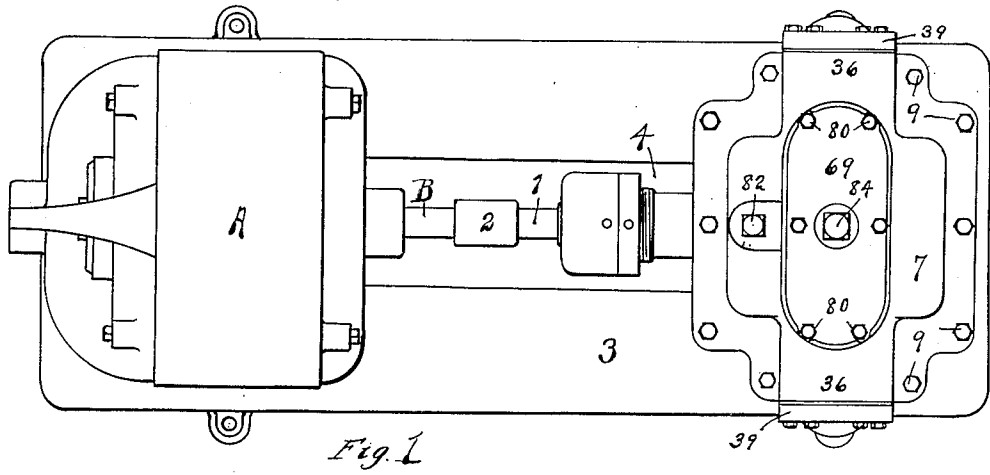
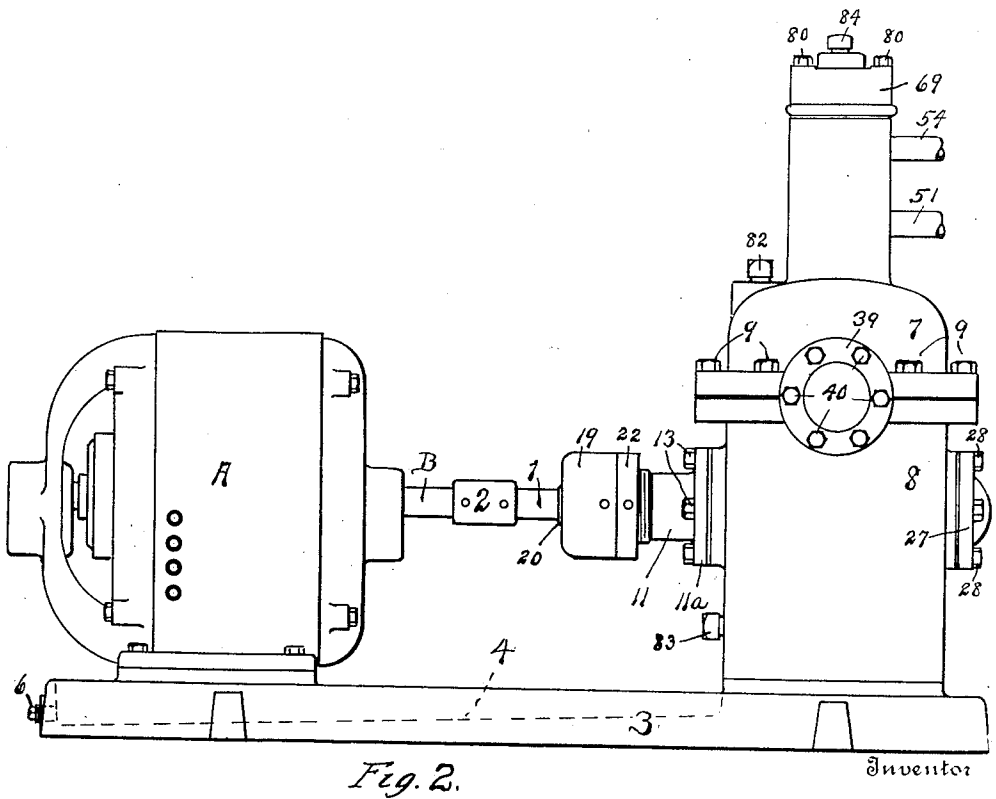


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COMPRESSOR.
APPLICATION FILED MAR. 11, 1918.

