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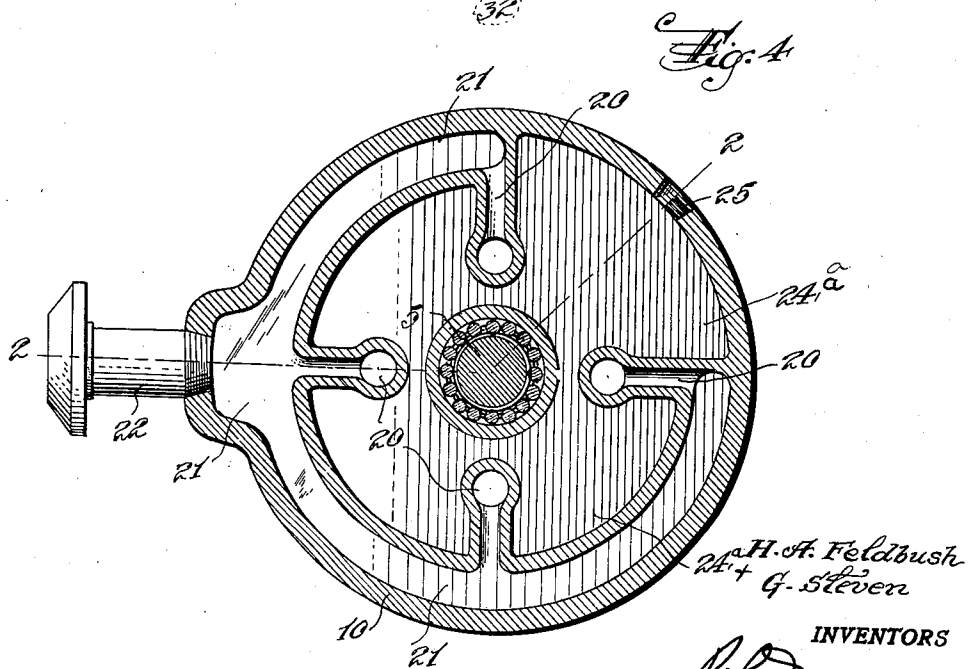
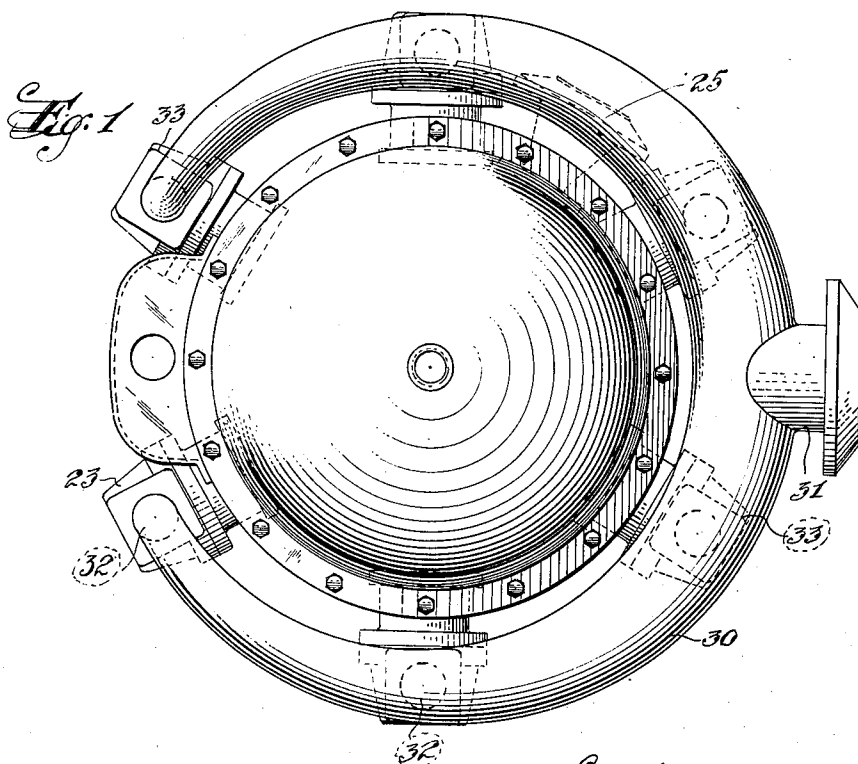
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COMPRESSOR

