March 15, 1949. P. H. DAVEY 2,464,560

COOLER AND SUPERCHARGER FOR COMPRESSORS

Filed April 15, 1946 4 Sheets-Sheet 1

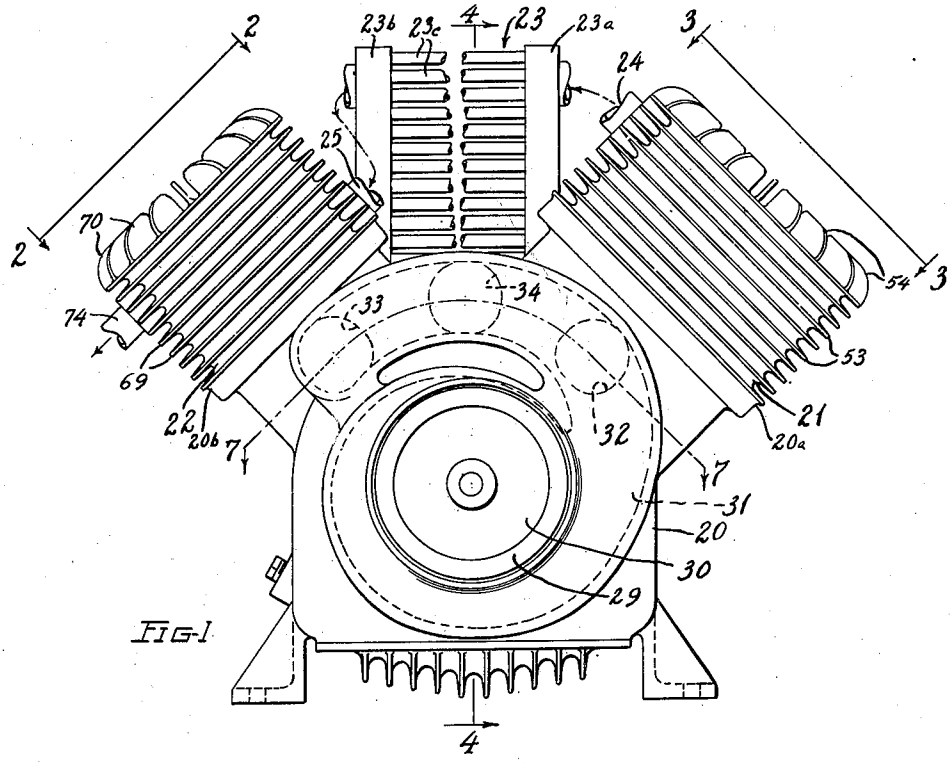


FIG-1

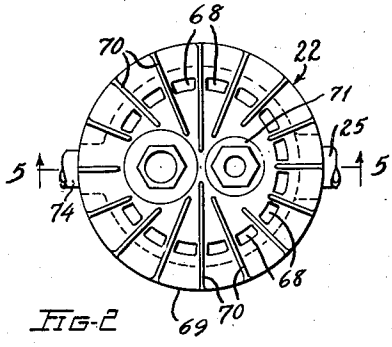


FIG-2

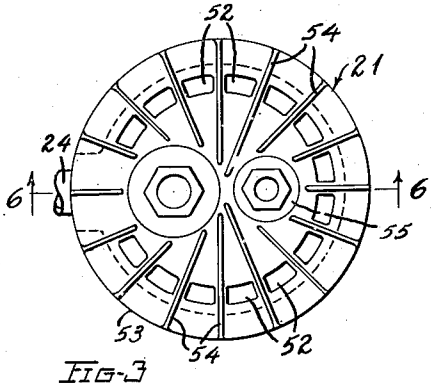


FIG-3

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COOLER AND SUPERCHARGER FOR COMPRESSORS