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Patented Feb. 17, 1920.
3 SHEETS—SHEET 1.



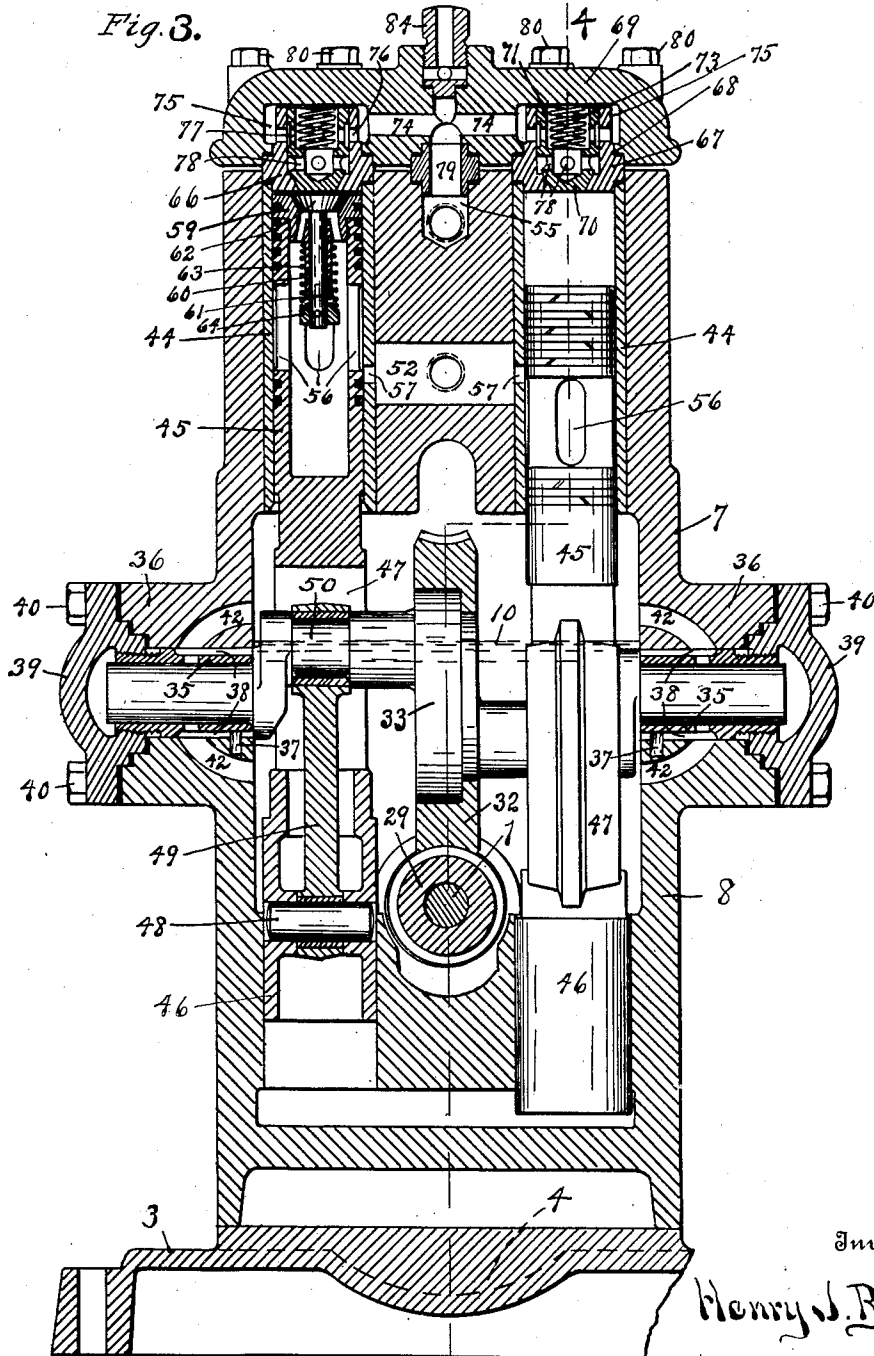
