

May 7, 1940.

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2,199,482

AIR COMPRESSOR
Original Filed Oct. 17, 1932

3 Sheets-Sheet 1

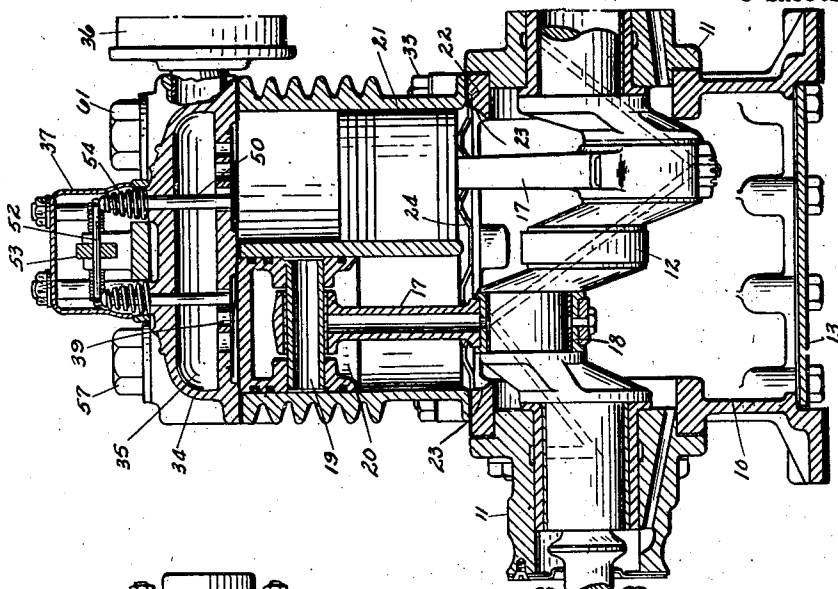


Fig. 2

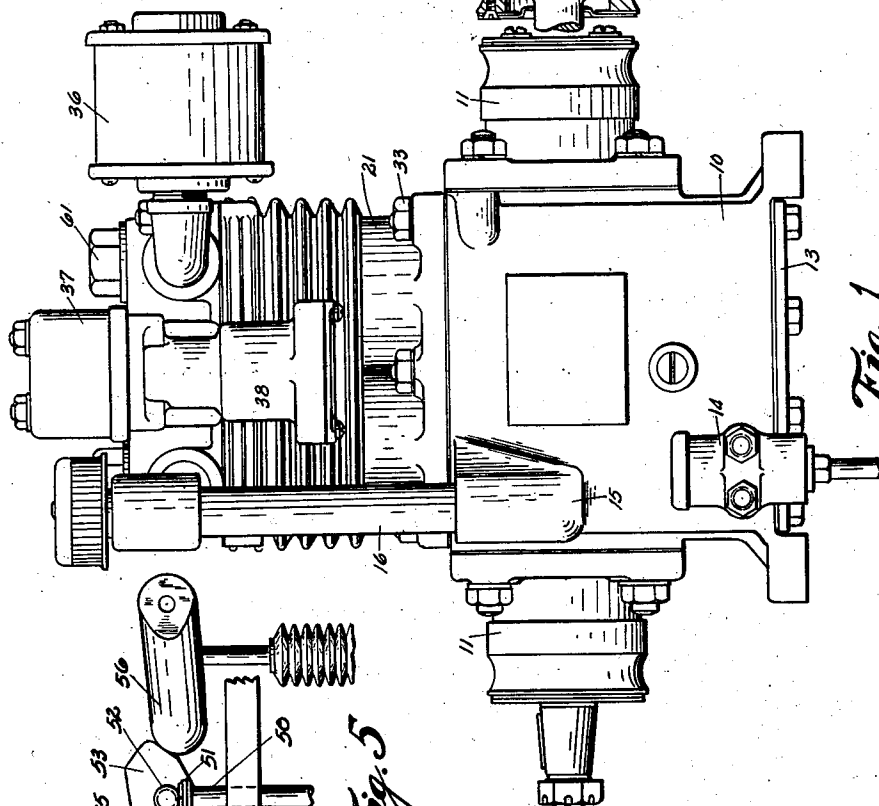


Fig. 1

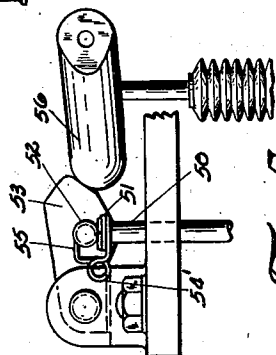


Fig. 5

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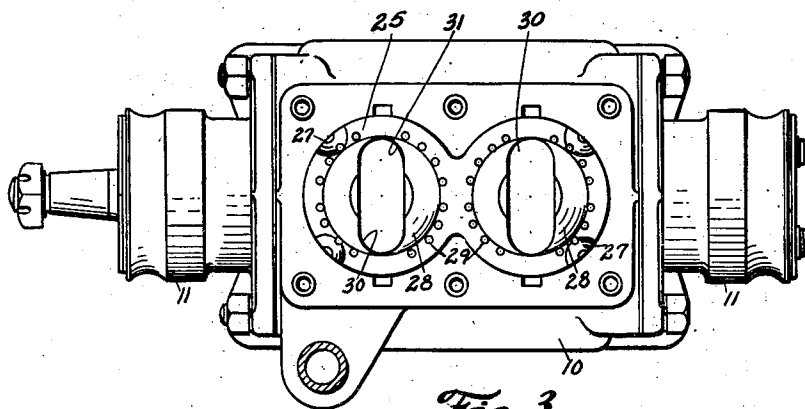