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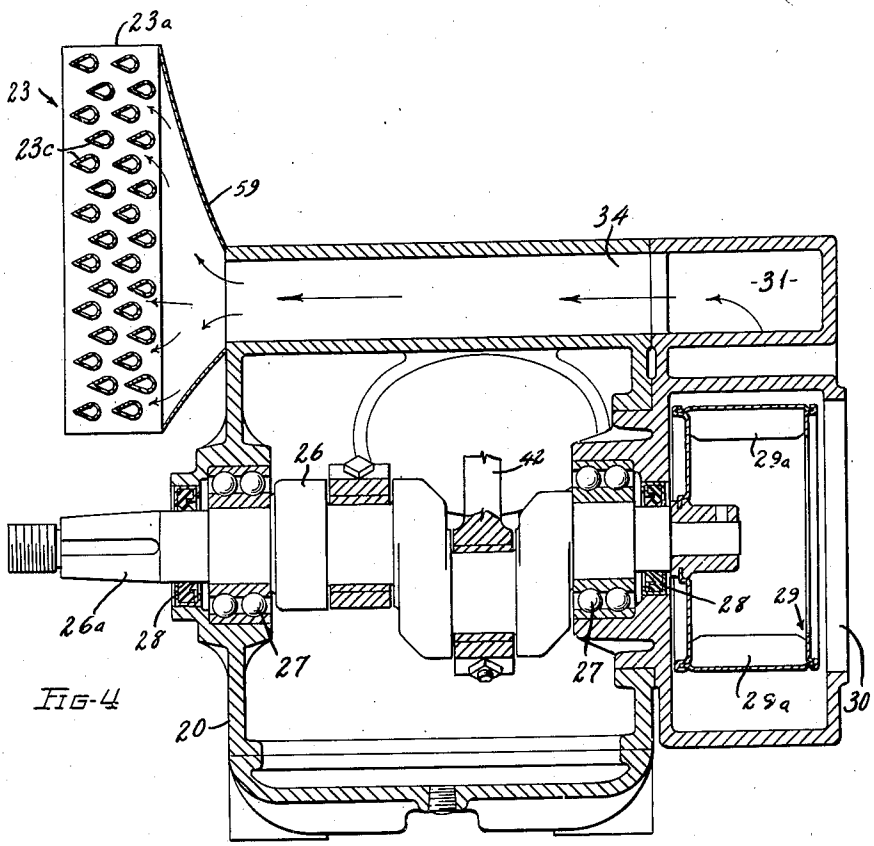


FIG-4

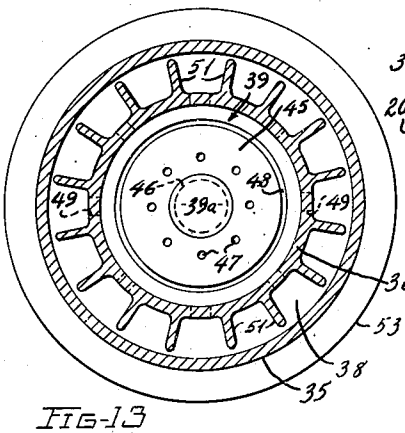


FIG-13

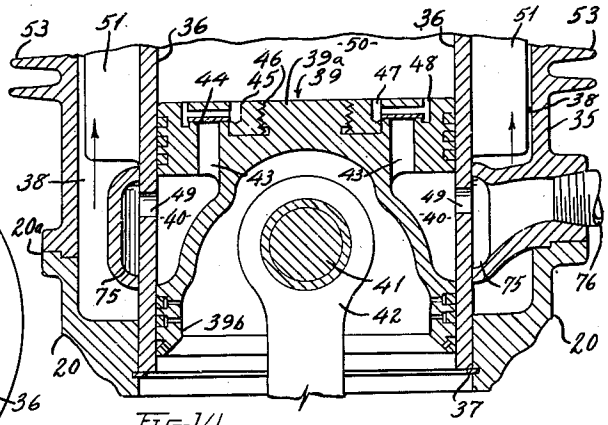


FIG-14

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COOLER AND SUPERCHARGER FOR COMPRESSORS

