March 8, 1949. H. F. HADLEY 2,463,766

COMPRESSOR

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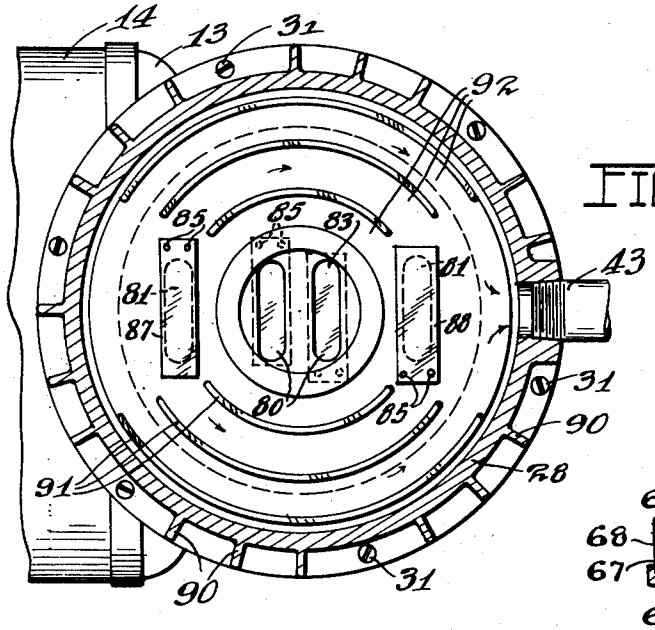