Fig. 3

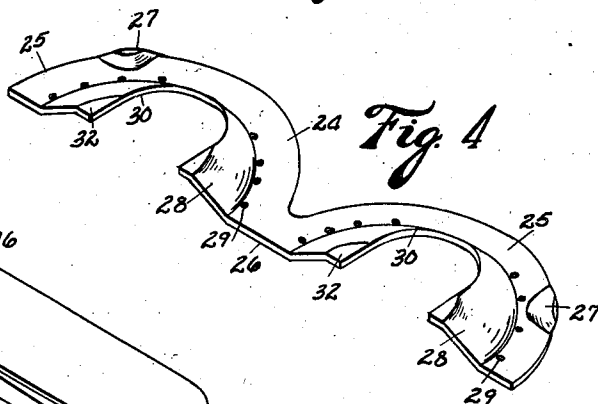


Fig. 4

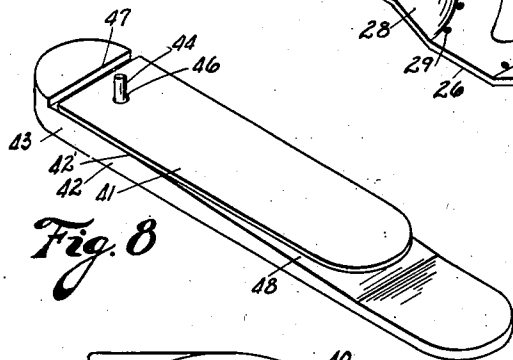


Fig. 8

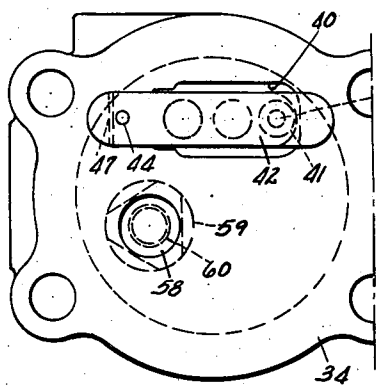


Fig. 6

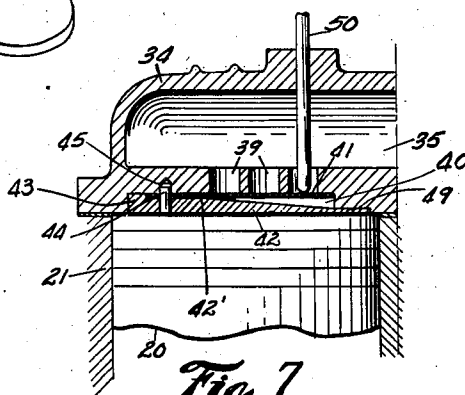


Fig. 7

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Fig. 10

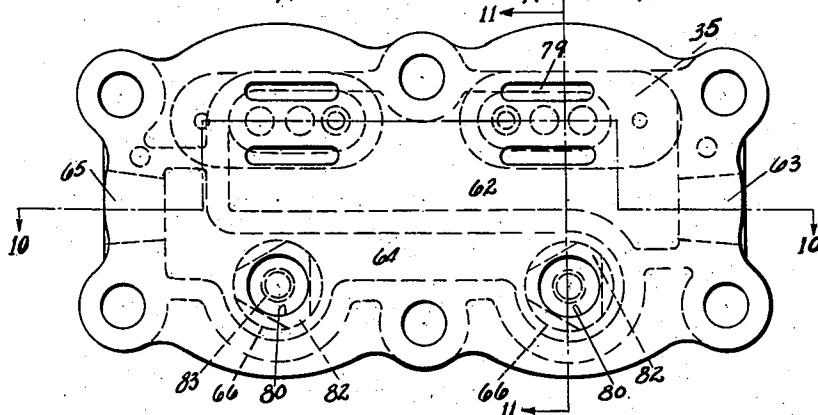
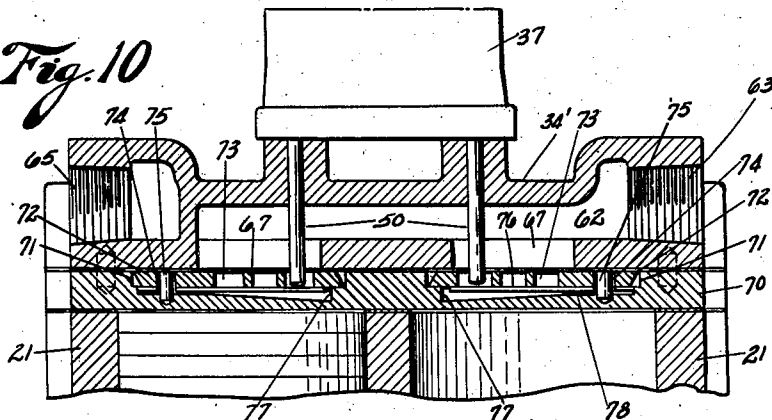


Fig. 9

Fig. 11

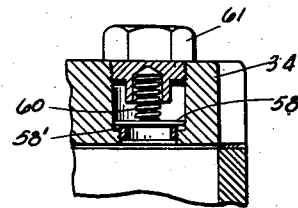
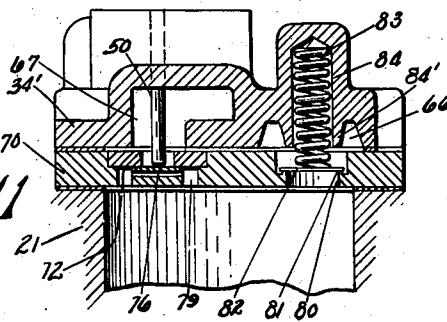


Fig. 6a

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UNITED STATES PATENT OFFICE

2,199,482

AIR COMPRESSOR

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Original application October 17, 1932, Serial No. 638,123. Divided and this application February 24, 1937, Serial No. 127,511

7 Claims. (Cl. 230-228)

This invention relates generally to air compressors and is a division of my co-pending application Serial No. 638,123 filed October 17, 1932, for Air compressors and an important object of the invention is to provide inexpensive valve construction for compressors, which, under ordinary conditions have tendencies to set up a singing reed action, but with the construction and arrangement herein provided, these valves are floatingly retained in position to counteract any tendencies for the valves to set up humming or whirring sounds.