Filed Feb. 19, 1936

5 Sheets-Sheet 1



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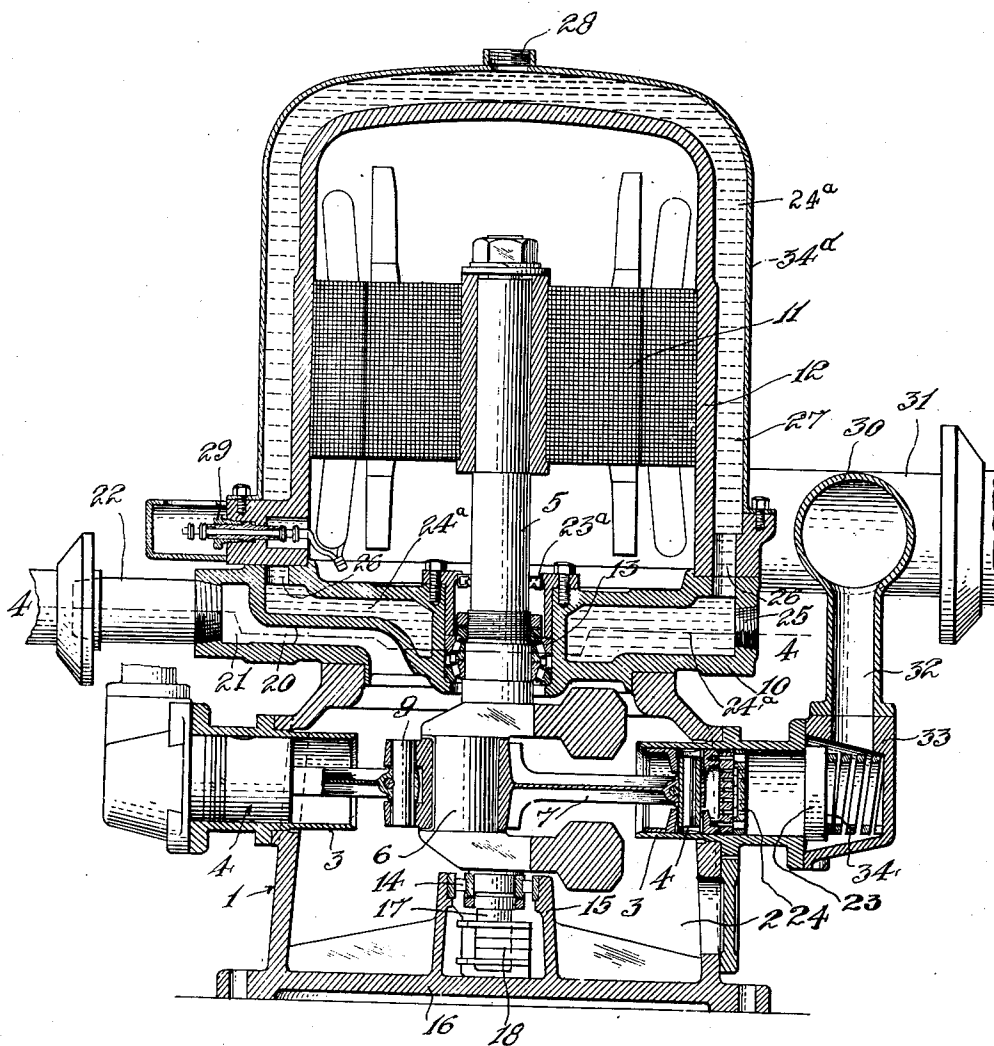
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Fig. 2



