

Jan. 11, 1927.

J. O. CARREY

1,614,100

COMPRESSOR

Filed Feb. 10, 1923

6 Sheets-Sheet 1

Fig. 1

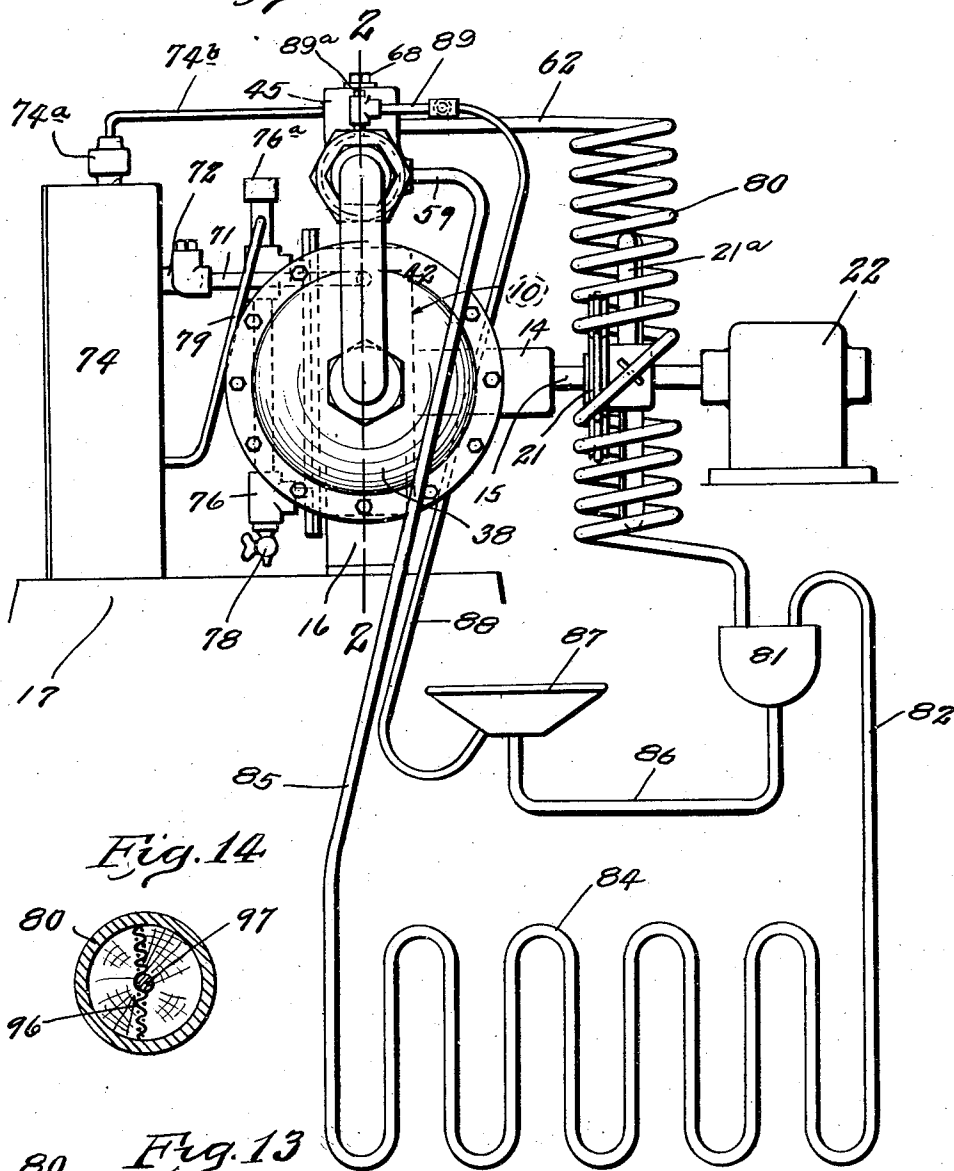


Fig. 14

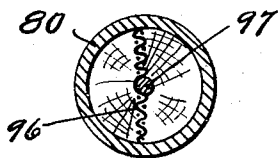
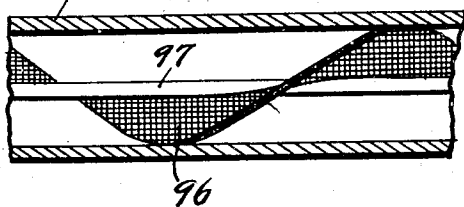


Fig. 13



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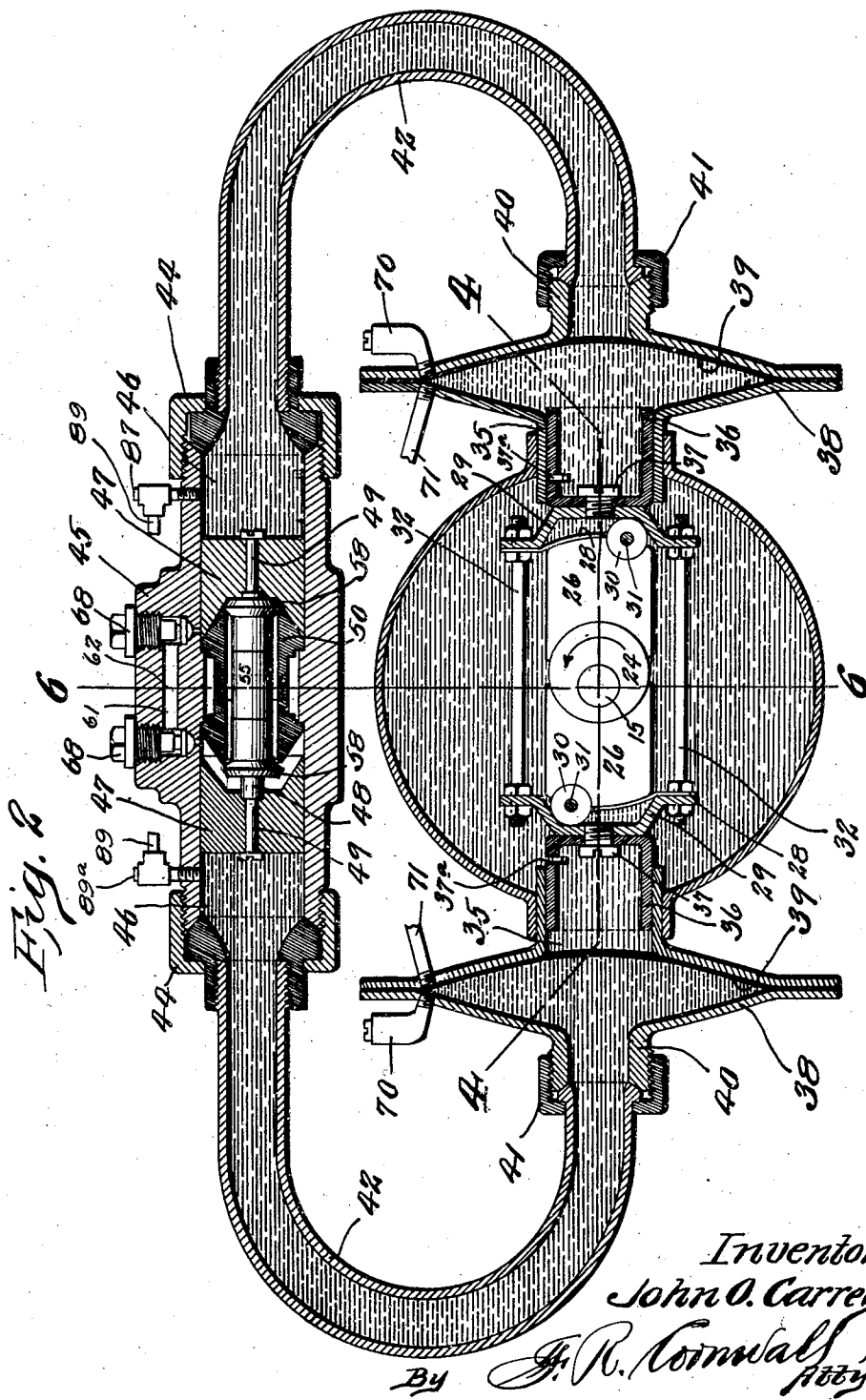
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COMPRESSOR