A further object of the invention is to reduce machining of the cylinder head to a minimum by provision of a simple and durable valve seat member.

Another object of the invention is to provide an improved form of spring for the governor control which will not be as subject to fatigue and crystallization as the more usual form of compression coiled springs employed for this purpose and will be considerably cheaper.

Other objects and advantages of the invention will become apparent during the course of the following description.

In the accompanying drawings forming a part of the description and wherein like numerals are employed to designate like parts throughout the several views:

Fig. 1 is a side elevation of an air compressor with governor control,

Fig. 2 is a longitudinal vertical section of the same,

Fig. 3 is a top plan of the compressor with the head of the cylinder and governor control removed.

Fig. 4 is an enlarged perspective view of half of the improved type of baffle,

Fig. 5 is an enlarged side elevation of a portion of the trigger mechanism of the governor illustrating the new type of spring release for the inlet valve,

Fig. 6 is a bottom plan of the cylinder head with a dotted circular line indicating the relative operative position of the cylinder walls overlapping the ends of the valve guard for preventing accidental displacement thereof,

Fig. 6a is a fragmentary section through the discharge valve of the above form of cylinder head,

Fig. 7 is a fragmentary vertical section through a portion of the cylinder head showing the inlet valve in operative position,

Fig. 8 is an enlarged perspective view of the improved valve and guard therefor,

Fig. 9 is a bottom plan of a modified form of cylinder head and valve plate assembly,

Fig. 10 is a longitudinal section of the same on line 10-10 of Fig. 9, and

Fig. 11 is a transverse section of the same on line 11-11 of Fig. 9.

Referring now more specifically to the drawings for further details, the numeral 10 designates the crankcase portion of an air compressor having openings in opposite ends for the attachment of bearings 11, having suitable bushings for mounting a compressor crankshaft 12. This crankshaft may be connected directly or geared in any suitable manner to a crankshaft of a prime mover, not illustrated, as this connection is well understood from the prior art and my several prior patents. The bottom of this crankcase casting is closed and sealed by a removable plate 13 giving access to the enclosed parts. One side of the casting is provided with a filler 14 having an overflow to the engine crankcase as shown in Fig. 1, and the same side is equipped with an integral lateral enlargement 15 which is hollow and communicates with the interior of the crankcase at its lower end and at its upper end has threaded therein a breather tube 16.

The top of this crankcase is of course open for the projection of connecting rods 17 which are bored out and connected at their lower ends by bearings 18 to the crank portions of the shaft 12. This crankshaft has a longitudinally extending lubricant passage which communicates with the hollow connecting rods whereby lubricant may be forced to the upper ends thereof to lubricate the wrist pins 19 journaled in pistons 20.

The present improvements have been illustrated in conjunction with a twin compressor but of course may be employed in the manner herein-after specified in a single cylinder compressor as will be obvious as the description proceeds.

The top of the crankcase for a twin compressor is provided with a pair of circular communicating openings defining generally the shape of the numeral 8 so that the bore of a twin cylinder 21 may register therewith as illustrated. Seats 22 are provided continuously around the edges of these openings and downwardly inclined shoulders 23, at opposite ends of the openings are provided to deflect any lubricant running down the same on to the crankcase bearings. In order to prevent lubrication from being thrown up into the cylinders 21, by the crankshaft during its rotation, baffle means are clamped upon the seat 22 by bolting the cylinder portion upon the crankcase. The baffle means in the