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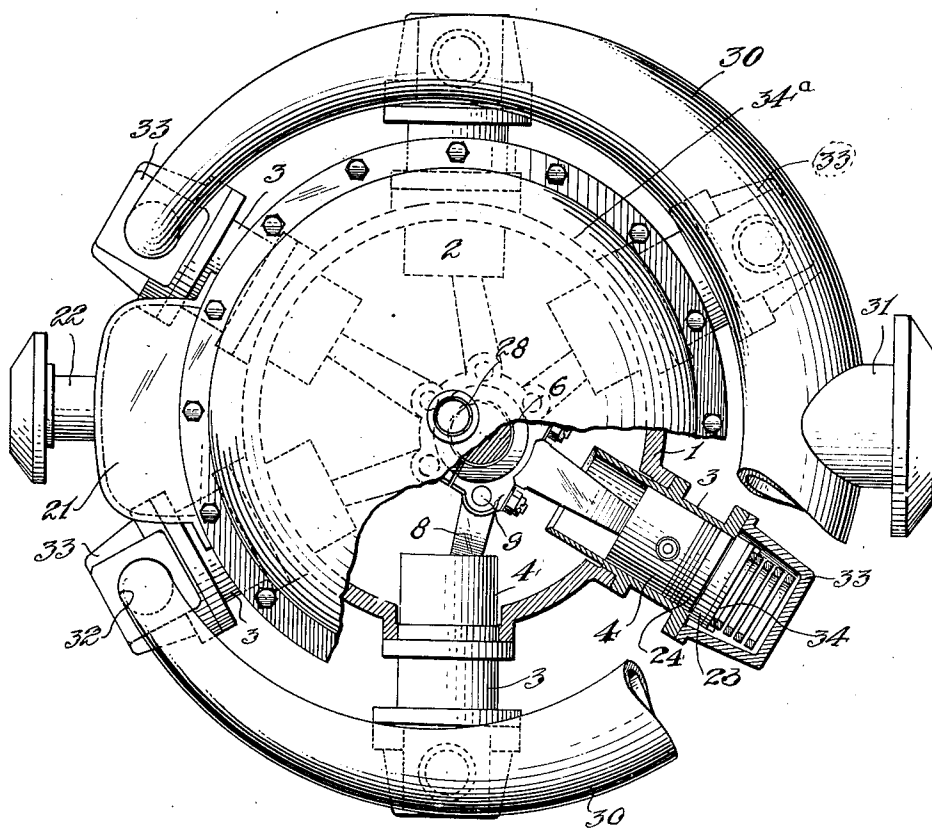
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Fig. 3



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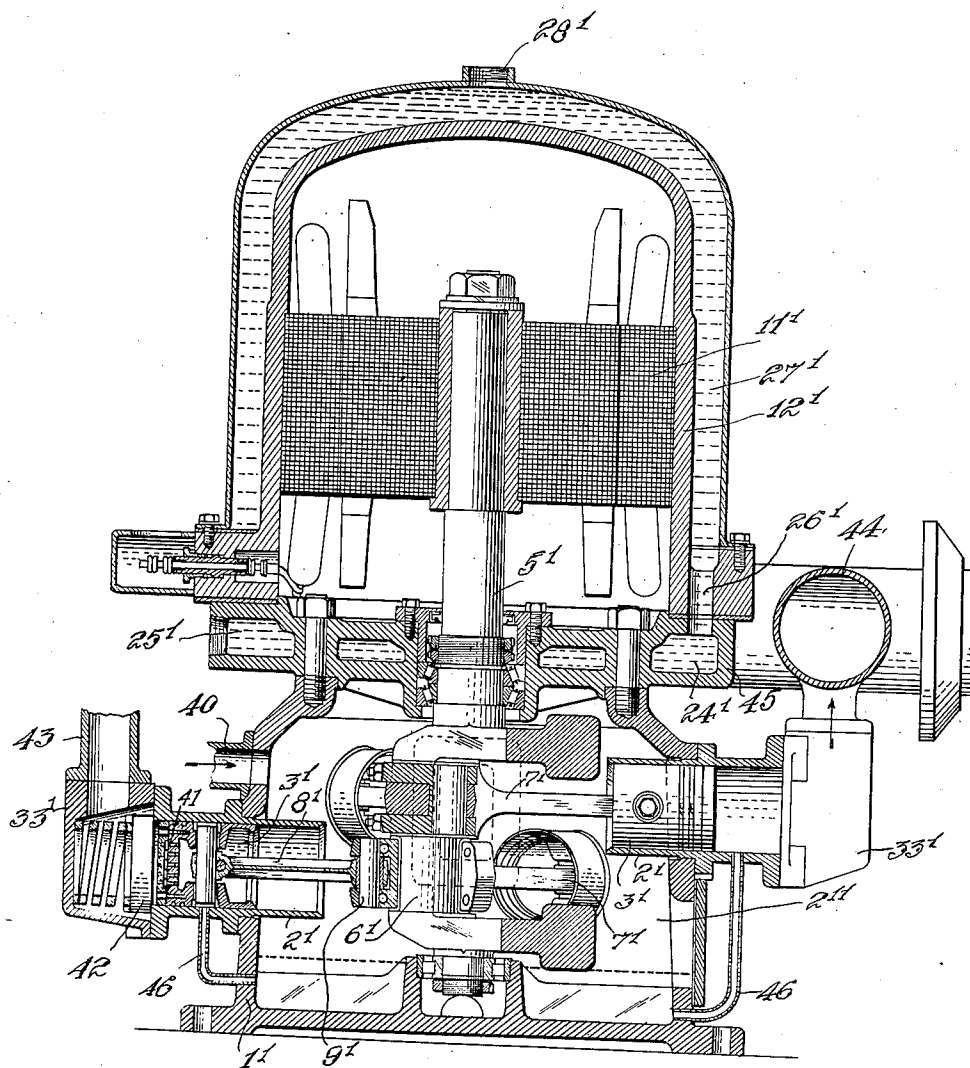
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COMPRESSOR

