

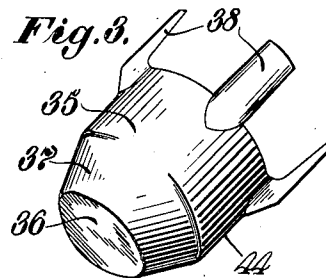
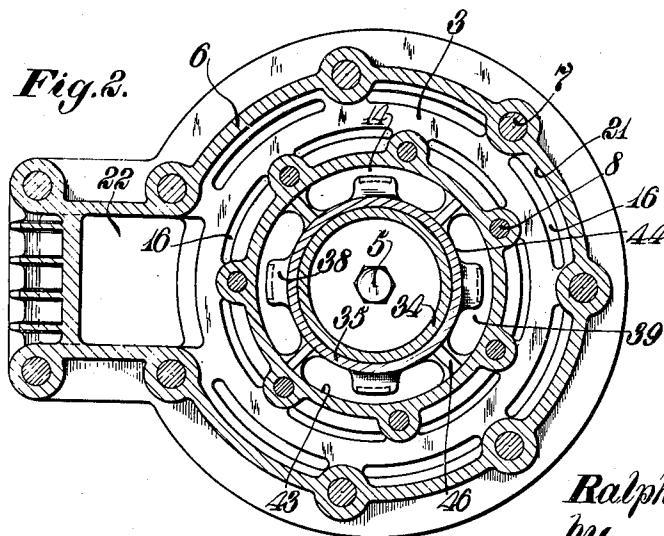
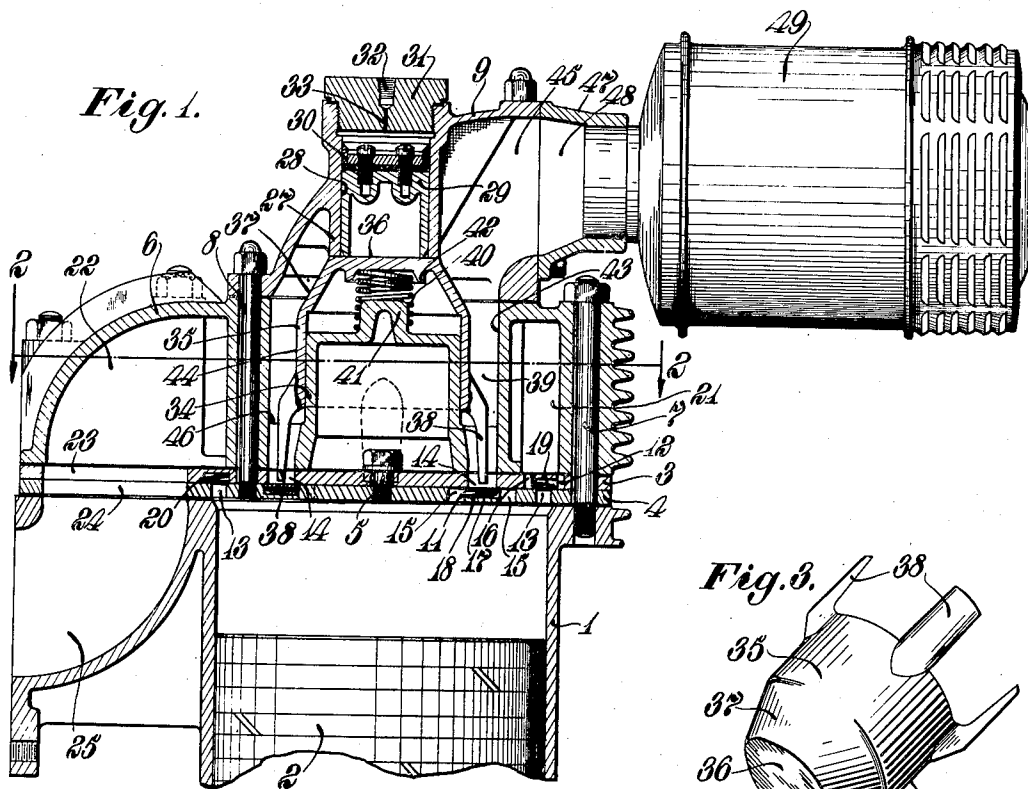
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AIR COMPRESSOR

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## UNITED STATES PATENT OFFICE

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## AIR COMPRESSOR

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This invention relates to air compressors and pumps, and more particularly to an improved and more efficient intake flow passage arrangement associated with the inlet valve means and improved compressor unloading mechanism whereby, due to streamlining, a smooth flow of air to the compressor intake is assured.