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6 Sheets-Sheet 2



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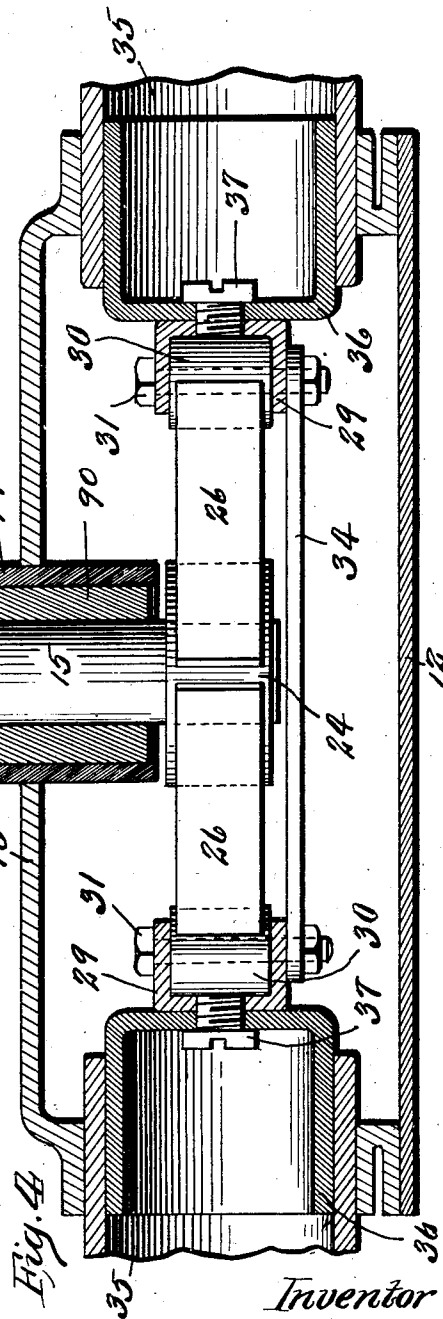
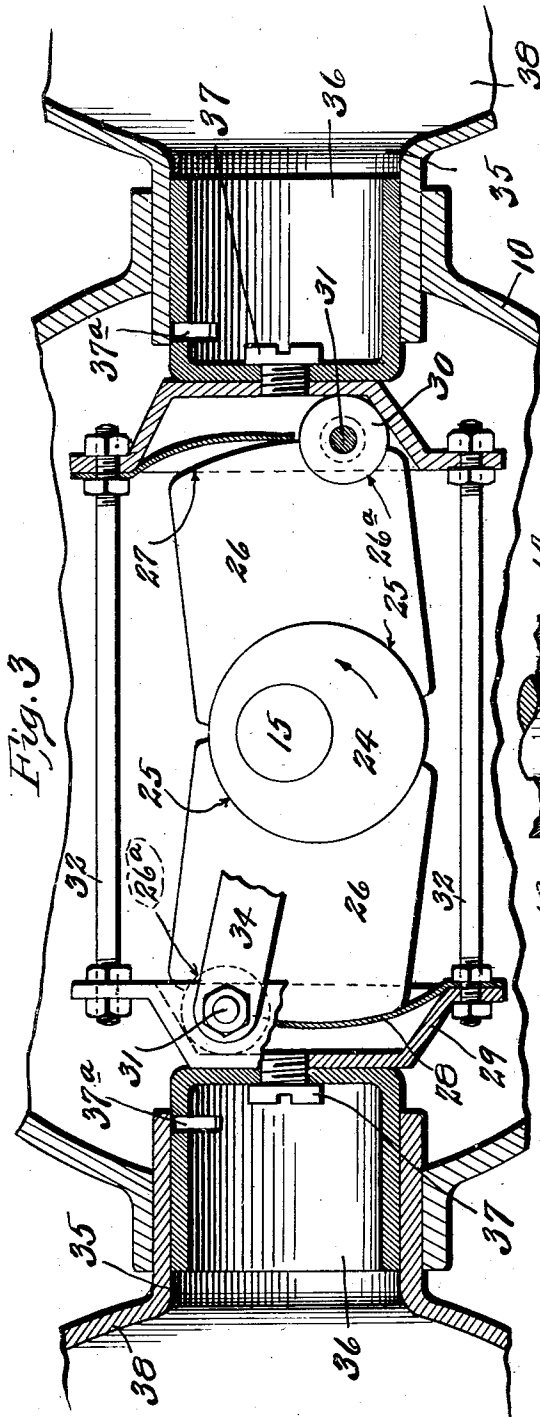
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COMPRESSOR