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Fig. 5



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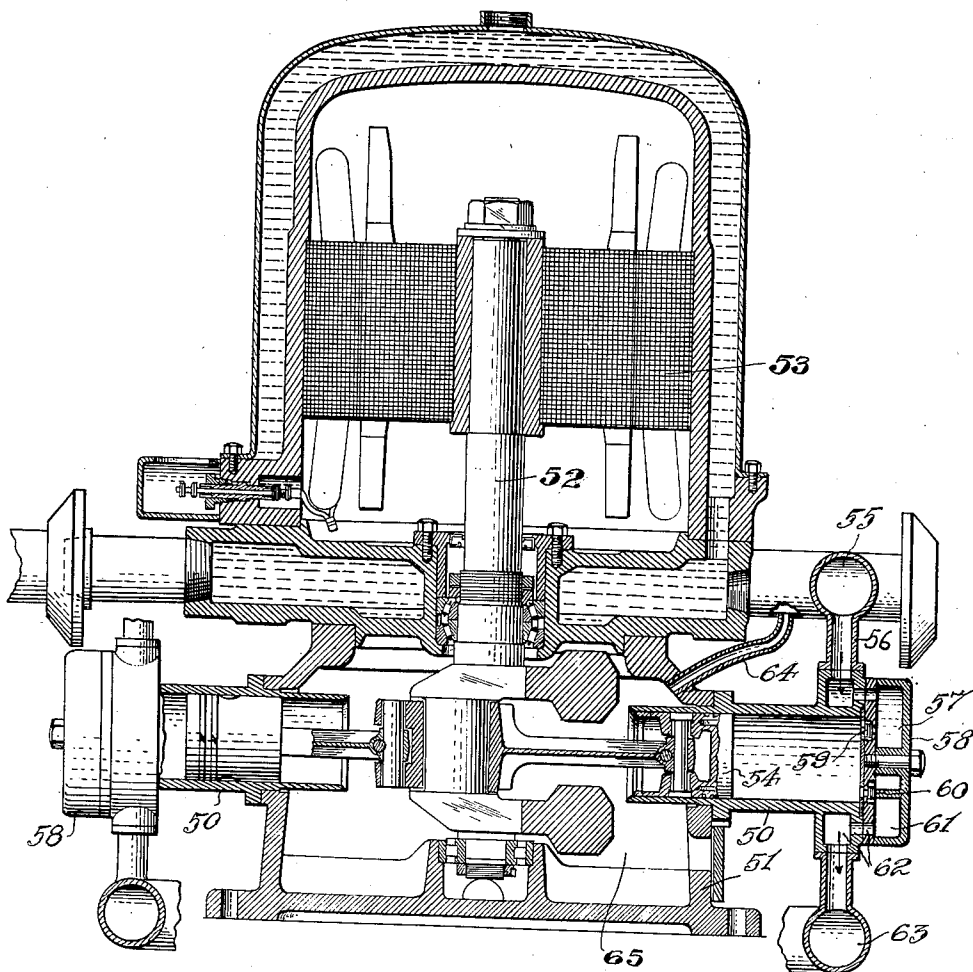
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Fig. 6



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2,138,093

COMPRESSOR

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Application February 19, 1936, Serial No. 64,748

2 Claims. (Cl. 230—58)

This invention relates to compressors and more particularly to electric motor driven compressors having a plurality of radially arranged cylinders and compressors particularly provided for compressing various kinds of gases, such as "Freon" or the like used in refrigeration.