Henry J. Bery.
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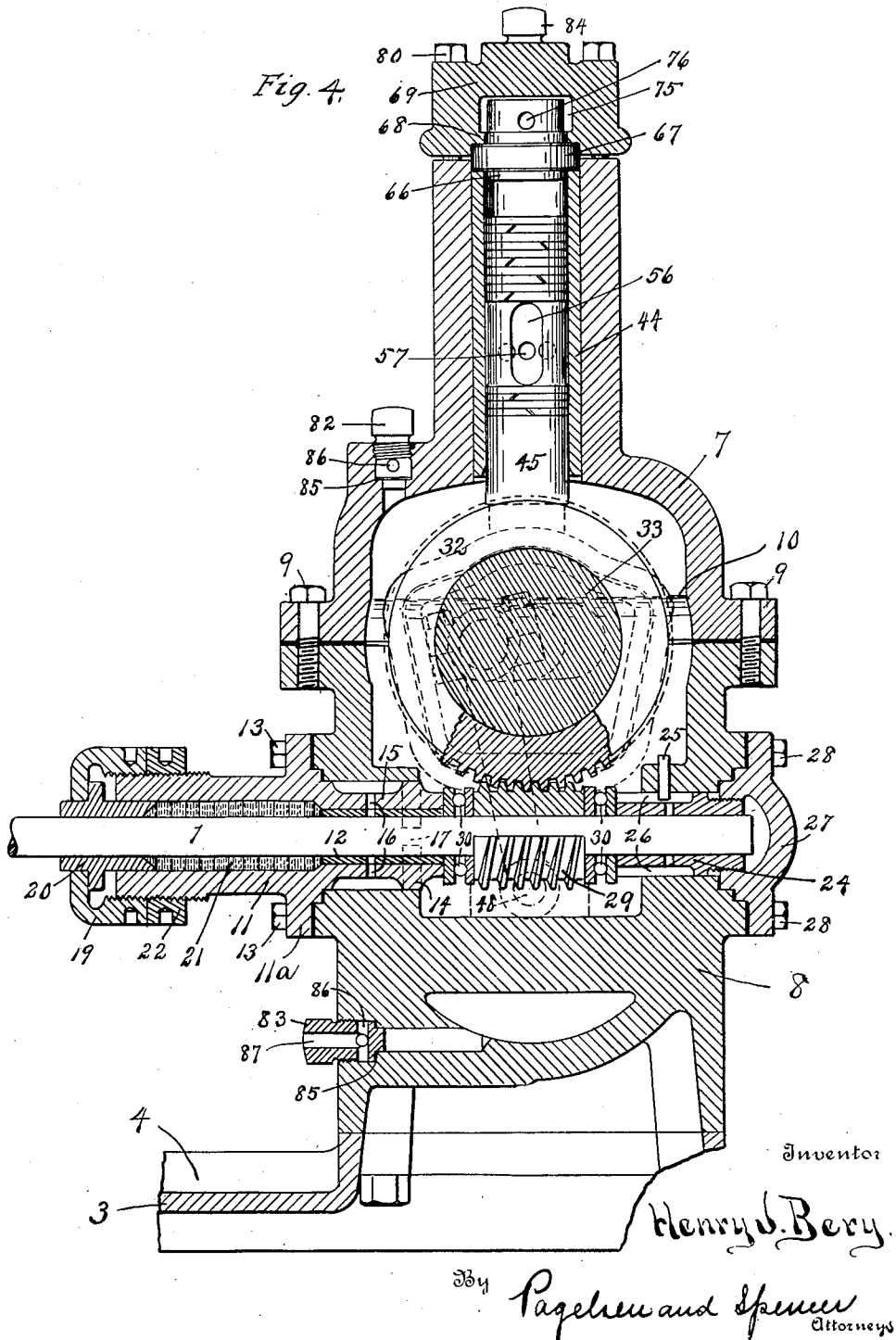
Inventor