present illustration are composed of a pair of plates or stampings 24, best seen in Figs. 3 and 4, possessing a shape generally similar to the numeral 3 in the case of a twin compressor; while in the case of a single compressor, the baffle means would be constituted by a pair of semi-circular plates, or one-half of the baffles for the twin compressor. Each of the baffle plates has an outline corresponding to one-half of the seat 22 of the crankcase portion and its margin 25 is flat to snugly fit the seat 22 with the exception of portions spaced equi-distant from its straight inner edge 26 where the margin is provided with upwardly deflected and curved lips 27. The body portion of each end of each baffle plate is provided with a semi-spherical bulged or embossed portion 28 which is concentric with the adjoining marginal portion of the baffle plate. A series of apertures 29 are provided in the flat marginal portion 25 of the baffle plate at the base of the bulged portion in circumferential relationship to be concentric with the semi-circular end portions of the baffle. In some cases, these apertures may extend into the bulged portions to facilitate the passage of any liquid lubricant from the cylinders back into the crankcase. As appreciated from Fig. 2, the openings of the ends of the baffle plates are disposed above the inclined ledges or shoulders 23 so that the latter will guide any returning lubricant and spill the same upon the crankshaft bearings.

The central portion of each bulge 28 is removed to provide each section of the baffle with an opening 30, extending from the inner straight edge 26 of the baffle plate throughout the bulged portion to touch the flat marginal portion 25 and thereby provide, with its complementary baffle section, an elongated slot 31, having its longest dimension diametrically of the cylinder to accommodate the projection of the connecting rod 17 into the cylinders 21. Opposite edges of each notch or opening 30 adjacent the straight edge 26 and the crest of the humps are flattened as indicated at 32 to be disposed substantially in a plane parallel to the plane of the flat margins 25. Obviously the raised portions 28 prevent lubricant overflowing into openings 30 and being carried upwards by the connecting rods.

Two of these complementary baffle plates as shown in Fig. 4 are placed together with their straight edges 26 abutting and their flat margins resting in the seat 22 of the crankcase as shown in Fig. 3, and with their bulged portions 28 extending upwardly and slightly into the lower ends of the bores of the cylinder 21. When the cylinder is bolted on to the crankcase by the bolts 33, with a gasket disposed between the bottom of the cylinder and the flat marginal portions 25 of the baffles, the lips 27 will be depressed into the gasket to increase the frictional lock between the parts and to prevent accidental rattling or rotation of the baffle plates, when used in a single cylinder compressor where the two complementary baffles form a circular baffle plate and may have a tendency to rotate if not precluded by such or equivalent means. The slots or openings 30 in the baffles are of such dimensions to afford proper clearance for the connecting rods 17 and yet are of a size to preclude lubricant being thrown up into the cylinder by rotation of the crankshaft. The openings 29 also permit the passage of lubricant vapor up into the cylinder 21 and still provide ample drainage of any oil dropping from the wrist pins, cylinders or pistons back into the crankcase.

A head 34 is suitably bolted on the cylinders 21 and incorporates therein inlet and outlet valves, the former being fed atmospheric air through the passageway 35 drawn in through the air cleaner 36. An automatically acting governor mechanism is indicated in general by the numeral 37 and includes a pressure Syphon housed in chamber 38 and actuated by reservoir pressure to automatically open the inlet valve 41 when reservoir pressure reaches a predetermined amount. This type of inlet valve constructed from thin sheet spring steel is generally shown in my prior Patent No. 1,798,440 granted March 17, 1931 and it is one of the objects of this invention to improve the construction of the inlet valve and guard member and obviate any hum of the valve due to air currents passing the same, setting up a reed action. The construction of the cylinder head in Figs. 6 and 7 of the formation of the valve and guard seats is generally the same as in my previous patent, it being noted that the valve seats and parts have their center line located in a chordal line relative to the bore of the cylinder as indicated in dotted lines in Fig. 6.