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6 Sheets-Sheet 3



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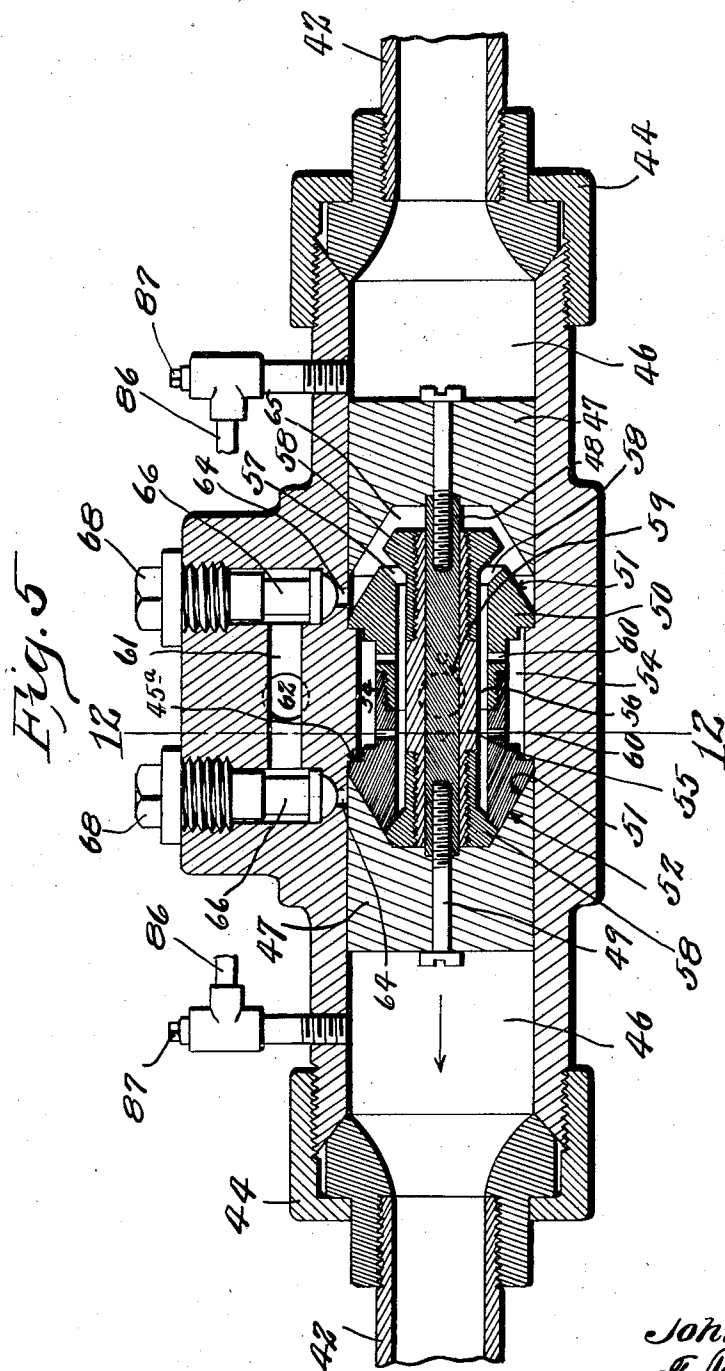
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6 Sheets-Sheet 4



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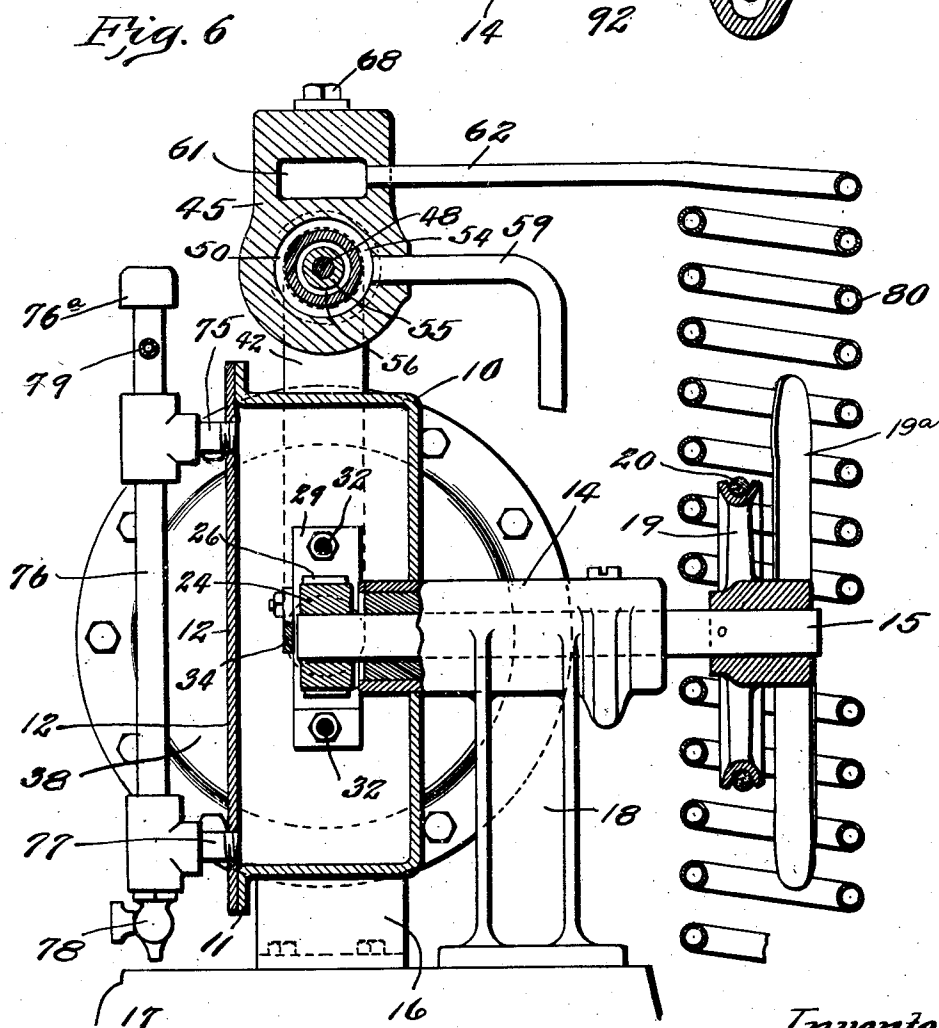
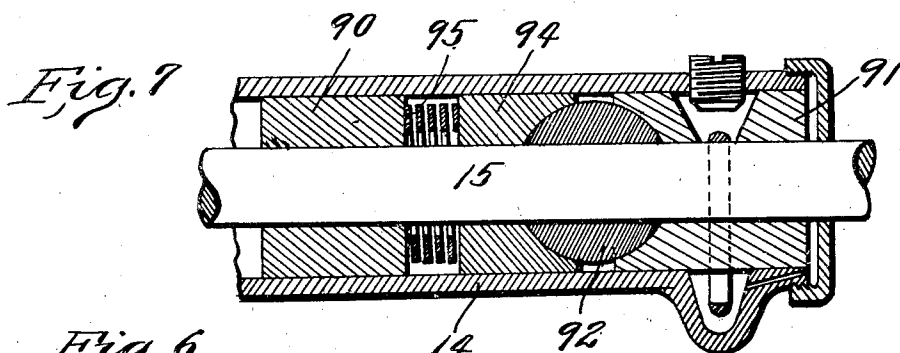
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COMPRESSOR