In most air compressors and pumps using inlet-valve opening as the method of unloading, the intake passage means associated with the inlet valve mechanism and the unloading mechanism, due to the particular location and design of the unloading mechanism, necessarily have had projections, both on the unloading elements and the associated casing, protruding into the path of air flow, and due to this, and to the irregular shape and tortuousness of the intake passages, flow has been restricted and eddy currents have been produced, thereby materially further impeding the flow, and, as a result, compressor efficiency has been quite materially decreased.

An object of the present invention is to provide an improved flow passage arrangement for the compressor or pump intake whereby a relatively smooth and free flow of air to the inlet valve means is attained. Another object is to provide in a compressor or pump an improved unloading mechanism of the inlet valve type and an improved flow passage arrangement associated therewith whereby a relatively free and smooth flow of air, past the unloading mechanism, to the compressor inlet valve is attained during loaded operation and whereby, during unloaded operation, as little power is used as possible during the rapidly alternated drawing in and forcing out of air relative to the compressor cylinder. A further object is to provide an improved "streamline" flow passage arrangement for the intake of an air compressor or pump. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

In the accompanying drawing there is shown for purposes of illustration one form which the invention may assume in practice.

In this drawing,—

Fig. 1 is a vertical sectional view taken through a compressor cylinder and cylinder head and the associated inlet valve means and unloading mechanism, constructed in accordance with one illustrative form of the invention.

Fig. 2 is a cross sectional view taken substantially on line 2—2 of Fig. 1.

Fig. 3 is a perspective view of an unloading plunger.

In this illustrative embodiment of the inven-

tion there is shown an air compressor of the vertical cylinder type, although it will be evident that the improved air passage arrangement and associated unloading mechanism may be embodied in air compressors of various other types. The compressor shown herein comprises a cylinder 1 containing a reciprocating piston 2 connected to any appropriate reciprocating means. Supported at the top of the cylinder is a pair of valve cage forming plates 3 and 4 secured together in superimposed relation by a center screw 5, the latter having a head contacting with a washer engaging the upper surface of the top plate 3 and having a shank passing through an opening in the top plate into threaded engagement with the bottom plate 4, so that the lower end of the screw is substantially flush with the bottom surface of the bottom plate. The valve cage plates are held in position on the top of the cylinder by means of a cylinder head 6 secured to the cylinder 1 as by means of bolts 7. Secured to the top surface of the head as by bolts 8 is a supplemental head 9, the bolts 8 passing through openings in the head bosses and valve plate 3 into threaded engagement with the lower valve plate 4 in the manner shown. In accordance with the usual practice, sealing gaskets are interposed between the joining surfaces of the various parts to prevent leakage. If desired, the supplemental head may be formed integral with the cylinder head, although for manufacturing purposes separate heads are more practical.

The valve cage plate assembly is herein of the combined inlet and discharge type, the lower plate having formed in its upper surface an annular recess 11 forming the valve chamber for the inlet valve, while the lower surface of the top plate 3 has formed therein an annular recess 12 forming a valve chamber for the discharge valve. Formed in the bottom plate is a series of arcuate discharge passages 13 communicating with the valve chamber 12, while formed in the top plate 3 is a series of arcuate inlet passages 14 for the valve chamber 11. In accordance with the usual practice, the sides of the inlet valve chamber 11 communicate as at 15 with inlet passages in the lower plate 4, while the upper plate 3 is likewise formed with slots 16 communicating with the valve chamber 12 to provide discharge passages. Arranged in the inlet chamber 11 is an annular plate valve 17 held in seated position against the lower face of the top plate 3 by means of a spring 18, and this valve controls the flow of air from the inlet passages 14 through the valve chamber and the slots 15 to the compressor cylin-

