Dec. 16, 1930. W. FOURNESS 1,785,407

COMPRESSOR MECHANISM

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Fig. 1

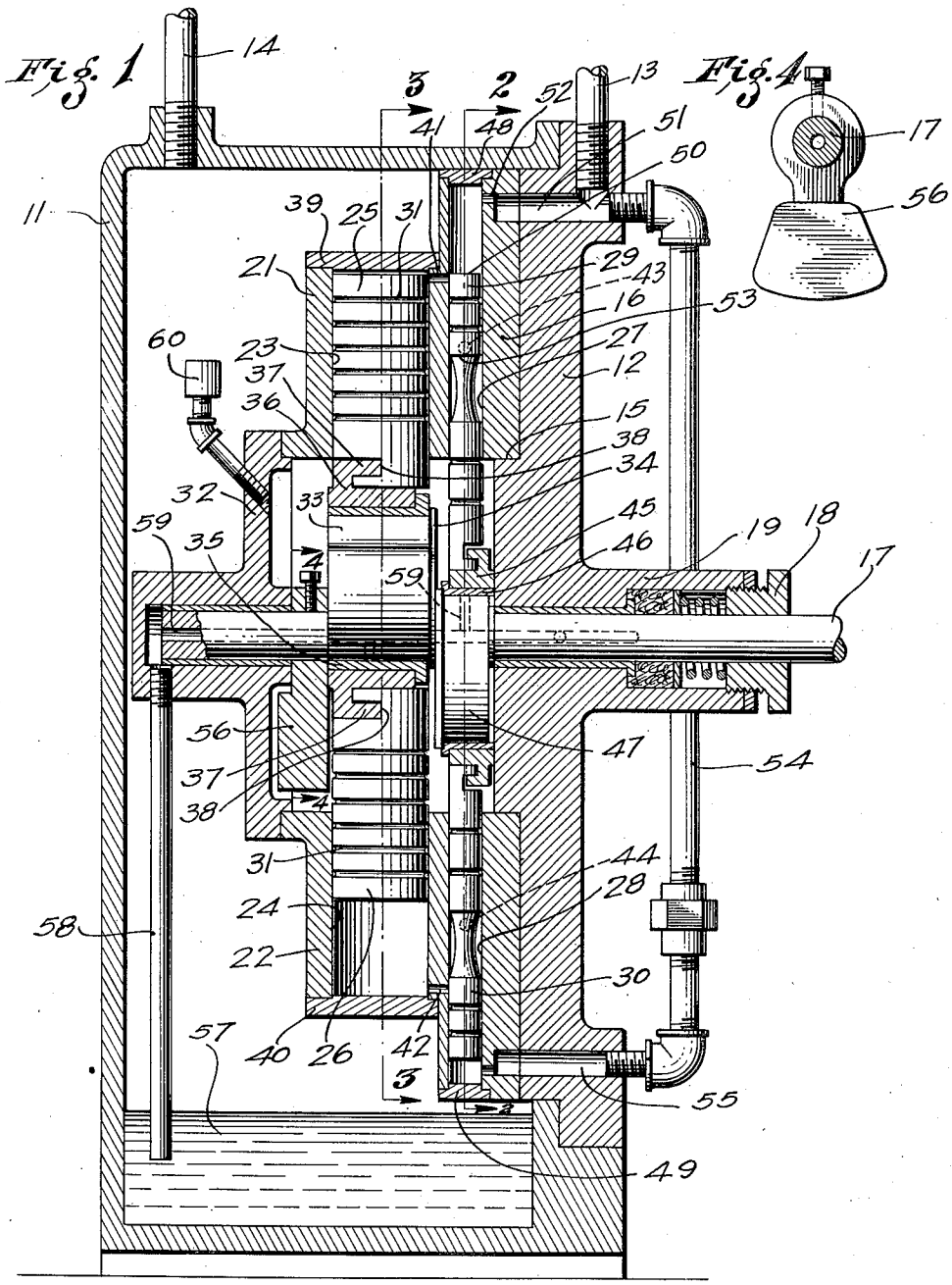


Fig. 4

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Fig. 2

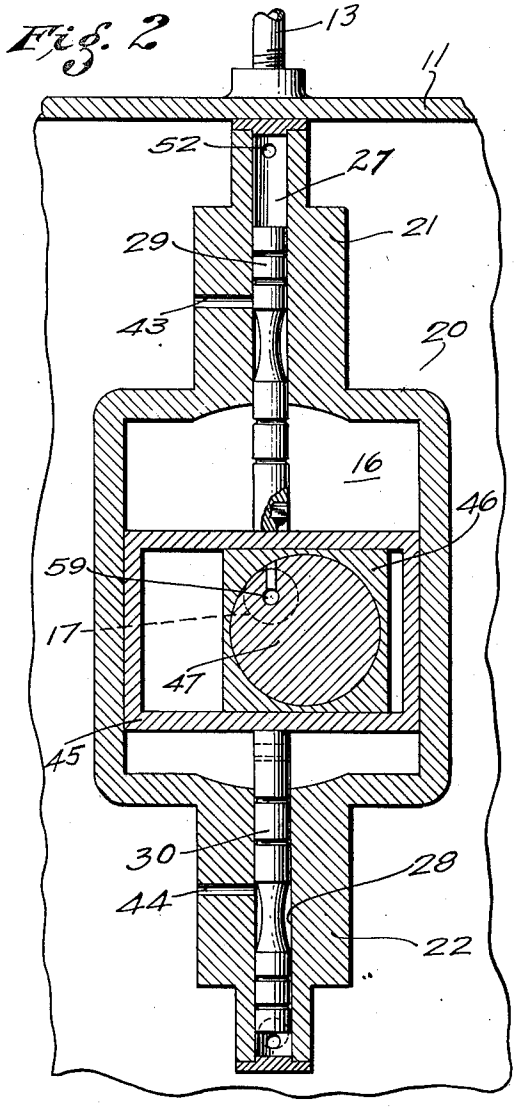
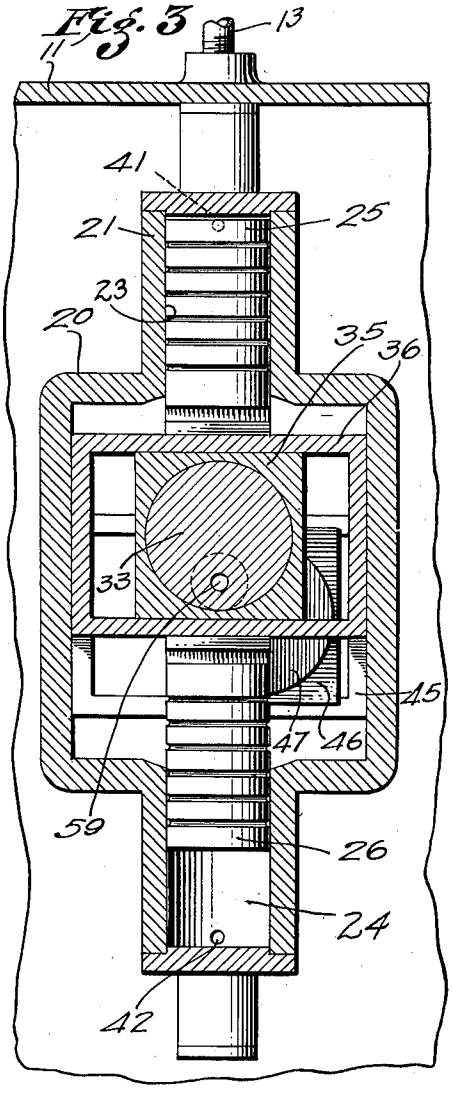


Fig. 3



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UNITED STATES PATENT OFFICE

WILFRED FOURNESS, OF OAKLAND, CALIFORNIA, ASSIGNOR TO THE FOURNESS DEVELOPMENT CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

COMPRESSOR MECHANISM

Application filed November 12, 1928. Serial No. 318,736.