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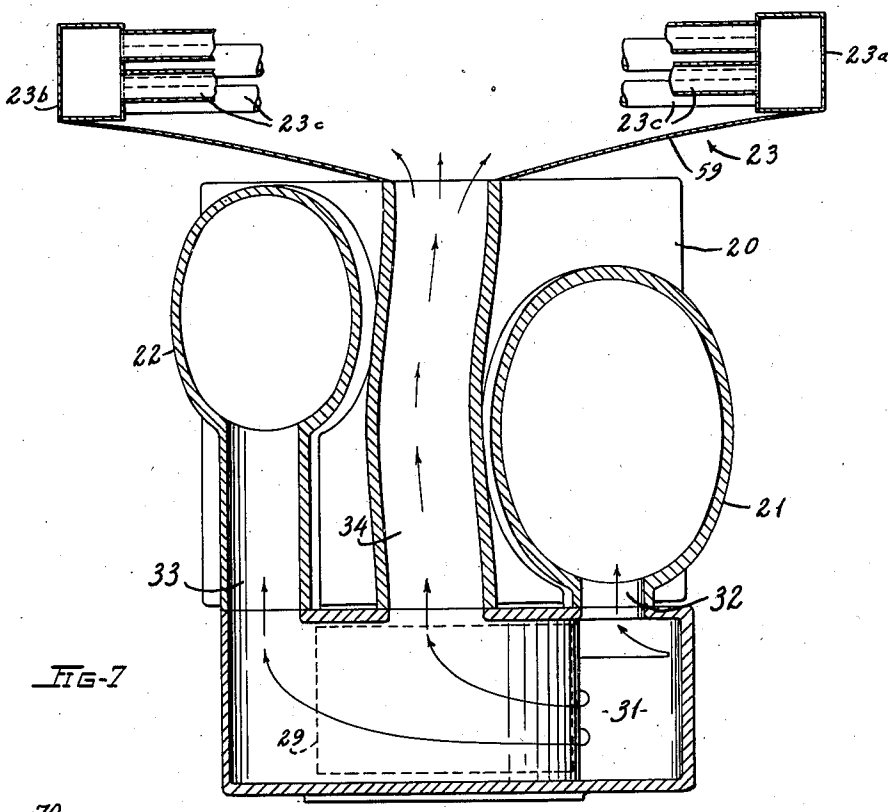


FIG-7

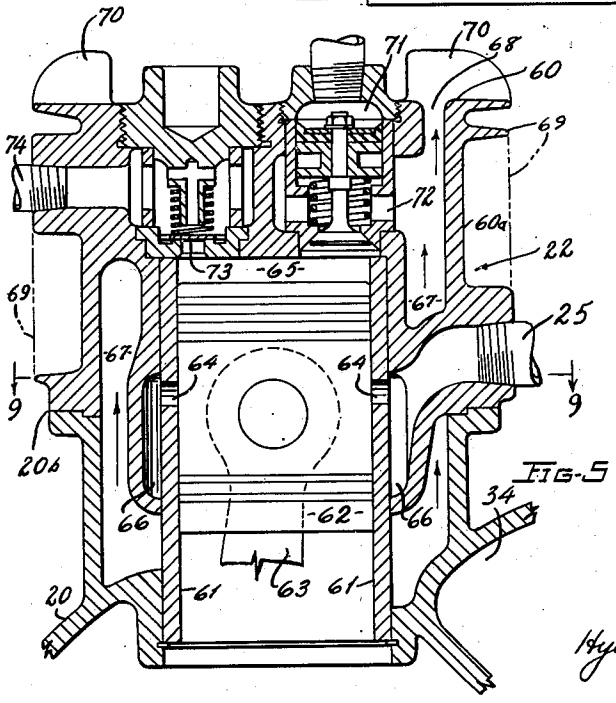


FIG-5

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COOLER AND SUPERCHARGER FOR COMPRESSORS

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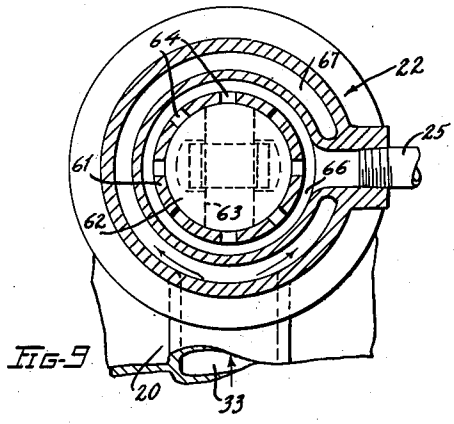