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6 Sheets-Sheet 5



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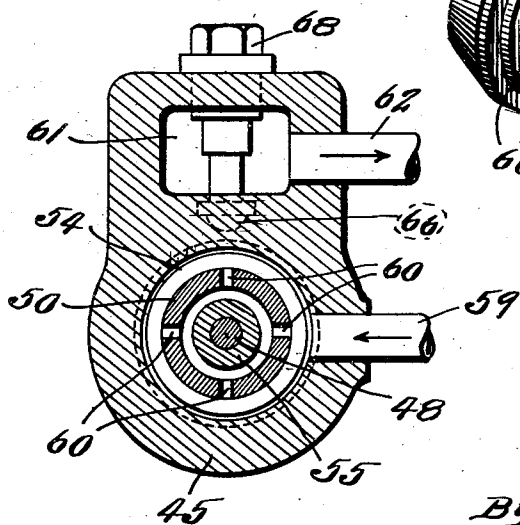
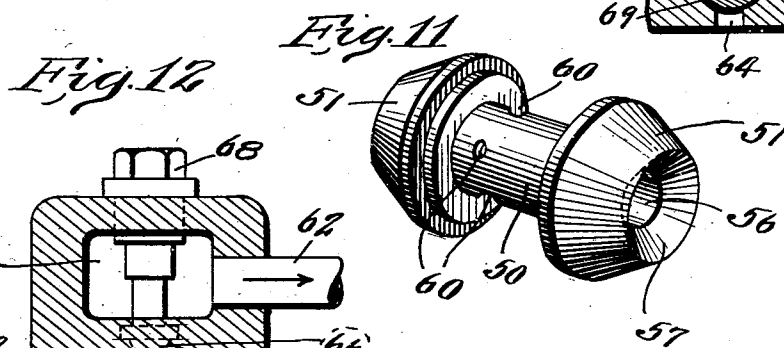
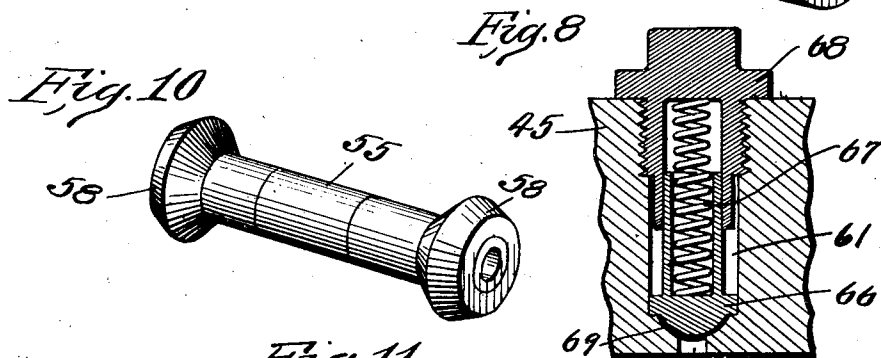
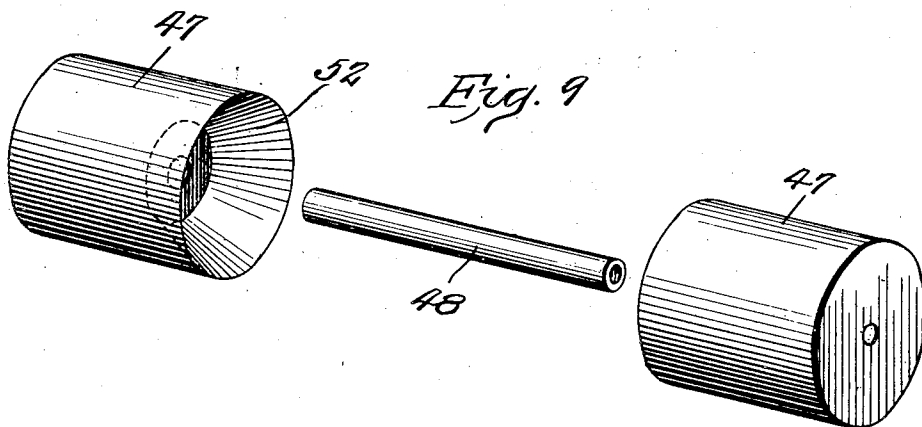
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COMPRESSOR

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6 Sheets-Sheet 6



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UNITED STATES PATENT OFFICE.

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COMPRESSOR.

Application filed February 10, 1923. Serial No. 618,321.

This invention relates generally to compressors and more particularly to compressors for refrigerating systems.

The objects of my invention are to provide a compressor which is compact in size and of strong and rigid construction, is inexpensive to manufacture and operate, and is practically noiseless in operation.

Further objects of my invention are to provide a compressor in which the solution used as a refrigerant is effectively sealed and the possibility of the refrigerant leaking or escaping from the compressor is reduced to minimum.

Still further objects of my invention are to provide a set of primary pistons which are operated directly by the driving mechanism and to provide a set of secondary or auxiliary pistons which are utilized to compress the refrigerant and are operated by the first set of pistons through the medium of a suitable fluid placed under pressure by said primary pistons.

Further objects of the invention are to place in the fluid pressure chambers connecting the primary and secondary pistons suitable sealing means whereby the communication between the respective chambers in which said pistons operate is sealed and the passage of the refrigerant from the compression chamber to the primary pistons and the driving mechanism is thereby prevented.

Still further objects of the invention are to provide simple and efficient valve means for controlling the inlet and outlet ports of the compression chamber and to generally improve upon and simplify the construction of the compressors of the class described and to provide simple and efficient means for positively sealing the circulating system of the refrigerant.

With these and other objects in view, my invention consists in certain novel features of construction and arrangement of parts hereinafter more fully described and claimed, and illustrated in the accompanying drawings, in which—

Figure 1 is an end elevation of the compressor connected to a refrigerating system.

Figure 2 is a vertical cross section through the compressor.

Figure 3 is a detail sectional view of the primary pistons and the driving connections therefor.