FIG-2-

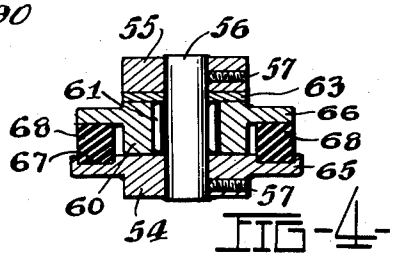


FIG-4-

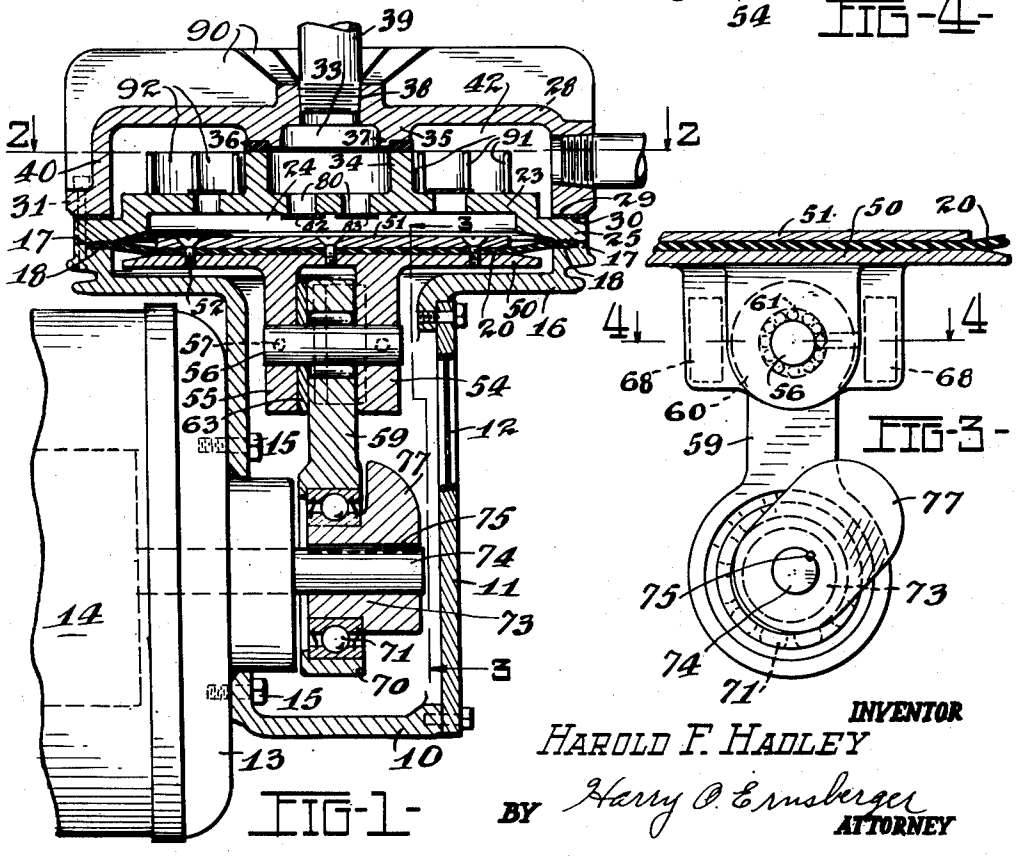


FIG-1-

FIG-3-

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COMPRESSOR

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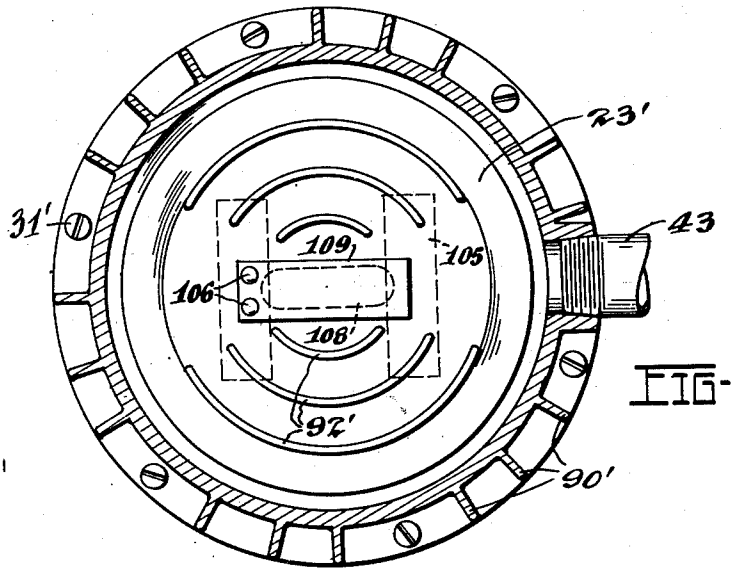


FIG-6-

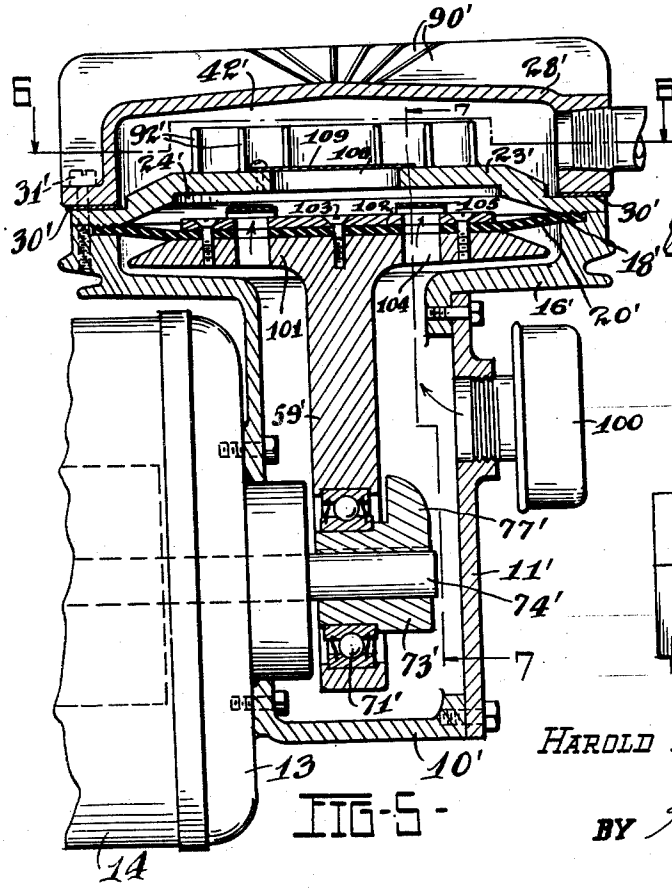


FIG-5-

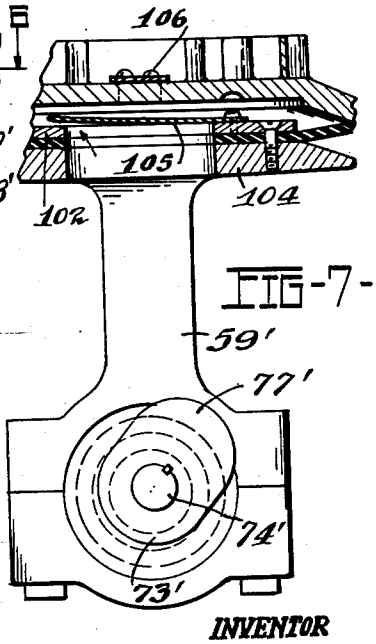


FIG-7-

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2,463,766

COMPRESSOR

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Application January 5, 1944, Serial No. 517,290

3 Claims. (Cl. 230—170)

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This invention relates to compressors and more especially to compressors of the diaphragm type.

