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W. R. BROWN

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DIAPHRAGM COMPRESSOR

Filed May 12, 1932

Fig. 1.

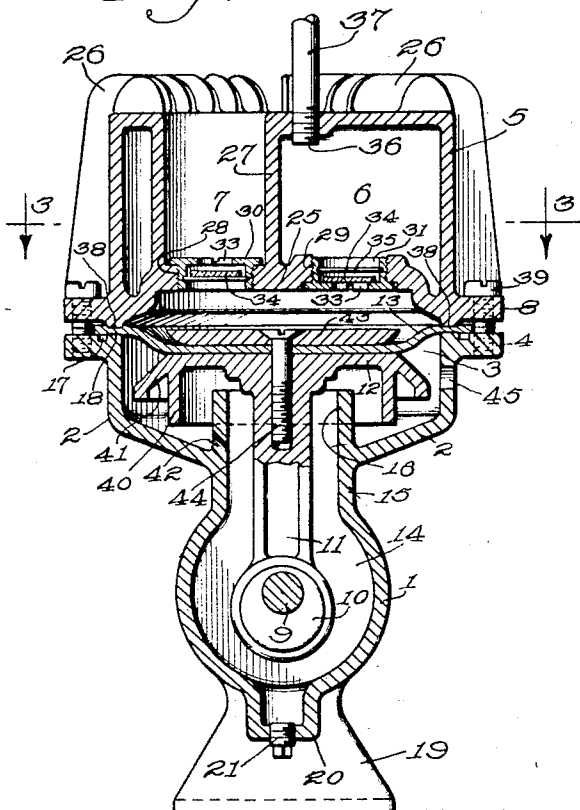


Fig. 2.

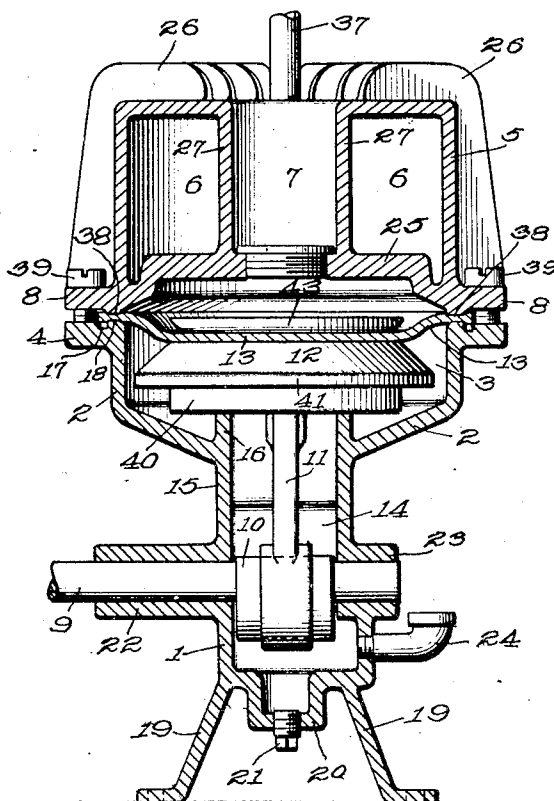
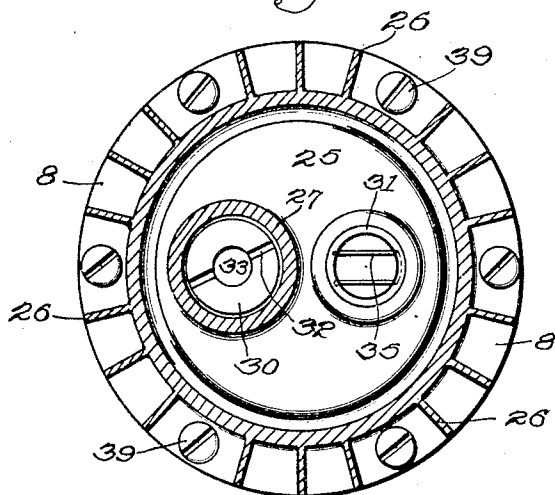


Fig. 3.



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DIAPHRAGM COMPRESSOR

Application filed May 12, 1932. Serial No. 610,903.

This invention relates to compressors and particularly to diaphragm air compressors suitable for use with spray guns and the like.