FIG-9

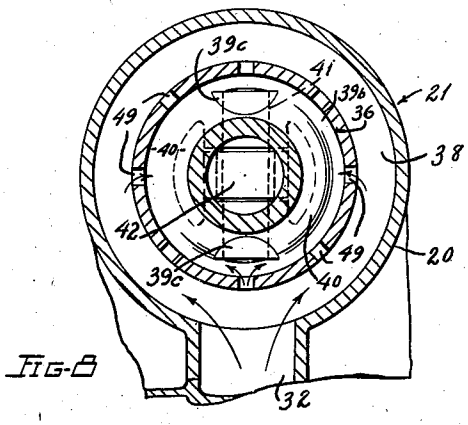


FIG-8

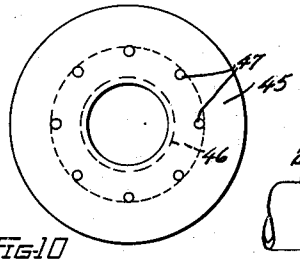


FIG-10

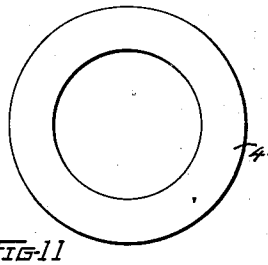


FIG-11

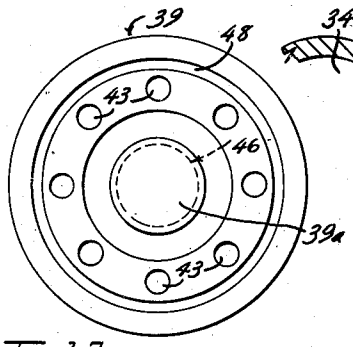


FIG-12

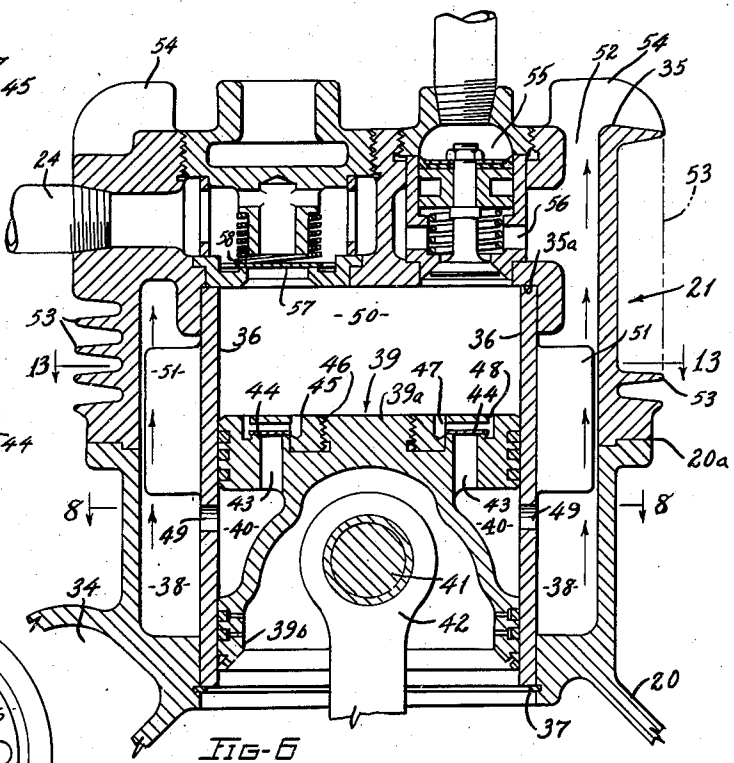


FIG-6

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Patented Mar. 15, 1949 2,464,560

UNITED STATES PATENT OFFICE

2,464,560

COOLER AND SUPERCHARGER FOR COMPRESSORS

Paul H. Davey, Kent, Ohio

Application April 15, 1946, Serial No. 662,330

2 Claims. (Cl. 230—211)

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This invention relates to improvements in compressors for air, gases and the like, and more particularly to a novel arrangement of cooling and supercharging means therefor.