This invention relates to compressors, and more particularly to that type of compressor which is described and claimed in my copending application, entitled "Compressor", filed March 8, 1927, under Serial No. 173,750.

It is one of the objects of my invention to provide a compressor, especially for refrigeration purposes, that can be driven at a high speed and with proper lubrication.

It is another object of my invention to provide a compressor that can be assembled or taken apart with great ease; and especially by the aid of keyed elements that obviate the necessity of any other fastening means such as screws or bolts.

It is another object of my invention to simplify the structure of fluid compressors, thereby reducing expense.

It is another object of my invention to provide a reciprocating piston type compressor in which the piston is relieved from any undue pressure.

It is still another object of my invention to prevent any leaks from the high pressure to the low pressure side of the device, by a careful positioning of the various ports.

My invention possesses many other advantages, and has other objects which may be made more easily apparent from a consideration of one embodiment of my invention. For this purpose I have shown a form in the drawings accompanying and forming part of the present specification. I shall now proceed to describe this form in detail, which illustrates the general principles of my invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of my invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a sectional view of a reciprocating compressor mechanism embodying my invention;

Fig. 2 is a sectional view, taken along plane 2—2 of Fig. 1;

Fig. 3 is a sectional view, taken along plane 3—3 of Fig. 1; and

Fig. 4 is a detail section, taken along plane 4—4 of Fig. 1.

In Fig. 1, there is shown a housing 11 in which the compressor mechanism can be located. This housing has a removable end wall 12. The inlet for the compressor can be provided through a pipe 13, and the outlet through a pipe 14.

The compressor proper is conveniently supported on wall 12, which has a shoulder 15 over which the main compressor body 16 is accommodated. The compressor can be driven by any appropriate source of motion, as by the aid of shaft 17 passing through the fluid tight packing gland 18, which is provided in a hub or boss 19 on wall 12. This shaft extends into the interior of housing 11, and mechanically drives the piston devices utilized in the compressor.

The compressor body 16, as shown most clearly in Fig. 2, has a substantially rectangular portion 20, from which extend in diametrically opposite directions, the cylinder blocks 21 and 22. Each of these cylinder blocks has a large bore 23 or 24, radial to the axis of shaft 17, for the accommodation of the main pistons 25, 26 that are reciprocated therein. The blocks 21, 22 are also provided with the valve bores 27, 28 that are parallel and close to bores 23, 24, and that accommodate the valve pistons 29, 30 for the control of inlet and outlet ports for the cylinders 23, 24. All pistons 25, 26, 29, 30 can be provided with grooves such as 31 to facilitate oiling.

I shall now describe the mechanism whereby pistons 25 and 26 are reciprocated, and shall then proceed with the description of the devices used for controlling the passage of fluid into and out of the cylinders.

Shaft 17 is journalled inside of housing 11 in a cap or cover member 32 that fits over the end of the rectangular portion 20 to provide a fluid tight enclosure therein. Shaft 17 carries an eccentric portion 33 that has a small flange 34. This eccentric portion 33 is freely rotatable in an eccentric block 35. This block is in turn embraced by a slide 36 formed as a four-sided frame (see Fig. 3). Two opposite sides of the frame are in contact with the inner wall of rectangular member 20 and slidable thereon; and the block 35 is just wide enough to enter the space

formed by the other two sides, and slidable therein. Block 35 is thus constrained to move only in a horizontal direction in frame or slide 36, which in turn is constrained to move only in a vertical direction. Therefore rotation of eccentric 33 causes a side to side motion of block 35, and a vertical reciprocation of slide 36.

Pistons 25, 26 can be mechanically connected to opposite sides of slide 36. I prefer to make this a dovetailed connection, whereby quick and inexpensive assembly can be secured. Thus I provide undercut projections 37 on opposite sides of the slide, which interfit with grooves 38 formed in the bottom of pistons 25, 26. The resultant reciprocations of pistons 25, 26 cause the fluid fed to the compressor, to be compressed. This process will now be explained.