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1,331,233.

3 SHEETS—SHEET 3.



UNITED STATES PATENT OFFICE.

HENRY J. BERY, OF DETROIT, MICHIGAN, ASSIGNOR OF ONE-HALF TO ELLSWORTH S. BRYANT, OF DETROIT, MICHIGAN.

COMPRESSOR.

1,331,233.

Specification of Letters Patent.

Patented Feb. 17, 1920.

Application filed March 11, 1918. Serial No. 221,814.

To all whom it may concern:

Be it known that I, HENRY J. BERY, a citizen of the United States, and residing at Detroit, in the county of Wayne and State of Michigan, have invented a new and Improved Compressor, of which the following is a specification.

This invention relates to compressors for air and other fluids, but particularly for ammonia and other poisonous and irritating gases, and its object is to provide a device of this character which may be constructed at moderate cost, which will run with a minimum of friction, and which can be prevented from leaking.

This invention consists, in combination with a casing, a driving shaft extending into the casing, and having a worm secured to it, a double-crank shaft journaled in the casing and having a worm wheel secured to it between the cranks and meshing with the worm, said casing being formed with working cylinders above the crank shaft and others below the crank shafts, in alignment with those above, the pistons in alignment being connected into pairs of which the upper piston is the working piston and the lower the guiding piston, and connecting rods extending from the crank shaft to the guiding pistons.

It further consists in forming intake and discharge passages in the casing and in forming the working pistons hollow and with ports connecting to the intake passage, and in mounting an intake valve in the upper end of each working piston.

It also consists in mounting a valve casing for the discharge valve between the upper end of each cylinder and the general cylinder head and in forming passages in the cylinder head connecting said valve casings to the discharge passage in the main compressor casing.

It also consists in forming the casing as an oil reservoir in which the level of the oil shall be above the crank shaft so that the worm and the guiding pistons shall be constantly submerged so as to reduce friction and also to act as a seal to prevent the gases from escaping around the main driving shaft of the compressor.

It also consists in the details of construc-

tion illustrated in the accompanying drawings and particularly pointed out in the claims.

In the drawings, Figure 1 is a plan of this improved compressor connected to an electric motor. Fig. 2 is a side elevation thereof. Fig. 3 is a central vertical transverse section of the compressor. Fig. 4 is a section on the line 4-4 of Fig. 3.

Similar reference characters refer to like parts throughout the several views.

The compressor may be driven in any desired manner, the drawings showing an electric motor A whose armature shaft B connects to the main driving shaft 1 of the compressor by means of a coupling 2. The compressor and motor may be mounted on a base 3 provided with a central trough to catch the oil which may drop down from the motor and compressor, this oil being drawn off by removing a plug 6.

The compressor casing is formed of two parts 7 and 8 secured together by screws 9. It contains lubricating oil up to the line 10, which oil will be splashed onto all wearing surfaces not submerged therein. The lower part 8 of the casing is formed to receive the inner end of the stuffing-box sleeve 11 which is preferably fitted with a Babbitt bearing 12 for the shaft 1. A flange 11^a on this sleeve is secured to the part 8 of the casing by means of the screws 13. The inner end of the sleeve is in the form of a collar 14 just beyond the reduced portion 15 which is provided with oil holes 16, the collar 14 being formed with a longitudinal groove 17 to permit oil to flow to the holes 16. A nut 19 on the outer end of the sleeve forces the gland 20 against the packing 21 within the stuffing box and this nut 19 may be locked in place by means of a jam nut 22.

The opposite end of the shaft 1 is journaled in a bearing 24 which is slidable in the casing, being prevented from turning by a pin 25 extending into one of the grooves 26. Two grooves 26 are provided so that the bearing can be turned if it should wear out of alignment. The bearing is moved longitudinally of the shaft by means of the cap 27 screwing onto the end of the bearing, the cap being secured in position by the screws 28.

The worm 29 is secured to the shaft 1 and is prevented from moving endwise with the shaft by means of the ball bearings 30 between 11 is worm and the ends of the sleeve 11 and bearing 24, the latter being adjustable as above set forth. The worm meshes with the worm-wheel 32 on the crank shaft 33, more clearly shown in Fig. 3.

The double crank shaft is mounted in bearings 35 fitted in the bosses 36, half of each of which is formed on each of the two parts of the casing. Each bearing is prevented from turning by a pin 37 extending into one of the grooves 38, two being provided so that the bearing can be turned when worn. A cap 39 screws onto each bearing and is held in place by the screws 40 so that the crank shaft and the worm wheel can be accurately positioned. Oil passages 42 in these bosses insure satisfactory lubrication of the journals of the crank shaft.