The inlet ports 39 from passage 35, extend into the bottom of a valve seating recess, against which a floating valve pin of thin sheet spring steel normally seats under its inherent spring action and the manner in which it is mounted. A valve guard 42 of less width than the recess 40 is provided for retaining the valve in operative position and also has the function of preventing broken valves from falling into the cylinder. One end 43 of the guard member is provided with a pin 44 removably fitting in a cavity 45 provided in the bottom of the recess 40, the pin passing through an aperture 46 in one end of the leaf spring valve with sufficient clearance to prevent the spring valve 41 being held too rigidly at one end. This end of the valve guard is provided adjacent the pin 44 with a transverse shoulder 47 having a height slightly greater than the thickness of the leaf spring valve. The pin retains the end of the spring slightly spaced from the shoulder 47 and also retains the free end of spring spaced from the end wall of recess 40. The surface 48 of the guard member next to the leaf spring valve is tapered from a transverse shoulder 42' adjacent the pin 44 to a point adjacent the other end of the guard where the surface, then, is angularly disposed in a plane parallel to its outer surface. The end of the guard is seated in a recess 49 in the bottom of the cylinder head so that the entire outer surface of the valve guard member is flush with the under surface of the cylinder head whereby opposite ends of the guard member will fit flush on the upper surface of the cylinder wall. The chordal arrangement of the guard member across the bore of the cylinder with its ends resting upon the cylinder walls prevents the guard and valve from falling into the bore. It will also be obvious that the valve 41 in opening and closing, flexes to some degree on the shoulder 42' rather than at the pin 44.

As explained in the aforesaid patent, the governor control includes a push pin 50 slidably mounted in the cylinder head for engagement with the free end of the valve 41 to hold the same in open position when reservoir pressure has reached a predetermined quantity. As better shown in Figs. 2 and 5, the upper side of the push pins are provided with heads 51 normally retained in engagement with the underside of the

trip pin 52 carried by a trigger member 53 of the governor control. As shown in Fig. 2, light compression springs 54 have been employed, heretofore, for retaining the push pins 50 in elevated position whereby the inlet valves may close upon their seats. This compression spring should be of strength sufficient to overcome the weight of pin 50, but due to slight vibrations at high motor speeds and due to production difference in workmanship and material from which these springs are made it has been found necessary to materially increase the strength of these springs beyond the mere weight of the pin 50 to such an extent as to set up a factor which may materially affect the normal operation of the governor. For these reasons a different type of spring has been provided as illustrated in Fig. 5.

As will be readily seen, this new type of spring shown in Fig. 5 imposes no functions interfering with the normal governor operation and its strength can vary within large ranges. This modified spring comprises an intermediate coil portion 54' with one end extended horizontally and looped about push pin 50 under the head 51. The other end 55 of the spring is directed vertically and then horizontally to be disposed in an annular groove in one end of the pin 52 and partially coiled thereabout to prevent accidental displacement. Such a spring yieldingly retains the head of the push pin 50 against the under side of the pin 52 so that it is elevated with pin 52 and the inlet valve functions when reservoir pressure has not reached the maximum degree. It is of course understood that the finger 53 is depressed by a spring pressed plunger 56 sliding over the tapered nose of the trigger whenever reservoir pressure swings the spring pressed plunger 56 vertically and exerts pressure on the trigger 53 to move the pin 50 downwardly and thereby unseat the inlet valve so that on the compression stroke of the pistons, the air drawn in will be idly forced out of the atmosphere. However, with the push pins 50 in the position shown in Fig. 2 the inlet valves are free to seat and do so after their opening movement is compelled by the downstroke of the pistons and the compressed air is then forced out through suitable ports and outlet valves 57 to the reservoir.

As illustrated in Figs. 6 and 6a, the outlet valve comprises small triangular plates 58 adapted to be forced to their separable seats 58' concentric with outlet ports 59 by means of small coil springs 60 carried in axial cavities of cap screws 61 threaded into openings concentric with the port 59. As will be noted in Fig. 6, the valve plates 58 are substantially triangular shaped with their apices removed and are of such dimensions as to have free movement perpendicularly of their seats but not laterally thereof. Air pressure within the cylinder obviously unseats the valves, and permits escape of air through suitable discharge passages; the springs 60 serving to return the triangular valve plates to their seats upon the suction stroke of the piston. The lift of the outlet valves of Fig. 6a is governed by the distance between their seats 58' and the inner ends of the cap screws 61, necessitating accurate disposition of the valve seat carrying shoulder and adjustments of the cap screws.