der. Arranged in the discharge chamber 12 is an annular plate valve 19 held in seated position against the top face of the bottom plate 4 by a spring 20, and this valve controls the flow of compressed air from the cylinder through passages 13 and through the valve chamber to the slots 16. Formed in the cylinder head is an annular discharge chamber 21 with which the discharge slots 16 communicate and from which the compressed air flows through a communicating downwardly curved passage 22 and registering passages 23 and 24 in the plates 3 and 4 respectively, to a discharge passage 25. It will thus be seen that as the compressor piston reciprocates, air at atmospheric pressure is drawn in through the inlet passages 14 and through the valve chamber and slots 15 to the upper end of the cylinder, and the compressed air is discharged from the cylinder through the discharge passages 13, through the valve chamber and discharge slots 16 to the discharge chamber 21 in the cylinder head and thence through the passages 22, 23, 24 and 25 to discharge.

Now referring to the improved intake passage arrangement embodied in the cylinder head and the associated inlet valve unloading mechanism, it will be noted that formed integral with the supplemental head 9 is a vertical cylinder 27 having a bore 28 in substantial alignment with the compressor cylinder bore, and this bore 28 contains a reciprocatory piston 29 carrying a usual cup packing 30 to prevent leakage past the piston. Secured within the upper end of the cylinder 27 is a detachable cap 31 having a connection 32 communicating through a passage 33 in the cap with the upper end of the cylinder bore 28 at the upper side of the piston 29. This connection 32 is adapted to be in communication with the compressor discharge pressure under the control of usual pilot valve means so that when the compressor discharge pressure exceeds a predetermined maximum, air pressure is conducted, under the control of the pilot valve means, through the connection 32 and passage 33 to the cylinder bore at the upper side of the piston 29 for a purpose to be later mentioned. Formed centrally within the cylinder head is an upstanding cylindrical guide portion 34 having slidably guided thereon a plunger 35 having a circular plane upper surface 36 with which the lower surface of the piston 29 is engageable. In this instance, the cylindrical vertical walls of the plunger 35 guided on the cylindrical portion 34 are connected at their top to the upwardly tapering upper portion of the plunger, which has a smooth exterior wall 37; and formed on the lower portion of the cylindrical guide portion of the plunger are depending fingers 38 projecting through annularly arranged passages 39 surrounding the cylindrical bearing portion 34, within the inlet passages 14 in the top plate 3. Interposed between the upper surface of the guide portion 34 and the inner surface of the plunger 35 is a coil spring 40 for constantly urging the plunger toward its uppermost position against the lower surface of the cylinder 27, this spring being centered on the guide portion 34 by a guide boss 41 and centered with respect to the plunger by means of an annular guide flange 42 on the plunger. The smooth inner cylindrical surface 43 of the flow passage 39 in the cylinder head and the smooth cylindrical exterior surface 44 of the plunger 35 cooperate with a curved flow passage 45 in the supplemental head 9 and the tapered exterior surface of the converging upper

walls of the plunger to provide a smooth "stream-line" flow passage through the supplemental head and the cylinder head to the inlet passages of the inlet valve, all protuberances projecting within the flow path being reduced to a minimum; and in conjunction with this smooth flow passage arrangement, the fingers 38 on the plunger and the strengthening webs 46 in the cylinder head, the latter leading to the cylindrical portion 34, are shaped to obtain a smooth flow of air past the same as the air flows through the annular flow space 39. Secured, as by bolts, to the supplemental head is a connection 47 having a passage 48 communicating with the passage 45, and supported within this connection is an air filter 49 of a conventional design through which atmospheric air flows to the intake passage means. As the cycle of air compression in a compressor of this type is well known to those skilled in the art, further description of the mode of operation and control is herein considered unnecessary other than to state that air at atmospheric pressure is drawn into the compressor cylinder, compressed, and discharged therefrom; and when the compressor discharge pressure exceeds a predetermined maximum, air pressure is admitted to the cylinder bore 28 at the upper side of the piston 29 to move the latter downwardly, thereby depressing the unloading plunger 35 to bring the depending fingers 38 thereof into engagement with the inlet valve plate 17 to unseat the latter, thereby to hold the inlet valve open, and as a result, unloading the compressor. When the compressor discharge pressure drops below a predetermined minimum, the pressure in the cylinder bore above the piston 29 is vented to atmosphere through the pilot valve means, causing the coil spring 40 to lift the unloading plunger 35 to its inoperative position, thereby permitting the inlet valve to operate in a normal manner.