An object of the present invention is to provide a radial type compressor with its shaft in a vertical position, in which the driving motor and compressor are completely enclosed, preferably hermetically sealed, whereby the driving motor is located in a dead gas space, that is entirely self-driven in so far as it relates to the balance of the machine and which eliminates the need of a stuffing box or boxes in the compressor construction with their resultant problems and expenses.

Another object of the invention is to provide a water jacket in the space between the compressor and driving motor and about the driving motor for cooling the gases in the dead gas space about the motor, thereby eliminating the need of circulating cool gas about the driving motor.

A further object of the present invention is to provide a compressor structure as specified which provides maximum valve area with minimum clearance; embodies structure which will admit ready adaption of a suction by-pass control and will result in the least possible amount of pre-heating of the gas before compression, and one in which, due to its construction and manner of operation, permits of thorough and efficient lubrication of the wear parts in a simple inexpensive manner.

With these and other objects in view, as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts, which will be first described in connection with the accompanying drawings, showing a compressor of the preferred form embodying the invention, and the features forming the invention will be specifically pointed out in the claims.

In the drawings:

Figure 1 is a top plan of the improved compressor.

Figure 2 is a vertical section through the improved compressor.

Figure 3 is a view partly in top plan and partly in horizontal section of the improved compressor.

Figure 4 is a horizontal section through the compressor taken on the line 4—4 of Figure 2.

Figure 5 is a vertical section through a modified form of the compressor.

Figure 6 is a fragmentary vertical section

through a still further modified form of the compressor.

Referring more particularly to the drawings, the improved compressor, of the radial type, includes a housing 1 which has a chamber 2 therein tightly sealed at all joints except through the cylinders 3 which are carried thereby and extend radially from the vertical axis of the housing 1.

The cylinders 3 each have pistons 4 therein which reciprocate upon rotation of the driving shaft 5. The driving shaft 5 has a balanced crank 6 thereon to which a master connecting rod 7 is detachably connected as clearly shown in Figure 3 of the drawings. The master connecting rod 7 has the piston rods 8 of the other pistons of the compressor pivotally connected thereto as shown at 9 so that a single connection with the driving shaft is provided for all of the pistons. In the preferred form shown in Figures 1 to 4 inclusive of the drawings, all of the cylinders 3 and pistons 4 are arranged in the same horizontal plane. The driving shaft 5 extends vertically through the housing 1, through the spacer head 10 and has an electric motor rotor 11 of any approved type mounted upon its upper end. As clearly shown in Figure 2 of the drawings the motor 11 is positioned above the compressor proper. The spacer head 10 has sealed connection with the top of the compressor housing 1 and with the housing 12 which encloses the motor 11. These elements, namely the housings 1 and 12 and the spacer head 10 are preferably hermetically sealed so as to prevent the escape of any gas from their interiors to atmosphere and also to prevent the leakage of any atmospheric air into the housings.

The shaft 5 is supported by a suitable bearing 13 of any approved type, which is carried by the spacer head 10. In the drawings a roller bearing is shown for this purpose but it is to be understood that any suitable type of bearing may be provided. The lower end of the shaft is supported by a second bearing 14 of any suitable type which is carried by a suitable supporting projection 15 on the base 16 of the housing 1.

The shaft 5 is shown in Figure 1 as having an extension 17 formed thereon on which is mounted a pump 18 of any approved construction for pumping lubricant to the various wear parts of the compressor.

In the preferred form of the compressor, the intake of gas to be compressed is into the cylinders from their outer ends, with the discharge through the pistons into the chamber 2 and the outlet is from the chamber 2 through a plurality

of radial passages 20 formed in the spacer block 10 into the substantially annular manifold 21 and from this manifold outwardly through a suitable outlet 22.