The two parts of the casing are accurately formed with two parallel vertical bores, the bores of one part being in alignment with those of the other. Into the bores of the part 7 are pressed the bearing sleeves 44, and double pistons 45-46, connected by yokes 47, are slidable in the bores of the lower part 8 of the casing and in these sleeves 44. Each lower or guiding piston 46 carries a pin 48 and a connecting rod 49 extends therefrom to a crank pin 50.

The intake pipe 51 for the gas to be compressed connects into a small chamber 52 in the casing while the discharge pipe 54 for the compressed gas connects into the chamber 55. The pistons 45 are hollow and are formed with ports 56 that constantly connect to the passages 57 leading to the chamber 53 so that virtually, the interiors of these pistons 45 are parts of the intake passage. The external diameters of the pistons may be reduced at these ports 56.

A valve seat 59 screws into the upper end of each piston 45 and carries a depending sleeve 60 in which the stem 61 of the valve 62 is slidable. A light spring 63 pressing against the collar 64 secured to the lower end of the stem 61 normally holds the valve on its seat. Each part 59 and the valve mounted therein can be removed as a unit without disturbing the piston so that the valve can be ground onto its seat without dismantling the compressor.

The case 66 for each discharge valve is formed with a collar 67 resting on the sleeve 44 and on which bears a shoulder 68 formed on the cylinder head 69. The valve 70 has a cylindrical extension 71 in which the spring 73 is mounted and which normally holds the valve on its seat. A transverse passage 74 connects to the circumferential passage 75, and the case 66 is formed with ports 76 while the valve has ports 77 and 78. A small col-

lar 79 fits between the upper end of the casing and the cylinder head and connects the passages 74 to the chamber 55.

The thin packing rings at the upper and lower sides of the collars 67 on the valve cases 66 and similar rings on the collar 79 seal all possible passages through which the gases may escape from the casing. These collars and the seats engaged thereby may be so accurately machined that no packing strips are necessary, but such great accuracy is unnecessary and thin packing is preferred. The bolts 80 which hold down the cylinder head exert their entire stresses directly on these three small collars so that perfect seal is easily obtained.

The pipes 51 and 54 connect directly to the solid metal of the compressor casing; proper provisions are made for packing the joints between the collars 67 and 79 and the casing and cylinder head; proper provisions are made for packing between the caps 27 and 33 and the casing; and the only movable part projecting from the compressor is the shaft 1 which extends through an unusually long stuffing box in the sleeve 11. But this shaft is far below the line 10 of the level of the lubricant and any pressure of gas which may accumulate above this lubricant will at most result in only a slight leakage of oil around the shaft 1 at the end of the gland 20. The lubricant will of course be one which is not adversely affected by the gas being compressed.

A plug 82 is provided to permit replenishing the lubricant, a second plug 83 for draining the crank case, and a third plug 84 for relieving the pressure in the discharge passage. Each is provided with a shoulder to receive a packing ring 85, transverse passages 86 and a longitudinal passage 87. The inner end of the plug is slightly tapering or free from the wall, so that when the plug is screwed back from its seat, the fluid may flow around the inner end of the plug and through the passages 86 and 87 to relieve the pressure within the casing without removing the plug.

I claim:

1. In a compressor the combination of an oil tight casing and oil therein, a main shaft and a crank shaft mounted therein below the level of the oil, means for connecting said shafts, a pair of longitudinally adjustable bearings for the crank shaft, a longitudinally adjustable bearing for one end of the main shaft, and means for preventing the escape of oil around the other end of the main shaft.

2. In a compressor, the combination of a casing, a crank shaft mounted therein and having a pair of cranks, a worm wheel secured to the crank shaft, a main shaft below the crank shaft and extending from the casing, longitudinally adjustable bearings for