As a result of this invention, it will be noted that an improved intake passage means is provided for an air compressor whereby a smooth flow of air to the inlet valve means is attained. It will further be noted that by associating the intake passage means with elements of the unloading means and by forming the unloading element with smooth exterior surfaces, an extremely smooth flow of inlet air is obtained past the unloading mechanism to the compressor inlet valve. Other uses and advantages of the invention will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In an air compressor, in combination, a cylinder containing a reciprocatory piston, a cylinder head, inlet valve means, a cylindrical guide portion formed in said head, a cylindrical unloading plunger guided on said guide portion and having a smooth exterior surface, said plunger adapted to engage and hold open the inlet valve means to unload the compressor, intake passage means associated with said cylinder head and including an annular flow passage formed in said head and surrounding said cylindrical plunger, and a sup-

plemental head attached to said cylinder head and having a cylinder containing a piston engageable with said plunger for actuating the latter, said passage means including an intake passage in said supplemental head communicating with said annular flow passage.

2. In a compressor, in combination, a cylinder containing a reciprocable piston, a cylinder head, inlet valve means, a centrally located cylindrical guide portion formed in said head, a cylindrical unloading plunger guided on said guide portion for axial movement with respect thereto and having a smooth exterior periphery, said plunger adapted to engage and hold open said inlet valve means to unload the compressor, a supplemental head attached to said cylinder head, a cylinder formed in said supplemental head containing a reciprocable piston engageable with said plunger for axially moving the latter, and intake passage means associated with said heads including an annular, smooth-walled flow passage formed in said cylinder head and surrounding said unloading plunger, and a communicating flow passage in said supplemental head.

3. In a compressor, in combination, a cylinder containing a reciprocable piston, a cylinder head, inlet and discharge valve means, a centrally located cylindrical guide portion formed in said head, a cylindrical unloading plunger guided on said guide portion for axial movement with respect thereto and having a smooth exterior periphery, said plunger adapted to engage and hold open said inlet valve means to unload the compressor, a supplemental head attached to said cylinder head, a cylinder formed in said supplemental head containing a reciprocatory piston engageable with said plunger for axially moving the latter, intake passage means associated with said heads including an annular, smooth-walled flow passage formed in said cylinder head and surrounding said unloading plunger and a communicating flow passage in said supplemental head, and an annular discharge passage surround-

ing said intake flow passage and separated therefrom and to which compressed air is discharged from the cylinder through said discharge valve means.

4. In an air compressor, in combination, a cylinder containing a reciprocatory piston, a cylinder head, inlet valve means, a cylindrical guide portion formed in said head, a cylindrical unloading plunger guided on said guide portion and adapted to engage and hold open said inlet valve means to unload the compressor, said plunger having a cylindrical portion of uniform diameter engaging said guiding portion and an upwardly tapering upper portion terminating in a plane circular top surface, and intake passage means associated with said head including an annular flow passage formed in said head and surrounding said cylindrical plunger and an elbow-like lateral supply connection mostly above said plunger.

5. In a compressor, in combination, a cylinder containing a reciprocatory piston, a cylinder head, inlet valve means, a centrally located cylindrical guide portion formed in said head, a cylindrical unloading plunger guided on said guide portion for axial movement with respect thereto and having a smooth exterior periphery and adapted to engage and hold open said inlet valve means to unload the compressor, said plunger having a cylindrical portion of uniform diameter engaging said guiding portion and an upwardly tapering upper portion terminating in a plane circular top surface, a supplemental head attached to said cylinder head, a cylinder formed in said supplemental head and containing a reciprocatory piston adapted to engage the top plane surface of said plunger for axially moving the latter, and intake passage means associated with said heads and including an annular smooth-walled flow passage formed in said cylinder head and surrounding said unloading plunger and a communicating flow passage in said supplemental head.

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