Each of the cylinders 23, 24 has a cap such as 39, 40, in order to define the cylinder spaces. The fluid to be compressed enters the cylinders through ports 41, 42, near the outer portions of the cylinder spaces. These ports can be open for a time that falls within the time corresponding to the piston movement out of the cylinder space. During this suction period, the cylinder space becomes filled with low pressure fluid. On the compression stroke, port 41 or 42 is closed, and the fluid is compressed in the cylinder space. After a definite piston movement into the cylinder space, port 41 or 42 again opens, but it is in communication with an outlet passage 43 or 44. Of course since pistons 25, 26 are on opposite sides of slide 36, one of them is on its suction stroke while the other is on its compression stroke.

The means whereby the port openings are controlled synchronously with the piston movement includes the piston valves 29, 30. These are reciprocated by a separate slide 45 axially displaced from slide 36, but similarly operated. For reciprocating this slide, use is made of a block 46 in which eccentric 47 on shaft 17 is rotatable. Valves 29, 30, can be dovetailed to slide 45 in the same manner as pistons 25, 26 are dovetailed to slide 36.

The ends of the valve cylinders 27, 28 can be capped as by covers 48, 49. When say piston valve 29 moves inwardly (or toward the axis of shaft 17), the outer edge 50 of this valve ultimately uncovers port 41. Fluid can then flow from inlet 13, through passageway 51 in wall 12, through port 52 in the upper part of cylinder 27, into this cylinder, and through port 41 into main cylinder 23. After an interval, piston valve 29 starts its outward movement; and first port 41 is covered; then as the outward movement is continued, the lower edge 53 of the valve uncovers port 41, and cylinder 23 is in communication with the discharge port 43, which conducts the compressed fluid to the interior of casing 11. By appropriate angular arrangement between eccentrics 33 and 47, the proper sequence of the valve opening and closing actions with respect to the movements of the piston 25, can be secured. In the drawings, no attempt is made to indicate the correct lead or lag of one eccentric with respect to the other.

The piston valve 30 is similar in its action to valve 29. It controls the port 42. A pipe connection 54 extends between passageway 51 and a corresponding passageway 55 for the lower piston valve. This pipe connection can be conveniently arranged exteriorly of the wall 12.

In order to obtain a smoothness of operation, a counterweight 56 can be provided, that is angularly adjusted on shaft 17 adjacent cover 32.

The oiling system herein disclosed is similar to that shown in some of my prior applications. A body of lubricant 57 can be placed in the bottom of housing 11. This is constantly under pressure, due to the pressure of the fluid above the level of this lubricant. A pipe 58 dips into this lubricant and conducts this lubricant to the oil passageways 59 in the shaft 17 and eccentrics 33, 47, to the various bearing surfaces. The cap 32 serves to enclose the various piston operating mechanisms; and oil fills the remainder of the space in rectangular portion 20. Should any of the compressed gas be trapped therein, it can be forced out through a check valve device 60 extending into the space of housing 11.

Certain definite advantages of the structure as now detailed can be now emphasized. The wall separating the main cylinders from the valve cylinder does not sustain any great differences of pressure on opposite sides thereof, because of the location of outlet apertures 43 and 44. Both sides of this wall are subjected simultaneously to discharge pressures; the inlet passages are at a material distance from the main cylinder walls. Therefore there is no danger of seepage between the main cylinder and these inlet passageways.

Another important advantage resides in the elimination of all bolts or screws for holding the piston operating parts in place. The shaft 17 with its attached eccentrics 33, 43 can be assembled in the wall 12; and the right hand surface of eccentric 47 determines the shaft spacing. Cover 32 holds the eccentrics and the counterweight 56 in proper axial position, their axial lengths being just sufficient to take up all the axial space in the compartment formed by casing 16 and cover 32.

