had to the accompanying drawings, which are a part of this specification.

My invention relates to a pump or compressor especially adapted for compressing a gas or liquid refrigerant and forcing it through the pipes or passages of a refrigerating machine or apparatus.

The object of the present invention is to provide a compressor especially adapted for use in or with a refrigerating apparatus, in which compressor simplicity and inexpensiveness of construction are minimized, the wear of parts and the escape of the refrigerant is mostly obviated, compactness, strength, and endurance are obtained, and other features incidental thereto and of value in machines for this purpose are secured.

The invention consists in the machine and its parts and combination of parts, as hereinafter described and claimed, or their equivalents.

In the drawings, Figure 1 is a central section of my improved compressor. Fig. 2 is a top plan view of the compressor, the cap (in two parts) being removed. Fig. 3 is a transverse section of the shell and cylinders of the compressor on line 3 3 of Fig. 1. Fig. 4 is a section of my improved compressor centrally of one of the cylinders and at a right angle to the section in Fig. 1. Fig. 5 is a section of a fragment of the shell or frame on line 5 5 of Fig. 1. Fig. 6 is a detail, being a transverse section of one of the compressor-pistons, showing, centrally, the under surface of the piston.

My improved compressor is especially adapted for compressing and forcing ammonia, as a refrigerant, through the refrigerating apparatus. For the purpose of suitably lubricating the bearing parts of the operative mechanism, and at the same time of closing the joints or bearings of operative parts of the mechanism against the escape of ammonia, I construct the frame or shell of my compressor in the form of a cup 10, provided with suitable caps 11, making it liquid and gas tight. The lower portion of this shell to nearly one-half its vertical height I fill with oil or other liquid lubricant, in which oil or lubricant the operative mechanism in that portion of the machine moves and by which it is constantly and sufficiently lubricated. For convenience of construction the shell at its lower extremity is provided with opposite apertures closed by the stuffing-box plates 12 12, which plates are provided with laterally-projecting sleeves or bosses 13, through which the driving-shaft 14 extends. These sleeves or bosses 13 are closed at their extremities by screw-threaded caps 15, turning thereon, which caps are pierced by the shaft 14. The bosses 13, with their caps 15, form suitable stuffing-boxes on the plates 12, in which the shaft rotates.

16 is the band-pulley on shaft 14, and 17 indicates a fly-wheel thereon.

The shaft 14 is doubly cranked within the shell of the compressor and is adapted to reciprocate pistons alternately in the compressor.

Within the shell 10 are two cylinders 18, open at their lower extremities and partially closed at their upper ends by the detachable plates 19, in each of which there is a central aperture encircled by a suitably-formed valve-seat. The caps 11, covering the upper extremity of the shell and secured thereto conveniently by threaded bolts 20, also inclose and secure the plates 19 in place on the cylinders 18. Gas-tight joints and proper bearings are obtained between the ends of the cylinders and the plates and between the plates and the caps by suitable grooves, shoulders, and tongues on the parts, and, where occasion requires, by the use of suitable packing between the members. These grooves, shoulders, and tongues are arranged as follows: Upon the under side of each of the plates 19 is an annular groove 19′, which receives an annular tongue 18′, extending upwardly from the cylinder, and extending laterally from the plate is an annular flange 19^2, which supports an annular shoulder 11′, formed on the under side of the cap 11. An annular flange 21 on each of the cylinders 18 fits into a proper recess and rests on a suitable shoulder 10^2 therefor on the shell, whereby the cylinder is supported in position. It will be seen that by this construction the parts are fitted tightly

together, the cylinders being supported by the shells, the plates by the cylinders, and the caps by the shells and the plates. When it is desired to separate the parts, they may be readily detached merely by removing the bolts 20. A gravity-acting check-valve 22 is seated in each of the plates 19 and normally closes the aperture therethrough, each of the check-valves being provided with a vertically-extending stem movable in and guided by the hub of a spider 23, which spider is supported on the plate 19, conveniently by being formed with a rim that is screw-threaded exteriorly and turns into a suitably-formed and screw-threaded annular flange 19^3, extending upwardly from the plate.