The invention comprehends the provision of a compressor particularly constructed to secure uniform distribution and rapid dissipation of the heat generated by compressor operation, resulting in lower temperatures of operation with a consequent increase in compressor efficiency.

An object of the invention resides in the provision of a plenum chamber for a compressor having an arrangement of interiorly disposed heat radiating means, providing a comparatively large metallic area for the dissipation and radiation of the heat of compression from the metal parts of the compressor.

Another object is the provision of a compressor of the diaphragm type wherein the plenum chamber thereof is bounded in part by a valve carrying plate on which is integrally formed a plurality of heat radiating fins extending interiorly of the plenum chamber to facilitate a uniform distribution of the heat of compression into the compressed gas whereby a large portion of the heat generated by compressor operations is conveyed away through the medium of the compressed gases.

Further objects and advantages are within the scope of this invention such as relate to the arrangement, operation and function of the related elements of the structure, to various details of construction and to combinations of parts, elements per se, and to economies of manufacture and numerous other features as will be apparent from a consideration of the specification and drawing of a form of the invention which may be preferred, in which:

Figure 1 is a vertical sectional view illustrating a form of compressor embodying the invention;

Figure 2 is a horizontal sectional view taken substantially on the line 2—2 of Figure 1;

Figure 3 is a vertical sectional view taken substantially on the line 3—3 of Figure 1;

Figure 4 is a detail sectional view taken substantially on the line 4—4 of Figure 3;

Figure 5 is a vertical sectional view similar to Figure 1 illustrating another form of the invention;

Figure 6 is a horizontal sectional view taken substantially on the line 6—6 of Figure 5;

Figure 7 is a vertical sectional view taken substantially on the line 7—7 of Figure 5.

The embodiments of the invention have been illustrated as particularly adapted for use in compressing gases such as air but it is to be

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understood the apparatus may be utilized as a vacuum producing means, or for any other purpose wherein the same may be found to have utility.

Referring to the drawings and especially to the form shown in Figures 1 to 4, the apparatus is inclusive of a housing 10 formed of metal and provided with an opening in the front thereof normally closed by a cover 11. The cover is formed with a screened breather opening 12 to permit the equalization of air pressure within the housing. The housing 10 is arranged to be mounted upon the frame structure or end plate 13 of a motor 14 adapted to drive the compressor, the compressor housing being held in place by means of screws 15. The compressor structure may be carried by other means without departing from the invention. The upper portion of the compressor housing 10 is flared outwardly or enlarged as at 16 and terminates in an annular surface or flange 17 bounding a circular recess 18. The recess 18 forms a seat to receive the peripheral portion of a flexible diaphragm or element 20 formed of rubber, synthetic rubber or the like which is preferably reinforced by fabric (not shown) moulded in the interior thereof or otherwise bonded thereto.

Positioned adjacent the diaphragm is a circular plate or member 23 having a peripheral portion 25 seating on the annular surface 17 of the housing 10, which clamps or secures the periphery of the flexible diaphragm in position, the plate 23 forming a wall of a compression chamber 24.

The compressor is provided with a head 28 which is formed with an annular lower surface 29 arranged to contact the plate 23, there being an annular gasket 30 interposed between the head 28 and plate 23 to effect a sealed joint. The head 28 and plate 23 are secured in fixed position by means of screws 3 threaded into suitable threaded openings in the flared portion 16 of the housing 10.

The plate 23 is provided with a concentrically arranged projecting flange or wall 34 which, with a depending annular flange 35 on the head 28, forms an air inlet passage 33 for the compressor chamber 24. Interposed between the juxtaposed edges of flanges 34 and 35 is a resilient gasket 36 formed of compressible material, as for example, rubber or the like arranged to seal the joint between the flanges. The flange 35 is provided with an annular shoulder or abutment 37 so that the pressure of the compressed air or fluid will not dislodge the sealing member 36.

The head 28 has a threaded opening 38 to accommodate an air cleaner connection 39.

The outer wall 40 of the head 28 together with the flanges or walls 34 and 35 define an annular plenum chamber 42 surrounding the air inlet passage 33, the wall 40 having an air outlet passage 43 arranged to accommodate a tube or other means for conveying the compressed air or other fluid to the place where it is used.