When cover 32 is removed, the counterweight 56 can be easily taken off; and then slide 36 can be slipped off block 35, which in turn can be moved outwardly off eccentric 33. This exposes the inner slide and eccen-

tric, which are similarly held in place without screws of any kind.

Due to the use of slides 36 and 45, the pistons 25, 26, 29, and 30 are moved with a force that has no transverse component; instead, a straight radial force is provided. Hence there is no tendency for these pistons even at high speed, to bind in their bores.

I claim:

1. In a compressor mechanism the combination of a casing, a detachable cover for the casing, a shaft extending across the casing, said casing having one or more cylinder bores radial to the shaft, pistons in said bores, and a slide in the casing arranged to be reciprocated by the shaft and guided by the casing, said slide being in mechanical connection with the pistons, said connection being characterized by the fact that the slide is detachably dovetailed to the pistons, and that the cover prevents relative axial movement of the slide and the shaft, to prevent disconnection of the dovetailed connection.

2. In a compressor mechanism, the combination of a casing, a shaft extending across the casing, said casing having one or more cylinder bores radial to the shaft, pistons in said bores, and a slide in the casing arranged to be reciprocated by the shaft and guided by the casing, said slide being detachably connected to the pistons by a transverse dovetail connection.

3. In a compressor mechanism, the combination of a cylinder block having a main cylinder bore and a valve bore, pistons in said bores, means for reciprocating said pistons, and a housing enclosing said cylinder block, said main cylinder bore having a port communicating with the valve bore, said valve bore having a discharge port communicating with the housing interior, as well as an inlet port, the piston valve alternately causing establishment of communication between the main bore and said two valve cylinder ports, said discharge port being located nearer the open end of the valve bore than the inlet port, said inlet port being beyond the active range of the piston valve, whereby the pressures on opposite sides of the wall separating the two cylinders are such as to obviate material seepage through said wall.

4. In a compressor mechanism, the combination of a housing, a pair of cylinders and pistons in the housing, means forming an outlet passage from the housing, means forming an inlet to one of the cylinders and passing through a wall of the housing, and a pipe connection external of the wall between said inlet and an inlet for the other cylinder.

5. In a compressor mechanism, the combination of a casing, a detachable cover for the casing, a shaft extending substantially across the casing, said casing having an end wall opposite the cover, as well as one or more cylinder bores, a slide in the casing and guided by the inner side walls of the casing for reciprocatory movement with respect to the bores, pistons in said bores, means for detachably connecting the pistons to the slides in such a way as to be readily detached by merely moving the slide outwardly from the casing, and means operated by the shaft for reciprocating the slide, the axial dimensions of the parts accommodated in the casing being such that the cover when in place thereon serves to hold these parts against undesired relative axial movement.

6. In a compressor mechanism, the combination of a casing, a detachable cover for the casing, a shaft extending substantially across the casing, said casing having an end wall opposite the cover, as well as one or more cylinder bores, a slide in the casing and guided by the inner side walls of the casing for reciprocatory movement with respect to the bores, pistons in said bores, means for detachably connecting the pistons to the slides in such a way as to be readily detached by merely moving the slide outwardly from the casing, said slide being in the form of a rectangular frame, a block slidable sidewise of the frame, and an eccentric fastened to the shaft and accommodated in the block for causing the slide to reciprocate.

7. In a compressor mechanism, the combination of a casing, a detachable cover for the casing, a shaft extending substantially across the casing, said casing having an end wall opposite the cover, as well as one or more cylinder bores, a slide in the casing and guided by the inner side walls of the casing for reciprocatory movement with respect to the bores, pistons in said bores, means for detachably connecting the pistons to the slides in such a way as to be readily detached by merely moving the slide outwardly from the casing, said slide being in the form of a rectangular frame, a block slidable sidewise of the frame, and an eccentric fastened to the shaft and accommodated in the block for causing the slide to reciprocate, the axial distance between the cover and the end wall of the casing being such that the parts accommodated in the casing are held by the cover against undesired relative axial movement.

In testimony whereof I have hereunto set my hand.

WILFRED FOURNESS.