Annular chambers 24 are formed about the cylinders 18 in the shell 10, which chambers open downwardly into the larger chamber of the shell or compressor. An inlet-pipe 25 leads through the shell into each of the chambers 24, preferably near their upper extremities, and discharge-pipes 26 lead away from the compressor severally from above each cylinder 18. The inlet-pipe 25 and the discharge-pipes 26 are severally secured gas-tight to the shell, the means for securing these discharge-pipes thereto being conveniently a plate or gland 27, screw-threaded onto the pipe and secured to the cap of the shell by screw-threaded bolts 28, suitable packing being used if found necessary.

Pistons 29, fitted and properly packed in the cylinders 18, reciprocate therein, being actuated by the cranks on the shaft 14, to the wrists of which they are connected by the rods 30. The pistons 29 are each provided with a valve-aperture closed by a gravity-acting valve 31, seated in the piston and provided with a depending stem which passes movably through and is guided by a spider or boss 32 on the under side of the central portion of the piston, the boss or spider in this instance being shown as formed integrally with the piston. In the construction shown in the drawings there is a laterally-expanded chamber 33 formed in the piston immediately below the valve-seat, which chamber communicates with the valve-aperture above and is provided with ducts or passages 34, leading therefrom into the chamber of the cylinder below the piston. This construction is an advisable one, the object being merely to provide free and suitable admission of the refrigerant to and through the valve-aperture in the piston and at the same time to provide a suitable guide and bearing for the valve-stem. These valves 31 are also preferably provided with expansion-springs 35, coiled about the stem and interposed between the under surface of the piston and a flange or collar on the stem at its extremity, which spring insures the prompt and certain closing of the valve when released from the lifting effort of the compressed and passing refrigerant.

As the connecting-rods 30 and the parts to which they are attached are inclosed within the shell of the compressor and cannot be got at readily it is desirable that their connections should be such as to constantly remain in good working condition without attention or adjustment by an attendant, and therefore I provide a construction for attaching them to the wrists of the shaft and to the pistons, that is, automatically adjustable, thus taking up wear and obviating supervision and adjustment by a care-taker. Each connecting-rod 30 terminates at its ends in the cross-head 36 36′, rigid with the rod and provided with a bearing for the wrist of the crank and for the pin 37, fixed in the piston, and cross-head caps 38 38′, opposite the cross-heads 36 and 36′, respectively, are provided with suitable bearings for the wrist and pivot-pin, thus together in pairs forming journal-boxes for the wrist and pivot pin, respectively. The caps 38 and 38′ are each held automatically adjustable toward their complementary cross-head journal-box 36 36′ by means of the side bars 39 39′, secured in the caps 38 38′ and advisably passing movably through the cross-heads 36 36′ into the glands or cross-bars 40 40′, through which glands the connecting-rods pass freely. The side bars 39 39′ extend through the glands and their outer ends are threaded to receive nuts 40^2 and 40^3, which nuts bear against the outer sides of the glands. Expansion-springs 41 41′ are coiled about the connecting-rod and interposed, respectively, between the heads 36 36′ and the glands 40 40′.

It will be seen from this construction that when any wear occurs at the connections the expansive force of the springs exerted upwardly against one of the glands and downwardly against the other will cause said glands to pull away from the cranks and pins, respectively, and draw the cross-heads 38 38′ against said cranks and pins. When the expansive force of the springs becomes impaired by wear, their tension is regulated merely by screwing the nuts 40^2 40^3 against the glands. It will be apparent that this is a most simple form of self-adjusting mechanism and is of such construction that should the spring break no further damage to parts can ensue with the further working of the machine.