Figure 4 is a horizontal cross section taken on line 4—4 of Figure 2.

Figure 5 is a vertical cross section through the compression chamber showing the compression pistons and the valves operating therein.

Figure 6 is a vertical cross section taken on line 6—6 of Figure 2.

Figure 7 is a detail view showing the improved sealed bearings of the driving shaft of the compressor.

Figure 8 is a detail cross sectional view of one of the pressure operated valves.

Figure 9 shows perspective views of the compression pistons and their connecting rods.

Figure 10 is a perspective view of the sliding valve.

Figure 11 is a perspective detail view of the stationary member designed to cooperate with the sliding valve.

Figure 12 is a vertical cross section taken on line 12—12 of Figure 5.

Figure 13 is an enlarged longitudinal section of a portion of the condensing coil.

Figure 14 is a vertical cross section through the same.

Referring by numerals to the accompanying drawings, 10 indicates a circular casing provided at its outer end with an outwardly presented annular flange 11 to which is adapted to be secured a closure plate 12. The opposite end of casing 10 has secured to it a tubular housing 14 in which is journaled in suitable bearings shaft 15. Casing 10 is supported in suitable brackets 16 which are fixed to the peripheral wall of said casing and are adapted to be secured to a suitable support 17. The tubular housing 14 is preferably supported by a standard 18 which may be formed integral with said housing or secured thereto in any suitable manner.

The outer end of shaft 15 has fixed thereto a grooved pulley 19 over which passes belt 20 driven by a smaller pulley 21 fixed to the shaft of an electric motor 22. The opposite end of said shaft projects within casing 10 and has fixed thereto an eccentric 24 which is in operative engagement with the inner concaved ends 25 of blocks 26. The outer ends of blocks 26 are convexed as indicated at 27 and are designed to bear against spring members 28 which are secured at their outer ends to box-shaped sup-

ports 29. A roller 30 is arranged in each support 29 and is held in position therein by a bolt 31 and each block 26 is provided with a semi-circular recess 26^a which forms a seat for bearing 30 so that each block 26 when actuated by eccentric 24 rocks about the axis of roller 30. Supports 29 are tied together by rods 32 and bolts 31 of bearings 30 have secured to their outer ends the ends of a bar 34. Rollers 30 and seats 26^a are located on the opposite sides of center lines of blocks 26 so as to receive the thrust of eccentric 24 and bar 34 serves to distribute this thrust to both supports 29.

Casing 10 is provided with diametrically opposed cylindrical pressure chambers 35 which are in horizontal alignment with blocks 26. Operating in these chambers are pressure pistons 36 which are secured at their inner ends by suitable fastening devices 37 to supports 29. Each of these pistons which are preferably formed cup-shaped is provided in its peripheral wall and near its inner end with a segmental slot 37^a which, when its respective piston occupies its innermost position, is adapted to establish communication between the interior of casing 10 and pressure chamber 35 so that oil may flow through said slot from the casing to the pressure chamber. The outer end of each cylinder forming the pressure chamber 35 is connected to a diaphragm housing 38 which is arranged concentrically with said pressure chamber and is provided with a diaphragm or flexible partition wall 39. The opposite end of diaphragm housing 38 is provided with a cylindrical extension 40 to which is secured by a union 41 the lower end of a pipe connection 42. These pipe connections curve upwardly and their upper ends are connected by means of unions 44 to the corresponding ends of a compression housing 45. This housing is provided with compression chambers 46 in which operate compression pistons 47 which are held in spaced relation by a connecting rod 48, the ends of which are secured to the inner ends of pistons 47 by screws 49.

The diaphragm housings 38 are preferably made in two halves and when the diaphragm 39 is placed in position, the marginal edge thereof is securely clamped between the flanged portions of said housing, thereby sealing the communication between the pressure chambers 35 and compression chambers 46. When shaft 15 is operated, eccentric 24 revolves in the direction indicated by the arrow in Figures 2 and 3 and imparts, through the cooperation of blocks 26, reciprocating motion to pistons 36. Casing 10 and pressure chambers 35, housing 38 and compression chambers 46 and pipe connections 42 are completely filled with suitable liquid such as oil so that when piston 36 moves outwardly the liquid contained in pressure chamber 35 and the corresponding half of diaphragm housing 38 is placed under pressure, which pressure is imparted to the liquid contained in the outer half of the diaphragm housing and in the pipe connection 42 and the corresponding compression chamber 46, causing the compression piston 47 in said chamber to move under this pressure inwardly. Pressure pistons 36 being interengaged by means of supports 29 and tie rods 32, the opposite piston 36 moves inwardly into the casing 10, thereby permitting diaphragm 39 located in the corresponding housing 38 to move under the pressure created by the displacement of liquid in the opposite compression chamber by the corresponding compression piston 47 toward the pressure chamber 35.

During the downward movement of eccentric 23 the operation is reversed causing the parts to again move into the positions shown in Figure 2. Thus the pressure is imparted through the liquid contained in the pressure chambers 35 by connections 42 alternately to the opposite compression pistons 47 which are caused thereby to reciprocate in the compression chambers and compress the fluid contained in the chamber between the inner ends of said pistons 47.

The diaphragms or flexible members 39 are designed to separate the liquids in the pipe connections 42 and pressure chambers 35 but are sufficiently flexible to allow their displacement from one side to the other so that the pressure created by pressure pistons 36 can be successfully transmitted to the liquid contained in pipe connections 42 and compression chambers 46.

A stationary valve seat member 50 is arranged in housing 45 equidistant from compression chambers 46 and the walls of the outer ends of this member are tapered at 51 to fit the inwardly tapered walls 52 of the inner ends of compression pistons 47. Member 50 for convenience is made in two sections which, when screwed together, engage the annular shoulders 45^a formed in the inlet chamber 54 of housing 45.

A sleeve 55 is slidably arranged on connecting rod 48 and the diameter of this sleeve is less than the diameter of the bore in member 50, thereby forming an annular space 56. The ends of this bore terminate in outwardly flared openings or bores 57 and adapted to be seated in these flared-out bores and closing bore 56 are valves 58 which are secured to the ends of sleeve 55. The outer faces of these valves are formed so that they fit snugly within the recessed inner ends of compression pistons 47 when the latter occupy their innermost positions, as shown in Figure 5. Terminating in the inlet chamber 54 is the inlet pipe 59 and member 50 is provided with openings 60 which form communication between the chamber 54 and bore

56. An outlet chamber 61 is arranged in housing 45 above inlet chamber 54 and has connected thereto one end of outlet pipe 62. Ports 64 establish communication between the outlet chamber 61 and valve chamber 65, which latter is formed when the compression pistons 47 occupy their extended positions. Ports 64 are normally closed by pressure operated valves 66. Valve 66 is held to its seat in port 64 by a spring 67, the lower end of which rests in a recess formed in said valve while its upper end is seated in a recess formed in a plug 68 which is securely seated in position in housing 45. Valve 63 is preferably provided with a renewable plate 69 which fits in the valve seat and may be renewed when worn out.