An object of the present invention is to provide novel means for rapidly dissipating the heat generated in the cylinder chamber where the compression takes place. To this end, the present invention provides a positively driven air cooling stream for the dissipation of this heat. It also provides novel means for the exchange of heat from the cylinder wall to the cooling stream.

Another object of the present invention is to provide novel means for the delivery of air at a slight pressure to the intake ports of the compressor whereby to more readily attain a full charge in the compression chamber as will later appear.

Another object of the invention is to provide blower means driven from the main shaft and a novel arrangement of passageways for conducting the air to the compressor cylinders and heads for cooling and supercharging purposes and also to an intercooler.

Other objects and advantages of the invention will be apparent from the accompanying drawings and description, and the essential features thereof will be set forth in the appended claims.

In the drawings,

Fig. 1 is an end elevational view of a two-cylinder compressor embodying my invention with an intercooler shown diagrammatically;

Fig. 2 is a top plan view of the high pressure cylinder head of Fig. 1 taken along the line 2—2 thereof;

Fig. 3 is a top plan view of the low pressure cylinder head of Fig. 1 taken along the line 3—3 thereof;

Fig. 4 is a sectional view taken along the line 4—4 of Fig. 1;

Fig. 5 is a transverse sectional view enlarged, taken along the line 5—5 of Fig. 2;

Fig. 6 is a transverse sectional view enlarged, taken along the line 6—6 of Fig. 3;

Fig. 7 is a sectional view enlarged, taken along the line 7—7 of Fig. 1;

Fig. 8 is a sectional view taken along the line 8—8 of Fig. 6;

Fig. 9 is a sectional view taken along the line 9—9 of Fig. 5;

Fig. 10 is a top plan view of the valve ring retainer which is secured to the top of the piston head of Fig. 6;

Fig. 11 is a plan view of a valve ring in the piston head of Fig. 6;

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Fig. 12 is a top plan view of the piston head of Fig. 6 with the valve ring and its retainer removed;

Fig. 13 is a sectional view taken along the line 13—13 of Fig. 6; while

Fig. 14 is a view similar to Fig. 6 showing a modification of my invention.

It is well known that gaseous compressors when run at high speeds in order to compress large volumes of gas, generate a great deal of heat which must be dissipated if the volumetric efficiency of the compressor is to be held at a high figure and if the compressor parts are to be run without damage. The present invention provides novel means for this purpose. Referring to Fig. 1, on the crankcase 20 are secured a low pressure cylinder 21 and a high pressure cylinder 22 with an intercooler 23 for cooling the air compressed in cylinder 21 before it enters cylinder 22, as is customary. The showing of Fig. 1 is diagrammatic, as the actual position of the intercooler 23 will be more fully apparent in Figs. 4 and 7. The air is discharged at 24 from the low pressure cylinder and enters the intercooler header 23a, then passes through tubes 23c into header 23b, whence it passes to the gas intake 25 of the high pressure cylinder.

Means, not shown, is connected at 26a (Fig. 4) to the crankshaft 26 of the compressor for the purpose of driving the same in the usual manner. This crankshaft has the usual bearings 27 supporting the same in the crankcase 20 and sealing rings 28 so that the crankcase is oil-tight. On one end of the crankshaft is mounted a blower 29, of known type, comprising a series of peripheral blades 29a, adapted to receive air at the central opening 30 and discharge the same at the periphery of the blades to the passageway 31. Three outlets from this discharge passageway are provided, as most clearly shown in Figs. 1 and 7. The outlet 32 leads to the low pressure cylinder, for both cooling and supercharging. The passageway 33 leads to the high pressure cylinder for cooling purposes, and the passageway 34 conducts air for the purpose of cooling the intercooler.

Referring first to the low pressure cylinder, as best seen in Figs. 1, 3, 6 and 8, it will be noted that the crankcase 20 extends partly up the side of the cylinder to the line 20a (Fig. 6), and from there on up, the cylinder housing 35 completes the cylinder head. A cylinder sleeve 36 has its upper end positioned in an annular shoulder 35a of the cylinder head casting and has its lower end held in casting 20 by retaining ring 37. It

will be noted in Figs. 6 and 8 that sleeve 36 is positioned inwardly from and concentric with the outer walls provided by the castings 20 and 35 thus providing an annular chamber 38 completely surrounding the sleeve 36. The air passageway 32, previously mentioned, enters this chamber 38 at one side thereof, as clearly shown in Fig. 8.