The central portion of the flexible diaphragm is supported upon a circular member 50 and is held in place by means of a plate 51 secured to member 50 by screws 52 or other suitable securing means. The member 50 has integral spaced depending bosses 54 and 55 provided with aligned bores which receive a journal pin or shaft 56 held in place by screws 57. An actuating means or connecting rod 59 has a circular boss 60 at its upper end which is bored to accommodate a needle bearing 61. Interposed between one face of boss 60 and the inner face of boss 55 is a thrust bearing or member 63 preferably of the self-lubricating type, for example, formed by compressed comminuted metal impregnated with a lubricant.

The boss 54 is formed with laterally extending projections 65, and the upper portion of connecting rod 59 is formed with projections 66, projections 65 being provided with recesses 67 to retain a pair of resilient members 68 of rubber, synthetic rubber or the like, each member 68 being positioned between an adjacent pair of projections 65 and 66. The resilient means 68 are initially compressed so as to continuously exert a lateral pressure upon the thrust bearing or element 63. These members 68 function as a vibration damping and shock absorbing means for minimizing the shocks due to rapid changes in direction of movement or reciprocation of the diaphragm and associated elements as well as to eliminate lost motion between the diaphragm support and connecting rod. This arrangement minimizes the metallic noises of moving parts.

The connecting rod 59 is formed at its lower end with a hollow boss 70 which accommodates an anti-friction bearing 71, preferably of the ball type of a character in which lubricant is sealed in the bearing. The inner race of the bearing snugly fits a hollow cylindrical member 73 which is fixedly positioned on the motor shaft 74 by means of a key 75 or other securing means. The axis of the exterior cylindrical surface of member 73 is eccentric with respect to the axis of the motor shaft 74, this eccentricity, during rotation, causing reciprocation of the connecting rod and diaphragm. The member 73 is formed with projection 77 arranged to counterbalance the "pull" of the reciprocating diaphragm and associated parts.

The valve mechanism of this form of compressor is carried by plate 23 which is provided with a pair of juxtaposed inlet passages or ports 80 communicating between the walled passage 33 and the compression chamber 24 and annular plenum chamber 42. The inlet ports 80 are of substantially rectangular configuration, and are normally closed by thin, flexible valves or plates 82 and 83. One end of each valve is fixedly secured to the plate 23 by rivets 85 driven into openings in plate 23, the valves being arranged in opposed relation as shown in Figure 2. Similarly constructed valves 87 and 88 are arranged to normally close the outlet ports 81 and are also arranged with the free or movable extremities extending in parallel and opposite directions.

One of the features of this invention resides in means of dissipating the heat generated by the compression of gases. The head 28 is formed exteriorly with a plurality of heat radiating fins 90 for radiating heat away from the head structure into the surrounding atmosphere. Compressors of the diaphragm type are generally used for operations where the compressed air or other gases are conveyed to a storage tank or direct to the point of use. The compressed gases are conveyed away from the plenum chamber 42 through the outlet passage 43 during operation of the compressor. I have provided means for dissipating a substantial amount of the heat of compression transferred from the compression chamber 24 to the plate 23. To this end there is integrally formed on plate 23 a plurality of fins or baffles 91 which extend into the plenum chamber 42. As particularly illustrated in Figure 2, the fins are configurated as segments of annulae and are spaced and concentrically disposed about the center of the plate 23. This arrangement provides a comparatively large metallic surface area to facilitate the radiation of heat away from the plate 23 into the compressed gas present in the plenum chamber 42. The arcuate configuration of the fins 91 forms curved channels 92 through which a portion of the compressed gas travels in moving toward the outlet 43 thus bringing the moving gas into direct contact with the heat radiating fins without appreciably retarding the flow of compressed gas. By this means the compressed gas moving through the plenum chamber and in intimate contact with the fins 91 entrains or carries away a substantial quantity of the heat generated by compression thus resulting in lower temperature operation of the compressor, with a consequent increase in the life of the flexible diaphragm. I have found this a factor of great importance, as high temperatures tend to cause premature failure of the diaphragm.

In the operation of the compressor, the motor 14 is started, rotating the shaft 74 and the eccentric member 73. The eccentric movement of member 73 causes reciprocatory movement of the connecting rod and diaphragm structure. Each downward stroke of the diaphragm structure sets up a differential pressure between the compression chamber 24 and passage 33 which causes the inlet valves 82 and 83 to open, permitting air or other fluid to flow into the compression chamber. On the upward stroke of the diaphragm, the valves 82 and 83 are closed, causing the air or fluid to be compressed in chamber 24. When the pressure within the chamber 24 exceeds that in the plenum chamber 42, the valves 87 and 88 are opened by reason of the higher pressure in chamber 24, causing the air or other fluid under compression to flow through the outlet ports 81 into the annular plenum chamber. As the compressed air or other gas is continuously being conveyed away from the plenum chamber 42 through the outlet duct 43, the compressed gas flowing through the channels 92 formed by the fins 91 absorbs heat from the latter which is carried away from the compression structure by the flowing compressed gas. Thus the external fins 90 on the head 28 and the fins 91 on the plate 23 provide a simple yet effective and efficient means of rapidly dissipating the heat resulting from compressor operations.