In the operation of the machine, assuming the valves to be in the position shown in Figure 5, the fluid to be compressed is admitted to the intake chamber 54 by pipe 59 and passes through openings 60 in member 50 into the annular space 56. The compression piston 47 in the righthand end of the compression chamber 46 is moved to its extreme outward position and the inner end of said piston is spaced away from the corresponding end of member 50, thereby forming valve chamber 65 into which the fluid passes from chamber 56 through the open bore 57. Valve sleeve 55 is of greater length than member 50 so that when one of the valves 58 is engaged by the corresponding piston 47 and moved to its seat 57, the valve carried by the opposite end of said valve sleeve 55 is moved an appropriate distance from its corresponding seat 57 to permit the fluid to pass therethrough.

When compression pistons 47 are moved in an opposite direction, i. e., in the direction indicated by arrow in Figure 5, valve sleeve 55 is caused to move through its frictional engagement with rod 48 simultaneously with pistons 47 until the righthand valve 58 seats itself in bore 57, thereby closing the communication between the intake chamber 54 and the righthand valve chamber 65 and opening communication between the lefthand chamber 65 and said intake chamber. The continued movement of pistons 47 places the fluid contained in the righthand valve chamber under pressure and when this pressure reaches a predetermined point it overcomes the spring of the corresponding valve 66, thereby unseating said valve and permitting the fluid to escape under pressure to the outlet chamber 61 and outlet pipe 62. The close fitting engagement of the inclined walls 51 of member 50 and of valve 58 and the inner end of compression piston 47 causes a thorough expulsion of fluid from the valve chamber into the outlet chamber. Valves 66 are one-way valves and prevent the back flow of fluid and spring 67 is sufficiently strong to hold the valve to its seat and prevent the leakage of fluid through ports 64 into the valve chambers so that during each outward stroke of piston 47, fluid is sucked from the intake chamber 54 through ports 60 and the corresponding bore 57 into the valve chamber.

The compression side of each diaphragm housing is provided at its highest point with a filler 70 which is closed by a suitable screw plug and through which the liquid may be introduced into the compression side of the housing and pipe connections 42 and these fillers are located at the highest point in order to allow the air to escape from said housing, thereby preventing the formation of air pockets. The pressure side of each housing has connected thereto at its highest point one end of a by-pass pipe 71. Arranged in this pipe is a valve 72 which controls the communication between the pressure sides of the housings so that the pressure therein may be equalized by opening said valve. This valve is automatically controlled by mechanism contained in box 74 shown in Figure 1, and this mechanism is operated by a pressure valve 74^a which is connected by a pipe connection 74^b to the outlet or pressure chamber 61 of housing 45 or in any other suitable manner. The level of oil contained in casing 10 is maintained above the highest point of housing 38, and casing 10 being connected with the pressure side of housings 38 by ports 37^a the pressure sides of said housings will at all times be completely filled with oil. The closure plate 12 is apertured near the highest point of the casing and said casing is connected by pipes 75 with a vertically disposed pipe or riser 76, the upper end of which extends above said casing and receives a cap 76^a. The lower end of pipe 76 is connected by a short pipe 77 to closure plate 12 near the lowermost portion of casing 10 and a valve 78 is arranged in pipe 76 below pipe 77 by means of which the oil may be drained from casing 10 and pressure sides of housings 38. Box 74 is preferably filled with oil and a pipe 79 connects said box to the upper portion of pipe 76 and conducts the surplus oil from said box to casing 10 through pipe 76. Where the compressor is used in refrigerating systems, outlet pipe 62 is connected to a condensing coil 80 where the refrigerant is cooled and the lower end of this condensing coil is connected to a sump 81. Leading from this sump is a pipe 82 which conveys the refrigerant to expansion coil 84 from which it is then returned by pipe 85 and pipe 59 to the intake chamber of valve housing 45. Sump 81 is connected by a pipe 86 to a pressure reducer 87 in which the oil is separated from the refrigerant and returned through pipe 88 and pipes 89 to the compression chambers 46. Pipes 89 are provided with suitable openings through

which the oil may be introduced into the compression chambers and these openings, when the latter are in operation, are closed by plugs 89^a. Condensing coil 80 is preferably located between the electric motor 22 and the compressor and surrounds pulleys 19 and 21, the coils of the condenser being spread for the accommodation of shaft 15 and the motor shaft. Pulley 19 is provided with fan blades 19^a and pulley 21 is provided with fan blades 21^a which as the machine is operated cause air to circulate through said condensing coils.

In Figure 7 is shown an improved bearing for the condenser shaft 15. 90 is a bearing which is fixed in tubular member 14. A bearing 91 is arranged in the outer end of member 14 and the inner end of this bearing is concaved to receive ball bearing 92. A bearing 94 having the concaved end engaging ball bearing 92 is spaced from bearing 90 and an expansion spring 95 is interposed between the two bearings and serves to hold bearing 94 in close engagement with bearing 92 and form an effective seal so as to prevent the oil from escaping along shaft 15.

Figures 13 and 14 show details of construction of the condensing coil, wherein means are provided for more readily dissipating the heat. This means consists of a metallic screen 96 spirally introduced into the coil, thus increasing the surface of the coil. A wire member 97 is preferably secured to the screen throughout its length and reinforces the same.

A compressor of my improved construction is noiseless in operation, is automatic in its action, and can be easily installed. The diaphragm member being entirely submerged in liquid is not subjected to pressure but merely separates the liquids of the pressure chambers from the compression chambers so that should any refrigerant escape into the compression housing connections past the compression pistons, the diaphragm members will prevent the refrigerant from entering the casing.

The eccentric and the blocks form an efficient means for driving the pressure pistons and by virtue of the construction thereof the wearing of the operating parts is reduced to minimum.

While I have shown and described the preferred forms of my improved compressor, it is obvious that various changes in the size, shape or form in the construction and arrangement of various parts may be made and substituted for those herein disclosed without departing from the spirit of my invention.