5 In such arrangement, the gas to be compressed comes into the cylinders 4 through suction valves secured in the carriers 23 in the heads of the cylinders, is compressed and delivered into the crank case or chamber 2 of the compressor through the discharge valves 24 in the piston. Such a construction permits of compressor operation with the least possible amount of preheating of the gas before compression, it permits the obtaining of maximum valve area with minimum clearance in the cylinders, and the crank case or housing 2 acts as a considerable receiver volume for the momentary discharge of each cylinder of the compressor. Also, it provides for a comparatively high pressure of gas in the crank case or chamber 2 which will retain lubricating oil in its proper place within the bottom or lower part of the chamber. With the electric motor housing 12 hermetically sealed, the use of stuffing boxes in the compressor may be eliminated and the gas which leaks past the bearing 13 will accumulate in the housing 12 and form a dead gas space about the electric motor 11. An oil seal 23a is mounted about the shaft 5 so as to prevent lubricating oil from entering the housing 12 with the leaking gas. The spacer head 10 has a water jacket 24a formed therein into which cooling water is admitted through a suitable inlet 25. The cooling water circulates through the water jacket 24a and passes through suitable openings 26 into the water jacket 27 which surrounds the motor housing 12 and out through the outlet 28 at the top of the motor housing.

The cooling water, circulating through the water jackets 24 and 27, cools the discharging compressed gas slightly and also cools the gas in the dead gas space within the housing 12, thereby eliminating the necessity of circulating cool gas or air through the housing 12 about the motor 11 and also eliminating the need or requirement of stuffing boxes about the shaft 5 to prevent the leakage of the gas into the housing 12.

The particular type of lead for the wire connections to the motor as shown at 29 forms no part of the present application.

An intake manifold for the incoming gas, of a novel structure is provided and is specifically shown in Figures 1 and 2 of the drawings. The intake manifold 30 is arcuate, curving about the spacer head 10 and having a single inlet 31 intermediate its ends. As clearly shown in Figure 1 of the drawings, the intake manifold 30 decreases in cross-sectional area as it progresses in both directions from its inlet 31 to its ends, and it is connected by down connections 32 to the cylinder heads 33. In the drawings six cylinders are shown as embodied in the compressor, but it is to be understood that any desired number of cylinders may be provided without departing from the spirit of the invention.

The incoming gas enters the cylinder heads 33 through the down connections 32 and passes about the safety release structures 34 through the intake valves 23 and the respective cylinders 3, where it is compressed. The compressed gas then passes through the discharge valves 24 in the heads of the various pistons 4 and thence through the pistons into the chamber 2 or the interior of the crank shaft, discharging from the interior of the crank shaft or chamber 2 through

the radial ports or passages 20 and outwardly through the final discharge 22.

The particular type of safety release or head 34 shown in the drawings forms no part of the present invention, being commercially on the market.

The water jacket 27 is formed between the housing 12 and the wall or shell 34a.

In Figure 5 of the drawings a modified form of the invention is shown comprising the compressor housing 1' which carries the cylinders 2' in which the pistons 3' reciprocate. The pistons 3' are operated by the driving shaft 5' which is driven by the electric motor 11' of any suitable construction. The driving connection with the pistons 3' differs, however, from the driving connection shown in the preferred form of the invention in that the crank 6' of the shaft 5' has two or more master connecting rods 7' connected thereto and disposed one above the other. An equal number of the piston or connecting rods 8' are pivotally connected as shown at 9' to each of the master connecting rods 7'.

In this modified form of the invention the inlet of gas to be compressed is into the crank case or chamber 2' through a suitable inlet 40 and the fluid to be compressed enters the crank case, passing therefrom through the pistons 3' and the suction valves 41 carried by the piston heads, into the cylinders outwardly of the pistons, where it is compressed. The compressed gas passes through the discharge valve 42 into the heads 33' of the cylinders and from these heads through connection pipes 43 to the exhaust or discharge manifold 44, the direction of travel of the gases being just oppositely to that of the structure shown in Figure 1 of the drawings. However, it is to be understood that the direction of flow of the gases may be reversed in either of these forms by changing the location of the respective valves. For instance, in the construction shown in Figure 2 of the drawings, the intake valves 23 may be placed in the heads of the pistons with the discharge valves 24 placed in the cylinder heads and the inlet of the gas to be compressed could be into the manifold 21 and from thence through the passages 20 into the chamber 2 and outwardly into the cylinder heads 33 and thence to the manifold 30 which would in such instances be a discharge manifold. Likewise, the discharge manifold 44 of the structure shown in Figure 5 may be reversed to an intake or suction manifold with the valves 41 and 42 reversed and the discharge through the pipe 40.