The main objects of this invention are to provide an improved diaphragm compressor in which the diaphragm functions as a cross-head and is easily replaceable; to provide an improved compressor having a simple one-piece crank case and improved means to shield the diaphragm from the crank case oil; to provide an improved compressor having an integrally formed piston and connecting rod; to provide a compressor having a single crank case casting embodying integral shaft bearings, oil reservoir, diaphragm shielding oil baffles and diaphragm holding means; to provide a compressor having a piston connecting rod journaled on an eccentric driving cam; and to provide a compressor having a single head casting comprising a plenum chamber, intake port and check valves.

A specific embodiment of this invention is shown in the accompanying drawing in which:

Figure 1 is a cross sectional view taken transversely of the drive shaft.

Fig. 2 is a sectional view taken parallel to the drive shaft.

Fig. 3 is a cross sectional view taken on the line 3—3 of Fig. 1.

In the form shown, my improved compressor comprises a one-piece crank case casting 1 having outwardly flared walls 2 forming a piston chamber 3 and terminating in an annular flanged rim 4; a single casting compressor head 5 comprising a plenum chamber 6, an intake port 7, and an annular flange 8 adapted to engage the flange 4; a drive shaft 9 extending into the crank case and carrying therein an eccentric cam 10; a connecting rod 11 journaled on the eccentric cam 10 and carrying an integrally formed piston head 12; and a diaphragm 13 clamped between the flanges 4 and 8 and secured to the piston head 12.

The walls of the crank case casting 1 are contracted above the crank portion 14 to form an upwardly extending neck 15 which houses the connecting rod 11 and extends be-

yond the junction with the flared walls 2 to terminate in an annular upstanding flange or collar 16, the rim of the flange 16 being positioned somewhat below the level of the annular flange 4. The inner margin of the flange 4 is provided with an annular groove 17 to set off a rib 18 which serves as a bearing surface against which the diaphragm 13 is clamped by the compressor head 5. A pair of feet 19 are integrally formed on the bottom portion of the casting 1, and a sediment well or trap 20 is also provided. The trap 20 is drilled and tapped and a plug 21 is inserted in the hole to provide a means for draining off the crank case oil.

At each side of the crank case through which the shaft 9 extends, shaft bearings 22 and 23 are integrally formed on the casting 1. These bearings are drilled and finished and the shaft 9 is journaled therein without the use of separate lining materials, the oil from within the crank case serving to keep them lubricated. The crank case casting is also tapped below the bearing 23 and a capped or plugged elbow 24 is inserted to provide a filling means for the oil reservoir.

The compressor head 5 is in the form of a hollow box-like casting having a substantially concave bottom 25 and a plurality of integrally formed external radial fins 26. The intake port 7 opens at the top of the head 5 and is bounded by partition walls 27 which divide it from the plenum chamber 6. The bottom 25 of the head is provided with a pair of threaded apertures 28 and 29 which lead into the intake port 7, and the plenum chamber 6 respectively, and a check valve 30, and an oppositely disposed check valve 31 are threaded into the respective apertures.

The check valve 30 is arranged so as to be normally open and the valve 31 is arranged to be normally closed. Each valve consists of an externally threaded cup-like casing having a slot 32 across its closed end and a central aperture 33 therethrough. A disk 34, of bakelike or the like, of larger diameter than the aperture 33 but smaller than the inside diameter of the casing, is inserted within the casing and is held therein by a double bent wire 35 which is sprung into a groove on the inner

side of the casing, the disk retaining wire being spaced from the disk to allow restricted vertical movement of the same.

The compressor head 5 is provided with a threaded hole 36 at its top and an outlet pipe 37 is screwed therein. Also an annular rib 38 is provided at the inner margin of the flange 8 to coact with the bearing surface 18 on the crank case casting. The head 5 is secured to the crank case 1 by means of a plurality of cap screws 39 inserted through holes in the flange 8 and engaging tapped complementary holes in the flange 4.

The piston head 12, which is integrally formed with the connecting rod 11, is provided with a flat top and is of lesser diameter than the piston chamber 3. A marginal depending annular skirt or flange 40 of larger diameter than the flange or neck 16, is formed on the head 12 and extends downwardly to surround and overlap the flange 16. The flange 40 is spaced from the flange 16 and is of such a length that it will overlap the flange 16 during the entire stroke of the piston 12. A second flange or skirt 41 spaced from the flange 40 and surrounding the same concentrically is provided on the piston head 12 and serves as a supplementary baffle.