It will be seen that by filling the shell of the compressor with oil or other fluid lubricant to a point somewhat above the plates 12 the shaft 14 and its cranks, with the lower extremities and connections of the rods 30 therewith, will be constantly submerged in the oil or lubricant, and that thereby these parts will be constantly lubricated; and it will also be understood that by the rapid movement of these connecting-rods and the wrist-connecting members oil will be splashed up onto the pistons and into the lower portions of the cylinders 18, whereby the pistons and their connections will also be sufficiently lubricated, and that the oil in the lower portion of the shell will form a gas-

tight packing, wholly obviating the escape of the refrigerant from the shell through any of the joints or apertures thus packed by the oil, while at the same time the refrigerant—advisably ammonia—is free to enter the compressor through the intake 25 and to pass therefrom by means of the annular chambers 24 into the space below the cylinders and above the oil in the shell, and thence through a valve-port in a piston into the upper portion of a cylinder as the piston goes down, and when the piston goes up and the valve 31 is closed to escape through the valve-opening in the plate 19 into the discharge-pipe 26. It will also be understood that as this compressor is in and a part of a continuous and unending system of refrigerating-pipes the compressing and forcing of the refrigerant into the pipes 26 also provides for and secures the return of the refrigerant through the inlet-pipe 25 to the compressor.

The annular chambers 24 about the cylinders 18, into which chambers the returning and cool-tempered refrigerant is admitted, prevent the overheating of the cylinders and adjacent parts, thus accomplishing the cooling of the compressors that usually is accomplished only by means of cold flowing water. It will be observed that my improved compressor is entirely without oil-cups of the form usually required with mechanism of this general character, and that the parts are so constructed and connected together as to require the minimum amount of attention and mostly to be automatically self adjusting and compensating.

As the exit from the annular chamber is only by way of the open lower end thereof, it is obvious that the ammonia, as above stated, passes to the space above the oil in the shell. As the gas subsequently rises it draws or sucks up oil from the lower part of the shell, which oil serves to lubricate the upper end of the rod, the piston, the cylinder itself, and the valves. It will therefore be seen that the lubrication of these parts is not dependent alone upon the splash of the oil onto the pistons and into the lower portions of the cylinders by the rapid movement of the connecting-rods and wrist-connecting members. As the lower portion of the shell is filled with oil to a point somewhat above the plates 12, lubricant for the sleeves or bosses 13 and the ends of the crank-shaft journaled therein is constantly furnished. As all the other working parts are lubricated in the manner just described, it will be seen that there is no necessity whatever for the employment of oil-cups.

The automatically-adjustable attachments for the ends of the connecting-rods subserve an important function, in that they obviate the necessity of constant supervision by a care-taker. If the construction referred to were not provided, it would be necessary, in order to get at the inner parts for adjusting purposes, to remove the wheels 16 and 17 and the sleeves or bosses after first having unbolted the plates 12, and so with other forms of machines a number of parts are required to be removed, necessitating considerable time and labor. This is all obviated by the self-adjusting mechanism employed by me.

I have shown and described a compressor in which there are two cylinders and two pistons, and this form of construction is preferable; but one cylinder, its piston, and related parts could be omitted, the remaining mechanism being sufficient to perform a limited amount of work and possibly would be well adapted for a small refrigerating-machine, and such construction would still embody the spirit of my invention.

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

The combination, of a shell, a cylinder within the upper portion of the shell and removed therefrom to form an annular space to which the inlet leads, the lower end of the annular space opening into the lower space of the shell, and the cylinder provided near its upper end with an annular lateral shoulder fitting a corresponding recess in the shell, the extremity of the cylinder forming an upwardly-projecting annular tongue, a plate for the upper end of the cylinder having a valve-opening therein, said plate provided upon its under side with an annular groove to receive the upwardly-extending tongue of the cylinder, and upon its edge with a lateral annular flange, and upon its upper side provided with an upwardly-extending spider having a hub projecting therefrom, a valve regulating the valve-opening, the stem of said valve being guided in the hub, a cap for the upper end of the shell, having a flange bolted to a corresponding flange of the shell, and also provided with an annular shoulder adapted to receive the lateral annular flange of the plate, and a reciprocating piston within the cylinder provided with a valve-regulated opening, substantially as described.

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

FREDERICK O. PIERSON.

Witnesses:
GEORGE HILTON,
GEORGE B. SIMMONS.