The driving motor 11' is enclosed in a housing 12' which receives leakage gas from the compressor housing 1' to form a dead gas space about the motor. The gas in the dead gas space about the motor 11' is cooled by a suitable cooling medium circulating through the water jacket 27' and the water jacket 24' which is formed in the spacer head 45. The spacer head 45 differs from the spacer head 10 in that it does not have a gas manifold therein, being provided simply with the water jacket ducts 26' which connect the water jackets 24' and 27'. Ducts or pipes 46 open into the cylinders 2' and are connected to the interior of the crank case or the chamber 2' below the level of the lubricating oil in the bottom of this chamber. When the pistons 3' are moving inwardly to draw gas to be compressed into the cylinders the suction action will also draw lubricating oil through the ducts 46 into the cylinders outwardly of the pistons. During the discharge action of the compressor, this

lubricating oil will, with the compressed gas, pass into and through the pistons and be distributed by the compressed gas not only on the piston and cylinder walls but also on the various working parts of the compressor within the chamber 2'.

In Figure 6 of the drawings a still further modified form of the invention is shown. In this particular modified form, the radial cylinders 50, like the radial cylinders 3 and 2' are carried by the compressor housing 51 and are arranged in horizontal planes having their driving shaft 52 disposed vertically and driven by a driving motor 53, which is preferably an electric motor. The pistons 54 reciprocate in the cylinders 50. However, in this construction of the compressor as shown in Figure 6 the intake of the gas to be compressed is from the intake manifold 55 through the drop pipe connections 56 into the chambers 57 in the cylinder heads 58 and thence through the inlet valve structures 59 into the cylinders 50. The compressed gas passes outwardly from the cylinders 50 through the discharge valves 60 into the chambers 61 in the cylinder heads 58 and thence through the passages 62 into the discharge or outlet manifold 63.

The interior of the housing or crank case 51 therefor acts neither as an intake nor a discharge chamber, and the only gas therein is that which leaks past the pistons, and such gas as enters the interior of the housing or crank case 51 through the vent 64. The vent 64 communicates with the interior of the housing or crank case 51 and with the suction side of the cylinders either by direct connection with the intake manifold 55 or at any other suitable point. The gas leaks from the chamber 65 and into the chamber about the driving motor 53 and forms a dead gas space, the gas in which is cooled in exactly the same manner as the gas in the dead gas space in the forms shown in Figures 1 to 5 inclusive.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown but that they may be

widely modified within the invention defined by the claims.

What is claimed is:

1. In a compressor, a compressor housing, a plurality of cylinders carried thereby, pistons in said cylinders, a driving shaft for said pistons, a driving motor for said shaft, a housing for said motor, a spacer head between said housings, said spacer head having an outlet gas manifold chamber therein and provided with a passage communicating with the discharges of said cylinders, a cooling water chamber in said spacer head, an intake manifold having an inlet, and a series of successive outlet connections to the suctions of said cylinders, said manifold decreasing progressively in cross sectional area from its inlet to its final outlet for progressively reducing the area in the manifold as the gas is withdrawn therefrom by the respective cylinders, thereby maintaining uniform pressure of gas at the inlets of all of said cylinders.

2. In a compressor, a compressor housing, a plurality of radially arranged cylinders in said housing, pistons in said cylinders, an intake manifold for said cylinders having an inlet intermediate its ends and having outlet connections to the intakes of said cylinders at successively spaced points in both directions from its inlet, said manifold decreasing in cross sectional area from its inlet to its final outlets in such ratio as to maintain equal suction pressure of material to be compressed at the inlets of all of said cylinders, an electric driving motor for operating said pistons, a housing for said motor, said compressor housing and said motor housing being sealed and arranged to permit leakage of gas into the motor housing to provide a dead gas space about said motor, a spacer head between said housings and having an exhaust manifold therein connected to the discharge outlets of said cylinders, and a cooling jacket within said spacer head and contacting said exhaust manifold.

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