The overlapping flanges 16 and 40, and the flange 41, provide a system of baffles that effectively precludes the splashing of oil from the crank case onto the diaphragm 13 and a drain hole 42, at the base of the flange 16, permits the oil intercepted by the baffles 40 and 41 to drain back into the crank case oil reservoir.

The diaphragm 13 is securely clamped between the coacting ribs 38 and 18 on the compressor head 5 and the crank case 1 respectively and is fastened to the piston head 12 by means of a broad plate 43 which in turn is fastened by the screw 44 threaded into the connecting rod 11 and countersunk into the plate 43. The concave bottom 25 of the compressor head provides a space to receive the plate 43 on the upward stroke of the piston and a breather hole 45 is provided in the side walls 2.

To assemble my improved compressor, the eccentric cam 10 is first inserted in the end of the connecting rod 11, and the assembly is passed through the neck 15 so that the cam 10 will be disposed in the crank shaft chamber 14. The shaft 9 is then passed through the bearing 22, and off-center hole in the eccentric cam 10, and into the bearing 23, and the eccentric cam is secured to the shaft with a set screw or other suitable means manipulated through the drain hole in the sediment pocket 20 from which the plug 21 has been removed.

The eccentric cam 10, after being secured to the shaft 9 serves as a thrust collar acting against the inner sides of the crank case to

receive thrust in either direction longitudinally of the shaft 9.

The diaphragm 13 is then laid over the top of the crankcase 1 so that its edges overlap the annular bearing surface or rib 18. The plate 43 is laid on top of the diaphragm, and the screw or bolt 44 is inserted through the plate and diaphragm and threaded into the connecting rod 11 to securely clamp the diaphragm against the top surface of the piston head 12. The compressor head 5 is then placed over the top of the crank case so that the holes for the bolts 39 are in registry and is clamped down by means of a bolt 39 passing through the coacting flanges 4 and 8. When the compressor head 5 is clamped against the crank case 1, the annular ridge 38 on the compressor head coacts with the bearing surface 18 to securely clamp the diaphragm 13 therebetween and lock the same against possible displacement.

In operation the crank case is first filled with a medium motor oil through the elbow 24 until the oil has reached a predetermined level, preferably just below the top of the elbow 24. The drive shaft 9 is provided with a pulley, not shown, of proper size according to the speed of the driving motor, to provide a speed of approximately 1,000 R. P. M.; and a safety valve and pressure regulator, not shown, is installed in the outlet pipe 37, in order to maintain a constant pressure in the plenum chamber 6.

As the drive shaft 9 is revolved the eccentric cam 10 causes the connecting rod and piston head to reciprocate, and the diaphragm 12 functions as a crosshead to maintain a substantially linear motion of the piston head 12. On the downward stroke of the piston head, air is drawn through the intake port 7 and the check valve 30, into the space between the bottom 25 of the compressor head and the plate 43 of the piston head. On the upward stroke, the disk 34 in valve 30 is forced upwardly to close the valve opening 33, and a similar disk in valve 31 is forced upwardly and away from the opening 33 therein to permit the air to be forced into the plenum chamber 6. The air pressure in the plenum chamber 6 and the vacuum created by the piston head on its downward stroke, serve to close the check valve 31 when air is being drawn into the compressor.

As the eccentric 10 is revolved in the crank case chamber 14, the oil therein will be splashed considerably, and will tend to work its way up into the piston chamber 13. The upwardly extending collar or flange 16 functions to substantially prevent the splashed oil from being carried into the piston chamber 3 in too great a quantity, and the depending flange 40 of the piston head 12 which continuously overlaps the flange 16 serves to catch whatever oil that passes beyond the rim of the flange 16.

This oil that is trapped by the flange 40 is deposited at the bottom of the piston chamber 3, and drains therefrom through the drain hole 42 back into the crank case.

5 The supplementary skirt or flange 41 on the piston head 12 serves merely as an additional baffle to obviate the possibility of any oil working its way up to the diaphragm 13. Thus the diaphragm is protected from the
10 deteriorating effect of the oil, so that its natural life period will be greatly increased.

After a long period of service, the diaphragm 13 will naturally wear and blow through at some point, and when this occasion arises, a new diaphragm head made of
15 any suitable material, such as regular rubber diaphragm stock, or a good grade of rubber sheet backing which has a strong cloth insertion, may be readily placed into the compressor so that it may continue its service.