In Figs. 9 to 11 inclusive, a modified form of cylinder head and valve carrying member is illustrated. In this form of device no valve seat surfaces are provided in the cylinder head and therefore a minimum of machining thereof is necessary due to the provision of a novel valve

carrying member or plate indicated in its entirety by the numeral 70. Moreover, this new association of parts obviates the necessity of separate guard members for the valves and makes it possible to locate the inlet valves centrally of the cylinder bore if desired and dispenses with the chordal arrangement of guard plates shown in Fig. 6.

The cylinder head 34' is cast with an inlet passage 62 communicating with the lateral inlet port 63 and an exhaust passage 64 communicating with a lateral exhaust port 65. The exhaust passage 64 is provided with an outlet port for each cylinder as best seen in Fig. 11, while the cored out inlet passage 62 is provided with an inlet port 67 for each cylinder.

A valve seat carrying member or plate 70 is clamped between the cylinder head 34' and the cylinder 21 with suitable gaskets interposed to seal the joints. The surface of the member 70 adjacent the cylinder head is provided with an elongated substantially oval cavity 71 above each cylinder bore in communication with an inlet port 67 for the reception of a correspondingly shaped steel valve seat element 72, the upper surface of which is flush with the upper surface of the element of the member 70. This valve seat element 72 is provided with a plurality of apertures 73 in registration with the inlet port 67 and adjacent one end is provided with a perforation 74, for the reception of a pin 75 fixed in plate 70 and adapted for floatingly mounting a valve plate 76 constructed of thin resilient sheet steel. The valve seat or plate 72 is reversible to present either top or bottom surface as a valve seat as shown in Fig. 10, and has its opposite ends beveled off in the same direction to provide a lip at one end under which a suitable tool can be inserted for lifting the seat out of plate 70. Either the arcuate ends of the cavity 71 or the ends of the seat 72 can be cut off with a straight edge to provide a space between the plate and its cavity to facilitate entry of the tool to lift the seat. Of course, the upper gasket effectively prevents leakage between the members 70 and 72. A valve cavity or recess 77 is located beneath the recess 71 and being shorter in length, provides the recess 77 with shoulders at opposite ends to seat the plate 72. The bottom wall of the cavity 71 at one end is just a few thousandths of an inch deeper than the leaf spring is thick and is substantially parallel to the upper surface of the member 70 to loosely receive one end of the spring valve 76. This end of the valve has an aperture to loosely admit the pin 75. The bottom of this end of cavity 77 adjacent the pin 75 gradually deepens toward the end of the cavity opposite the pin 75 thereby providing the bottom wall with a transverse shoulder 78 upon which the spring valve flexes when moved to an open position upon the downstroke of the piston. The intermediate portion of the cavity 77 is enlarged laterally to communicate at opposite sides with a pair of elongated parallel inlet ports 79 extending all the way through the inner surface of the member 70. In order to automatically unload the compressor when predetermined pressure in the reservoir is established, a governor mechanism 37 may be provided as in the preceding application with the push pins 50 depending through one of the inlet openings 73 of the valve seat element to flex the valve 76 to an open position; such flexing of the valve occurring in proximity to the shoulder 78 when maximum suction is created by the downstroke of the piston.

The valve carrying member 70 above each cylinder bore is also provided with an exhaust port 80, which extends all the way through the member 70 to communicate with the exhaust passage 66. This exhaust port 80 intermediate its ends is reduced in diameter to provide a valve seat portion or annular shoulder 81 for the reception of a triangular shaped free floating valve 82 normally held upon its seat by a coil spring 83 fitting within a cavity 84 of the cylinder head. These exhaust valve plates have a free riding fit within the enlarged portion of the exhaust ports above the seats and are automatically lifted therefrom upon the upstroke of the piston to permit the discharge of compressed air into the passage 64. The cavity 84 extends through a boss 84' extending into the passage 66 directly above the port 80. This boss serves as a stop to limit the lift of valve 82 and consequently the lift is determined by the depth of the enlarged portion of port 80 and the thickness of the gasket, thereby eliminating several fussy dimensions necessary when the construction of Fig. 6a is employed.