A piston 39 reciprocates within the sleeve 36 and comprises a head 39a, a lower trunk portion 39b, both of these parts being provided with the usual sealing rings. The intermediate portion of the piston is hollow, as indicated at 40 (Fig. 6), for a purpose presently disclosed. The piston supports a pair of bosses 39c in which is supported a wrist pin 41 which connects the piston to a connecting rod 42 which in turn is connected to the crankshaft 26.

A novel valve arrangement is provided in the piston 39 which is disclosed and claimed in my copending application, Serial Number 657,732, filed March 28, 1946, now abandoned, to which reference may be had for a complete description. Suffice it to state here that a plurality of openings 43 are provided through the head of the piston which are adapted to be closed by a ring valve 44. This valve is retained in place by the retaining ring or cap 45 which has a threaded connection with the piston at 46. Inlet passageways to the compression chamber of the cylinder are provided at 47 and 48 radially inwardly and outwardly, respectively, from the valve 44. Air or gas inlet to the chamber 40 is provided by a series of openings 49 leading from chamber 38 through the sleeve 36, as clearly shown in Figs. 6 and 8. It results from this construction that ports 49 are in communication with the chamber 40 during the major portion of the piston stroke and, as the piston reciprocates, valve 44 opens on the suction stroke to admit a fresh charge to the compression chamber 50, and valve 44 likewise closes promptly at the beginning of a compression stroke. By the operation of the blower 29 a pressure is created in the passageways 31 and 32 and in chamber 38 at the position of the ports 49. The pressure thus created in these ports aids in the introduction of a fresh charge into the chamber 40. This increases the volumetric efficiency of the compressor.

My improved compressor is suitable for very high speed operation with the result that large volumes of air are compressed in a short space of time, resulting in a great rise of temperature in the cylinder sleeve 36 and particularly in the upper portion thereof, and in the cylinder head. Novel means is provided for dissipating this heat. On the outer wall of sleeve 36 are provided a series of fins 51 extending entirely around the sleeve 36 and in intimate heat-conducting relationship with the sleeve 36. These fins extend substantially across the chamber 38, as clearly shown in Fig. 6. Some of the air from the blower entering through passage 32 into chamber 38 flows upwardly across the fins 51 with a scrubbing action which provides very efficient heat exchange, transferring heat from fins 51 to the cooling air stream moving in the direction of the arrows of Fig. 6. A series of ports 52 is provided in the top of casting 35, as best seen in Figs. 3 and 6. The cooling air stream escapes out these ports to the atmosphere. Other cooling fins 53 on the side of casting 35 and fins 54 on the top thereof may be provided for further dissipation of heat.

To dissipate heat from the cylinder head, casting 35 is preferably formed of a metal having high heat conductivity, such as aluminum. The ports 52 are provided in sufficient number to pass through nearly every part of the head 35 and the cooling air stream, passing out of ports 52, provides efficient cooling for the head.

The low pressure cylinder may be provided with a free air unloading device, as indicated generally at 55 (Fig. 6), but this forms no part of the present invention, except that the unloaded air may be directed out passageway 56 to discharge through the ports 52, if desired.

The discharge of air from the low pressure compression chamber 50 is controlled by the discharge valve 57 which is normally held closed by spring 58. The air compressed in chamber 50 is discharged through the conduit 24 to the intercooler 23a, thence through the intercooler tubes 23c to the intercooler header 23b, whence it passes to conduit 25 leading to the high pressure cylinder. It will be noted in Figs. 4 and 7, that air from the blower 29 is conducted through passageway 34 and through a hood 59 so as to cause some of this air to pass over the tubes 23c to cool the same.