- the crank shaft and main shaft, a worm on the main shaft meshing with the worm wheel, said crank shaft bearings being submerged in lubricating oil, a pair of compressor cylinders and pistons above the crank shaft, means connecting the pistons to the crank shaft, and means to prevent the escape of lubricant around the main shaft.
3. In a compressor, the combination of a casing, a crank shaft mounted therein and having a pair of cranks, a worm wheel secured to the crank shaft, a main shaft mounted below the crank shaft and extending from the casing, a pair of longitudinally adjustable bearings for the crank shaft; a worm on the main shaft meshing with the worm wheel, said crank shaft bearings being submerged in lubricating oil, a plurality of compressor cylinders and pistons above the crank shaft, a plurality of guiding cylinders and pistons below the crank shaft, means to connect the pistons into pairs, and means connecting the guiding pistons to the crank shaft.
4. In a compressor, the combination of a casing, a crank shaft mounted therein, bosses formed on the side of the casing, bearings provided for the crank shaft in the casing and formed with external threads on their outer ends, and caps for the bosses formed with internal threads to engage the threads on the bearings to position them and the crank shaft.
5. In a compressor, the combination of a casing, a crank shaft mounted therein and having a pair of cranks, a worm wheel secured to the crank shaft, a main shaft mounted below the crank shaft and extending from the casing, bosses formed on the sides of the casing, bearings provided in the bosses and formed with external threads on their outer ends, caps for the bosses formed with internal threads to engage the threads on the bearings to position them and the crank shaft, a worm on the main shaft meshing with the worm wheel, said crank shaft bearings being submerged in lubricating oil, a plurality of compressor pistons and cylinders above the crank shaft, a plurality of guiding cylinders and pistons below the crank shaft, means to connect the pistons into pairs, and means connecting the guiding pistons to the crank shaft.
6. In a compressor, the combination of a casing, a crank shaft revolvably mounted therein and provided with a pair of cranks, bosses formed on the sides of the casings, bearings slidable in the bosses and formed with external threads on their outer ends, caps for the bosses formed with internal threads to engage the threads on the bearings to position them and the crank shaft, a worm wheel secured to the crank shaft between the cranks, a main shaft journaled within the casing below the crank shaft, a worm secured to the main shaft, said crank shaft and main shaft being submerged in oil, a pair of working cylinders and pistons above the crank shaft, and means connecting the pistons to the crank shaft.
7. In a compressor, the combination of a casing formed with intake and discharge passages, a working cylinder having a port connecting to the intake passage, a hollow piston therein having a port connecting to the intake port in the cylinder, a suction valve mounted in the outer end of the piston, a head for the cylinder, a discharge valve casing mounted between the cylinder and cylinder head, a spring held discharge valve in said casing, said head being formed with a transverse passage connecting to said discharge valve casing, and a hollow connection between said transverse passage and the discharge passage in the casing.
8. In a compressor, the combination of a casing, a crank shaft mounted therein and having a pair of cranks, a worm wheel secured to the crank shaft, a main shaft below the crank shaft and extending from the casing, longitudinally adjustable bearings for the crank shaft, a worm on the main shaft meshing with the worm wheel, said crank shaft bearings being submerged in lubricating oil, a pair of compressor pistons and cylinders above the crank shaft, means connecting the piston to the crank shaft, a stuffing box sleeve around the main shaft and connected to the casing and having a bearing for the main shaft extending into the casing, a second bearing mounted within the casing for the inner end of the shaft, and thrust bearings between the worm and the bearings for the main shaft.
9. In a compressor, the combination of a casing, a crank shaft mounted therein and having a pair of cranks, a worm wheel secured to the crank shaft, a main shaft below the crank shaft extending from the casing, longitudinally adjustable bearings for the crank shaft, a worm on the main shaft meshing with the worm wheel, said crank shaft bearings being submerged in lubricating oil, a pair of compressor cylinders and pistons above the crank shaft, means connecting the pistons to the crank shaft, a stuffing box sleeve connected to the casing around the main shaft having a bearing for the shaft extending into the casing, a second bearing mounted within the casing for the inner end of the main shaft, thrust bearings between the worm and the bearings for the main shaft, and means for the longitudinal adjustment of the second bearing for the main shaft.
10. In a compressor, the combination of a casing having intake and discharge passages and a pair of working cylinders formed in the casing, a working piston in each cylinder, intake valves, a cylinder head

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formed with passages and recesses in alignment with the cylinders, discharge valve casings mounted in said recesses and in the outer ends of the cylinders and having bearing surfaces for sealing the joints between the cylinders and said head, and a flanged collar to seal the joint between the head and the casing at the discharge passage.

5 11. In a compressor, the combination of a casing formed with a working cylinder, a head for the cylinder spaced therefrom and formed with a discharge passage, a discharge valve casing fitting within the cylinder and having a flange between the cylinder and cylinder head and forming a connection between the head and cylinder, and a discharge valve in said passage. 15

HENRY J. BERY.