From the foregoing description, it will be seen that all of the fine machining of valve seats and valve attaching means is performed upon the separate valve carrying member 70 rather than upon the cylinder head and that as a consequence of this construction, no separate guards for the inlet valve are required as in the modification shown in Figs. 6 to 8 inclusive. However, as in the preceding modification, the inlet valves are floatingly retained in operative positions and in such manner as to preclude the setting up of any humming action of the valves when in operation. Furthermore, by reason of the independence of the valve carrying member 70 from the cylinder head, the passages in the latter can be readily cleaned of carbon or other foreign matter as well as the valve seats which can be easily taken out of the member 70 and cleaned or polished without disturbing or removing plate 70 from the cylinder.

It will of course be understood that these improvements are applicable to a single cylinder compressor as well as to prime movers and other types of pumps. It is also to be understood that various changes in the size, shape and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. In a compressor, the combination of a seat member having a port, and a flexible flat spring valve seating over said port and floatingly retained in an operative position with one end floatingly confined to cause slight flexure of the valve in maximum opening and closing movements.
2. In a compressor, the combination of a cylinder, a cylinder head having an inlet passage, a separate member clamped between the cylinder and cylinder head, said member having a valve cavity in its upper surface, the bottom of said cavity having inlet openings and forming a guard, a removable valve seat element closing the top of the cavity and having an opening adapted to

communicate with the inlet passage, and a floating valve loosely mounted between the element and bottom of said cavity.

3. In a compressor, the combination of a cylinder head, a valve guard, and a flat spring valve mounted between the valve guard and the cylinder head, said spring valve having one end free to flex, and having the other end loosely confined between the valve guard and the cylinder head.

4. In a compressor, the combination of a flat spring valve, a valve seat surface, and a valve guard having a stepped portion at one end adapted to engage the seat surface and be spaced therefrom a distance greater than the thickness of said valve, an inclined portion and a shoulder formed thereby adjacent to the stepped portion, the spring valve being floatingly retained between the stepped portion of the said valve guard and the valve seat surface with clearance sufficient to prevent reed action.

5. In a compressor, the combination of a spring valve, a valve seat surface, and a valve guard having a stepped portion at one end adapted to engage the seat surface and be spaced therefrom a distance greater than the thickness of said valve, an inclined portion and a shoulder formed thereby adjacent to the stepped portion, the spring valve being floatingly retained between the stepped portion of the said valve guard and the valve seat surface with clearance sufficient to prevent reed action, said valve flexing at said shoulder and having its maximum opening limited by the inclined portion of said valve guard, and said spring valve being returned to a normal position by its own inherent spring action.

6. In a compressor, the combination with a cylinder, a cylinder head member having a recess, the bottom of said recess having a depression adjacent one end thereof, a flat spring valve having a perforation near one end thereof, and a valve guard having a pin extending loosely through said perforation in the valve and into said depression to retain said valve in restricted floating condition prevent reed action thereof during rush of air thereby.

7. In a compressor, the combination of a cylinder, a removable cylinder head having a port, a removable plate clamped between the head and cylinder and having an elongated recess in its upper surface, the bottom of said recess having a smaller valve recess providing a shoulder and having a portion of its bottom inclined and another portion thereof provided with an upstanding pin, said plate having a port into said cylinder, a removable and reversible valve seat seated within said elongated recess upon said shoulder therein and having ports and an opening to receive said pin, and a flat spring valve loosely disposed in said valve recess and having an opening to loosely receive said pin, and said valve being adapted to seat against the bottom of said valve plate and to be flexed over the inclined bottom of the valve recess.

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