I claim:

1. A compressor comprising in combination a housing having a compression chamber provided with inlet and outlet connections, a pair of oppositely disposed inter-

engaged compression pistons operating in said chamber, a casing provided with pressure chambers connected with the respective ends of said compression chamber, a pressure piston operating in each pressure chamber, a diaphragm member in each pressure chamber for sealing the communication between said compression chamber and corresponding pressure chamber and permitting transmission of fluid pressure therebetween to actuate said compression pistons, a sleeve fixedly arranged between said compression pistons and having its ends adapted to be engaged by the inner ends of said pistons, said sleeve being provided with ports for establishing communication between said inlet and outlet connections of said compression chamber, and a member extending through said sleeve and movable relative thereto and having its ends adapted to enter into cooperating relation with the ends of said sleeve and the inner ends of said compression pistons for controlling the passage of fluid through said sleeve.

2. A compressor comprising in combination a housing having a compression chamber provided with inlet and outlet connections, a pair of oppositely disposed inter-engaged compression pistons operating in said chamber, a casing provided with pressure chambers connected with the respective ends of said compression chamber, a pressure piston operating in each pressure chamber, a diaphragm member in each pressure chamber for sealing the communication between said compression chamber and corresponding pressure chamber and permitting transmission of fluid pressure therebetween to actuate said compression pistons, a sleeve fixedly arranged between said compression pistons and having its ends adapted to be engaged by the inner ends of said pistons, said sleeve being provided with ports for establishing communication between said inlet and outlet connections of said compression chamber, a rod extending through said sleeve and fixed to said compression pistons, and a tubular member mounted on said rod and spaced from said sleeve, said tubular member being provided with enlarged ends adapted to close the respective ends of said sleeve during the compression stroke of the corresponding compression piston, the ends of said sleeve of said tubular member being shaped to fit snugly within the inner end of the respective compression piston whereby the fluid admitted between the ends of said sleeve and said tubular member and the inner end of the corresponding compression piston is discharged by the movement of the latter under pressure through the outlet connections.

3. A compressor comprising in combination a housing having a compression chamber provided with inlet and outlet connections,

tions, a pair of oppositely disposed inter-engaged compression pistons operating in said chamber, a casing provided with pressure chambers connected with the respective
 5 ends of said compression chamber, a pressure piston operating in each pressure chamber, a diaphragm member in each pressure chamber for sealing the communication between said compression chamber and cor-
 10 responding pressure chamber and permitting transmission of fluid pressure therebetween to actuate said compression pistons, a sleeve fixedly arranged between said compression pistons and having its ends adapted
 15 to be engaged by the inner ends of said pistons, said sleeve being provided with ports for establishing communication between said inlet and outlet connections of said compression member, a rod extending
 20 through said sleeve and fixed to said compression pistons, a tubular member mounted on said rod and spaced from said sleeve, said tubular member being provided with enlarged ends adapted to close the respec-
 25 tive ends of said sleeve during the compression stroke of the corresponding compression piston, the ends of said sleeve of said tubular member being shaped to fit snugly within the inner end of the respective com-
 30 pression piston whereby the fluid admitted between the ends of said sleeve and said tubular member and the inner end of the corresponding compression piston is discharged by the movement of the latter under pres-
 35 sure through the outlet connections, and check valves for closing said outlet connections during the intake stroke of the compression pistons.

4. In a compressor, compressing means
 40 comprising a compression chamber, a pair of spaced oppositely disposed pistons arranged therein, a rod extending between and secured to said pistons, a tubular member loosely mounted on said rod and mov-
 45 able longitudinally relative to said pistons, the inner ends of the latter being provided with seats for receiving the enlarged ends of said tubular member, and a sleeve fixed in said chamber between said compression
 50 pistons, the bore of said sleeve being greater than the diameter of said tubular member to form an annular chamber for admitting fluid through said chamber into the space formed by the inner ends of said pistons
 55 and the corresponding ends of said tubular member and said sleeve, said sleeve being provided with seats adapted to receive the enlarged ends of said tubular member, thereby closing the communication through said
 60 tubular chamber, the ends of said sleeve being formed to fit snugly within the inner ends of the respective pistons so as to expel fluid under pressure therefrom.

5. In a compressor, compressing means
 65 comprising a chamber having inlet and out-

let connections, a pair of spaced oppositely disposed pistons operating therein, a rod extending between and secured to said pistons, a tubular member slidable on said rod and movable relative to said pistons, said tubular
 70 member being provided with enlarged ends adapted to be seated in the inner ends of said pistons, a sleeve fixed in said chamber between said pistons and having its ends adapted to cooperate with the ends of said
 75 tubular member and the inner ends of said pistons, said sleeve being provided with an annular chamber communicating with said inlet connection and opening toward the ends of said pistons, said tubu-
 80 lar member being spaced from said pistons and having lost motion connection therewith so as to close the respective end of said sleeve during the initial movement of the corresponding piston whereby the fluid
 85 admitted therebetween is trapped and forced under pressure therefrom through said outlet connection.

6. A compressor comprising a housing having inlet and outlet connections and provided with a compression chamber, a pair
 90 of oppositely disposed interengaged compression pistons operating therein, a casing provided with pressure chambers, a pair of pressure pistons operating therein, flexible
 95 means arranged in each pressure chamber for sealing the communication between the corresponding chambers and adapted to permit the transmission of fluid pressure therebetween, a double-headed valve slidably ar-
 100 ranged between said pistons and engageable by the inner ends thereof for closing the inlet port of said compression chamber, and pressure operated valves for controlling the
 105 outlet connection of said housing.

7. A compressor comprising a housing having inlet and outlet connections and provided with compression chambers, a pair of
 110 compression pistons operating therein, a casing provided with pressure chambers, a pair of pressure pistons operating therein, flexible means arranged in each pressure chamber for sealing the communication between the corresponding chambers and adapted to permit the transmission of fluid
 115 pressure therebetween, pressure operated valves for controlling the outlet connection of said housing, and valve mechanism arranged in said housing interposed between said compression pistons and cooperating
 120 therewith for controlling the inlet connection, said valve mechanism being operable by and in time relation with said compression pistons.

8. A compressor comprising a housing provided with compression chambers, a pair
 125 of compression pistons operating therein, a casing provided with pressure chambers, pressure pistons operating therein, means for connecting the pressure chambers with the
 130

corresponding compression chambers, flexible means arranged in each connection for sealing the passage of fluid between the respective chambers and permitting the transmission of fluid pressure therebetween, and by-pass connections between said pressure chambers.

9. A compressor comprising a housing provided with compression chambers, a pair of compression pistons operating therein, a casing provided with pressure chambers, pressure pistons therefor, pipes connecting the pressure chambers with the corresponding compression chambers, flexible means arranged in each pipe for sealing the passage of fluid between the respective chambers and adapted to permit the transmission of fluid pressure therebetween, by-pass connections between the pressure chambers, and means controlling said by-pass connection and operable by the pressure created by said compression pistons.