To renew the diaphragm it is only necessary to remove the bolts 39 and lift off the compressor head 5, and then remove the
20 screw or bolt 44, which releases the clamping plate 43. The new diaphragm is then placed in position, clamping plate 43 fastened to the piston head 12, and the compressor head 5 again bolted into position by means of the bolts 39.

30 The main advantages of my improved compressor lie principally in its simplicity of construction, and its centralized means for lubrication. The one-piece crank case casting and compressor head casting greatly reduces the number of parts and produces an
35 extraordinarily light weight device. The integral connecting rod and piston head further reduces the number of moving parts at the points where lubrication is necessary.

40 Since oil is rapidly splashed in the crank case chamber, the shaft bearings 22 and 23, and the bearing surface of the eccentric cam 10 will at all times be provided with sufficient oil to keep them cool and prevent their wearing; and substantially the only part in the
45 entire device that need ever be replaced is the diaphragm 13, which only requires a few minutes of time to be changed. The valves 30 and 31 in the compressor 5 are readily removable for cleaning, and are of such simple
50 construction that they may practically never need renewal.

My improved construction is primarily a portable compressor, suitable for use in cases
55 where relatively small quantities of compressed air, at a constant pressure, are required, as in the case of spray guns and the like. The simplicity of its construction permits exceptionally low cost of manufacture,
60 so that the device can be sold as an accessory for spray gun equipment and obviate the necessity of investing a large sum in a more complicated device that might not have a sufficient continuity of use to warrant the expenditure involved.

Although but one specific embodiment of this invention has been herein shown and described, it will be understood that certain details of the construction shown may be altered or omitted without departing from
70 the spirit of this invention as defined by the following claims.

I claim:

1. A diaphragm compressor comprising a crank case having an upwardly extending
75 neck, flared outside walls integral on said neck and terminating in an annular flanged rim, a hollow compressor head having a substantially concave bottom wall and an annular flange coacting with said flanged rim, said
80 compressor head comprising an enclosed plenum chamber and a walled intake port passing therethrough, said bottom wall having apertures leading to said intake port and said plenum chamber, a check valve in said
85 intake port and in said plenum chamber aperture, a shaft extending into said crank case and journaled thereon, a connecting rod having one end eccentrically journaled on said shaft and an upwardly extending free end,
90 a piston head integral on the free end of said connecting rod, an annular collar extending upwardly from the junction of said flared side walls and said neck, annular concentric depending flanges on said piston head, the
95 innermost depending flange surrounding and overlapping said collar and being spaced therefrom, a diaphragm clamped between said flanged crank case rim and said compressor head, and a plate clamping said diaphragm concentrically to said piston head.

2. A device of the class described comprising a one-piece crank case terminating in an upwardly extending rim, a compressor head
105 secured to said rim and comprising a plenum chamber having a walled intake port passing therethrough, an aperture in the bottom of said head communicating with said plenum chamber, a one-way valve in said intake port and aperture respectively, a shaft extending
110 into said crank case and journaled thereon, an eccentric cam secured to said shaft, a connecting rod journaled on said cam and having a free end extending upwardly therefrom, a piston head on the free end of said connecting
115 rod, overlapping annular flanges on said piston head and crank case respectively, a diaphragm clamped between said rim and compressor head, and means clamping said diaphragm to said piston head.

3. A diaphragm compressor comprising a one-piece crank case terminating at its top in an integral piston chamber having a
120 flanged rim, a flanged compressor head coacting with said flanged rim, said compressor head having an intake port and an enclosed plenum chamber each communicating with said piston chamber, a valve in said intake
125 port and a valve between said plenum chamber and said piston chamber, a shaft extend- 130

ing into said crank case, a connecting rod
eccentrically journaled on said shaft and hav-
ing a free end extending upwardly into said
piston chamber, a piston head integral on
5 the free end of said connecting rod, a flange
extending upwardly from said crank case
into said piston chamber and surrounding
said connecting rod, a pair of spaced concen-
tric flanges depending from said piston head,
10 the innermost piston flange overlapping said
upwardly extending crank case flange and
being spaced therefrom, a flexible diaphragm
clamped between said compressor head and
the flanged rim of said crank case, and means
15 clamping said diaphragm to said piston head.
Signed at Chicago in the county of Cook
and State of Illinois, this 22d day of April,
1932.

WILLIAM R. BROWN.

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