Figures 5, 6 and 7 illustrate another form of diaphragm compressor structure embodying my invention. The compressor housing 10' similar to the housing 10 is provided with a cover 11', the

latter having a threaded opening accommodating an air cleaner 100. The upper part of the housing 10' is flared as at 16' and formed with a circular recess 18' to receive the peripheral portion of a flexible diaphragm 20'. A circular plate 23' is interposed between the enlarged portion 16' of the housing and a compressor head 28', and a sealing gasket 30' being secured in fixed relation to the housing by screws 31'.

The motor shaft 74' carries the eccentric 73' formed with a counterweight 77', a connecting rod 59' being journaled upon the eccentric 77' by means of an anti-friction or ball bearing 71'. In this form of compressor, the connecting rod is integrally formed with an enlarged disc-like portion 101 to which is secured the central portion of the flexible diaphragm 20' by means of a plate 102 and screws 103. The inlet ports 104 for the ingress of air into the compression chamber 24' formed by the plate 23' and diaphragm 20' are arranged in the disc-like portion 101 of the connecting rod, the diaphragm and the plate 102. The ports are normally closed by flexible reed valves or plates 105 one end of each being secured to the plate 102 by means of drive rivets 106 or similar means. The outlet port 108 for the compression chamber 24' is formed in plate 23' which is normally closed by a flexible reed valve 109. In the operation of the compressor, rotation of the eccentric 73' by the motor shaft 74' reciprocates the connecting rod 59' the diaphragm 20' and plate 102. On the "down" stroke of the diaphragm, valves 105 open to admit air into the compression 24' taken into the housing 10' through the air cleaner or filter 100. In the return or compression stroke of the mechanism, the air in chamber 24' is compressed and driven through the outlet port 108 as the reed valve 109 is opened under the influence of the pressure in the compression chamber, the compressed air passing into the plenum chamber 42'. In order to dissipate the heat of compression away from the compression chamber, the plate 23' is formed with heat radiating fins 92 extending into the plenum chamber 42', the fins 92' being similar to the fins 92 in the form of the invention disclosed in Figures 1 to 4 inclusive. The head 28' is also provided with heat radiating fins 90' which together with the fins 92' serve to rapidly dissipate the heat away from the compressor elements.

It is apparent that, within the scope of the invention, modifications and different arrangements may be made other than is herein disclosed, and the present disclosure is illustrative merely, the invention comprehending all variations thereof.

I claim:

1. A diaphragm compressor comprising a housing; a flexible diaphragm positioned in said housing; an actuating means for said diaphragm; a compressor head secured to said housing; a plate forming with said diaphragm a compression chamber; said plate and said head forming an inlet passage for said compression chamber and a plenum chamber arranged to receive fluid under pressure from said compression chamber; said plate having inlet and outlet ports therein; flexible plate valves for said ports; and a plurality of radially spaced arcuately shaped segmental heat radiating fins integrally formed on said plate and extending into said plenum chamber and arranged for direct contact with the fluid passing through said plenum chamber.

2. A compressor including a housing having a flared portion; a flexible diaphragm in the flared portion of said housing; actuating means for said diaphragm; a plate member adjacent said diaphragm and forming therewith a compression chamber; inlet and outlet ports in said plate; valves formed of thin, flexible metal arranged to open and close said ports; a head member; means for securing said head member and said plate member to said housing; said plate and said head having cooperating portions forming a fluid inlet passage communicating with said inlet ports and a plenum chamber communicating with said outlet ports; an outlet for said plenum chamber; heat radiating fins integrally formed on the exterior of said head member; and a plurality of radially spaced arcuately shaped heat radiating fins formed on one of said members and projecting into said plenum chamber.

3. A compressor for compressing gases including a housing; a flexible diaphragm in said housing; an actuating means including a connecting rod for reciprocating said diaphragm; a plate member adjacent said diaphragm and forming therewith a compression chamber; air inlet and outlet ports for the compression chamber; a head member secured to said compressor; said plate member and said head having cooperating portions forming a plenum chamber arranged to receive air under pressure from the compression chamber; and a plurality of radially-spaced arcuately-shaped segmental fins integrally formed on said plate and projecting into said plenum chamber and arranged for direct contact with the air passing through said plenum chamber.

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