10. A compressor comprising a casing provided with pressure chambers, pressure pistons operating therein, a support fixed to each piston, a roller arranged on each support to one side of the axis of said piston, a pair of oppositely disposed blocks having bearings on said rollers and provided with concave inner ends, and a driven eccentric arranged in said casing and having its periphery operatively engaging the inner ends of said blocks.

11. A compressor comprising a casing provided with pressure chambers, pressure pistons operating in said chambers, blocks operatively mounted on the inner ends of said pistons, an eccentric revolvably arranged in said casing and in operative engagement with the inner ends of said blocks, and means in said pistons for establishing communication between said casing and the respective pressure chambers when said pistons occupy predetermined positions.

12. A compressor comprising a casing provided with pressure chambers, pressure pistons operating in said chambers, blocks rockingly mounted on the inner ends of said pistons, and an eccentric revolvably arranged in said casing and operatively engaging the inner ends of said blocks, said piston being provided with passageways whereby when the piston occupies a certain position a communication is established between said casing and the corresponding pressure chamber.

13. A compressor comprising a casing with oppositely disposed pressure chambers, pistons operating therein, supports secured to the inner ends of said pistons, a pair of oppositely disposed blocks, the outer ends of which have operative bearings in said supports, the bearing of each block being offset to one side thereof, an eccentric revolvably mounted in said casing and in operative engagement with the inner ends of said blocks,

and flexible members secured to said supports and yieldingly engaging the outer ends of said blocks.

14. A compressor comprising a casing with oppositely disposed communicating pressure chambers, a diaphragm housing formed in the outer end of each pressure chamber, a diaphragm operatively arranged in each housing and dividing the latter into two compartments, one of which communicates with the corresponding pressure chamber, compressing means, and pipe connections between the other diaphragm compartment and the respective end of said compressing means whereby when the fluid in the pressure chamber is placed under pressure the pressure is transmitted through said diaphragm and the fluid contained in said pipe connection to said compressing means for actuating the latter.

15. A compressor comprising a casing provided with oppositely disposed pressure chambers, a sectional diaphragm housing connected to the outer end of each chamber, a compression chamber, compressing means arranged therein, said compressing means including a pair of spaced pistons, a fixed sleeve provided at its ends with oppositely disposed seats, and a tubular member operatively mounted in said sleeve and cooperating with the inner ends of said pistons to trap the fluid therebetween and discharge it under pressure therefrom, pipe connections leading from each diaphragm housing to the corresponding end of the compression chamber, and a diaphragm secured in position between the sections of said housing for sealing the communication between the compression chamber and the respective ends of said pressure chamber and permitting the transmission of fluid pressure between said pressure chambers and said compression chamber.

16. A compressor comprising a casing provided with oppositely disposed pressure chambers, a sectional diaphragm housing connected to the outer end of each chamber, a compression chamber, compressing means arranged therein, pipe connections leading from each diaphragm housing to the corresponding end of the compression chamber, and a diaphragm secured in position between the sections of said housing for sealing the communication between the compression chamber and the respective pressure chambers and permitting the transmission of fluid pressure between said pressure chambers and said compression chamber, and means for equalizing the pressure between said pressure chambers.

17. A compressor comprising a casing provided with oppositely disposed pressure chambers, a sectional diaphragm housing connected to the outer end of each chamber, a compression chamber, compressing means

arranged therein, pipe connections leading from each diaphragm housing to the corresponding end of the compression chamber, a diaphragm secured in position between the sections of said housing for sealing the communication between the compression chamber and the respective pressure chambers and permitting the transmission of fluid pressure between said pressure chambers and said compression chamber, and by-pass connections between said casing and the pressure side of each diaphragm housing for maintaining the latter completely filled with fluid.

18. A compressor comprising a casing provided with oppositely disposed pressure chambers, a sectional diaphragm housing connected to the outer end of each chamber, a compression chamber, compressing means arranged therein, pipe connections leading from each diaphragm housing to the corresponding end of the compression chamber, a diaphragm secured in position between the sections of said housing for sealing the communication between the compression chamber and the respective pressure chambers and permitting the transmission of fluid pressure between said pressure chambers and said compression chamber, and passageways formed in each pressure piston for permitting the passage of fluid from the casing to the pressure sides of the diaphragm housing at appropriate times.

19. A compressor comprising a casing provided with fluid pressure chambers, pressure pistons operating therein, a housing provided with a compression chamber, pipe connections connecting the pressure chambers with respective ends of said compression chamber, compression pistons in said compression chamber and operable by the fluid pressure created by said pressure pistons, means for tying said pistons together, a tubular member having lost motion connection with said pistons and cooperating with the inner ends thereof, and a sleeve valve fixed in said compression chamber cooperating with said compression pistons and said tubular member for controlling the communication between the inlet and outlet ports of the compression chamber.

20. In a compressor, a housing provided with a compression chamber having inlet

and outlet ports, a piston operating in said chamber, and valve means arranged in said housing adapted to be simultaneously engaged with said valve seat and said piston for controlling the communication between said chamber and said ports.

21. In a compressor, a housing provided with a compression chamber having inlet and outlet ports, a piston operating in said chamber, a stationary valve seat member in said chamber, a one-way valve controlling the communication between the compression chamber and the outlet port, a stationary valve seat member in said compression chamber, and a valve having frictional operative engagement with said piston and cooperating with said valve seat member and one end of said piston for controlling the communication between the inlet port and the compression chamber.

22. In a compressor, a housing provided with compression chambers, a pair of oppositely disposed pistons operating in said chamber and connected together, stationary valve seat members arranged in said compression chamber, and a valve operatively mounted between said pistons and adapted to alternately seat itself in the respective valve seats and be engaged by the corresponding piston for compressing and discharging the fluid from said compression chambers.

23. In a compressor, a housing provided with aligned compression chambers, fluid pressure operated pistons arranged in said chambers, stationary members arranged in said housing between said pistons and spaced from each other to form an inlet chamber, each of said stationary members being provided with centrally disposed openings connecting the inlet chamber with a corresponding chamber, a rod connecting said pistons, a sleeve slidably arranged on said rod and having its ends extending through the central opening in said members, and valves carried by the ends of said sleeve and adapted to be seated against said members and close the communication between said inlet chamber and the corresponding compression chambers.

In testimony whereof I hereunto affix my signature this 30th day of January, 1923.

JOHN O. CARREY.