Referring now to the high pressure cylinder, as best seen in Figs. 5 and 9, it will be noted that the casting 20 extends upwardly to the line 20b (Fig. 5) forming a part of the cylinder casting which is completed by the casting 60 thereabove. A cylinder sleeve 61 houses the piston 62 which is of known type and connected by connecting rod 63 with the crankshaft 26. Through the sleeve 61 there are provided flash-ports 64 for the admission of air to the compression chamber 65 from the annular chamber 66 which in turn is supplied from conduit 25, mentioned previously. Around the sleeve 61 and the cylinder portion 60a, there is provided an annular cooling chamber 67. This chamber is connected to passageway 33, as clearly shown in Figs. 1 and 9. A cooling stream of air, under pressure, therefore passes through conduit 33 and chamber 67 to cool the high pressure cylinder. This cooling stream moving in the direction of the arrows of Fig. 5, passes out a series of ports 68 in the top wall of casting 60. This casting may be further cooled, if desired, by the fins 69 on the side thereof, and fins 70 on the top thereof.

A free air unloading device for the high pressure cylinder is indicated generally at 71 and may discharge at port 72 so that this air is delivered to the atmosphere through the ports 68.

A discharge valve for compression chamber 65 is indicated at 73 for discharging the high pressure air at the outlet 74.

It will be noted in comparing Figs. 3 and 6 that the ports 52 which form the outlet at the top of annular chamber 38 are interrupted for the cooling ribs 54 and for the discharge conduit 24. It results from this construction that the discharge of air at the top of chamber 38 is somewhat restricted. Two results follow. This partial restriction at the outlet causes a more even distribution of the air entering from conduit 32 and flowing over the fins 51. Another result is the building up of a slight pressure at the ports 49, thus giving a slight supercharging as the air flows into the hollow piston portion 40 and through ports 43 to the compression chamber 50. This supercharging effect improves the volumetric efficiency of the compressor.

A modification of my invention is shown in Fig. 14, wherein all of the parts are exactly like those just described, except for the changes hereinafter mentioned. If it is desired to clean the

air going to the compressor, it is unnecessary to clean the air used for cooling, and the construction shown in Fig. 14 may be substituted for that previously described. A manifold 75 is provided surrounding the ports 49, and the inlet 76 for this manifold is led out through a suitable construction in the walls of the castings 20 and 35. This inlet 76 may then be provided with an air cleaner so that all of the air passing to the compressor is cleaned, while the air from the blower entering at 32 into the chamber 38 and passing over the fins 51 need not be cleaned. Otherwise, this modification is similar to that first described.

What I claim is:

1. In a fluid compressor having a cylinder and having a hollow piston reciprocable therein and having a crankshaft operatively connected with said piston, said cylinder providing a compression space adjacent the head of said piston, there being ports through said cylinder communicating with the hollow of said piston, valve means in said piston head controlling flow from the hollow of said piston to said compression space, means providing a manifold communicating with said ports outside said cylinder, fluid intake means for said manifold, means providing an annular chamber substantially surrounding said cylinder, fins in heat-conducting relationship with said cylinder and extending into said annular chamber, and means for passing a cooling stream over said fins.

2. In a fluid compressor having a cylinder and having a hollow piston reciprocable therein and having a crankshaft operatively connected with said piston, said cylinder providing a compression space adjacent the head of said piston, there being ports through said cylinder communicating with the hollow of said piston, valve means in said piston head controlling flow from the hollow of said piston to said compression space, means providing a manifold communicating with said ports outside said cylinder, fluid intake means for said manifold, means providing an annular chamber substantially surrounding said cylinder, fins in heat-conducting relationship with said cylinder and extending into said annular chamber, an air blower operatively connected with said shaft for actuation thereby, and a passageway leading from the discharge side of said blower to said chamber upstream from said fins, there being discharge ports leading out of said chamber downstream from said fins.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
741,419	Sutton	Oct. 13, 1903
955,822	Mayhew	Apr. 19, 1910
1,507,293	Kettering et al.	Sept. 2, 1924
1,636,291	Davey et al.	July 19, 1927
1,669,530	Miller	May 15, 1928
1,714,836	Aikman	May 28, 1929
1,764,526	Rothmann	June 17, 1930

FOREIGN PATENTS

Number	Country	Date
216,157	Great Britain	Nov. 6, 1924