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E. PRESTAGE

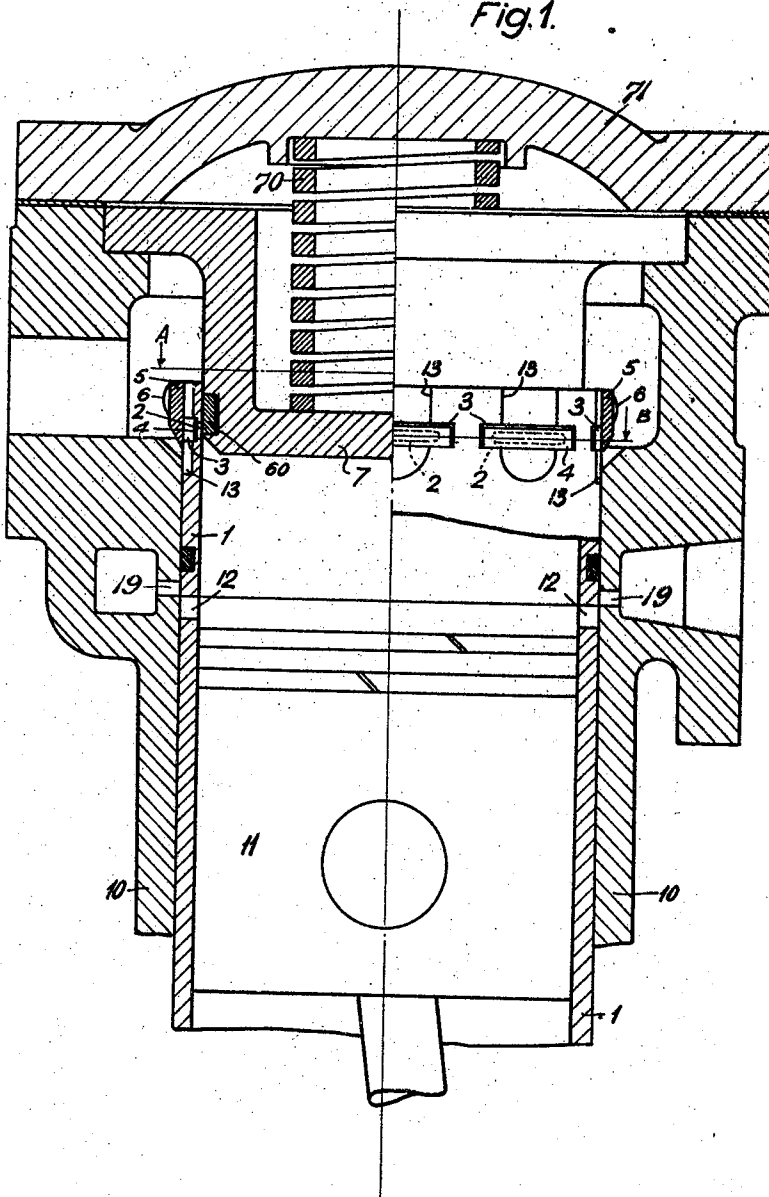
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HIGH PRESSURE GAS COMPRESSOR

Filed March 12, 1930

3 Sheets-Sheet 1

Fig. 1.



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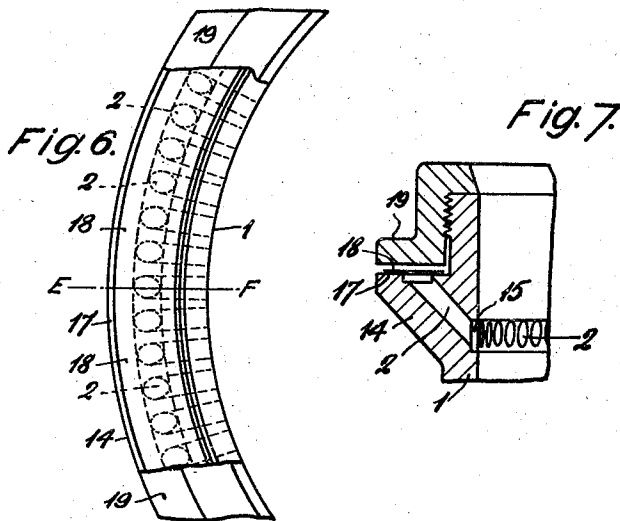
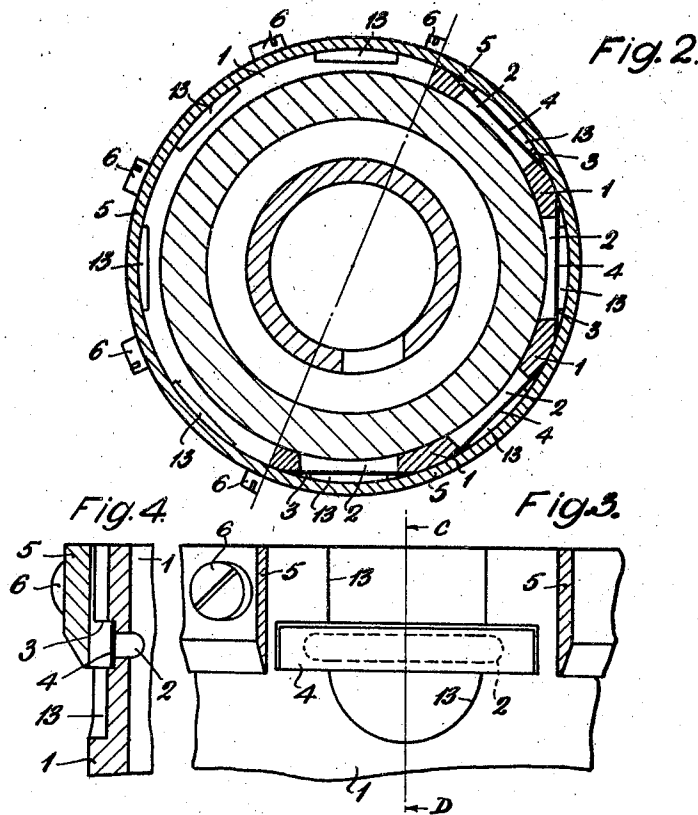
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HIGH PRESSURE GAS COMPRESSOR

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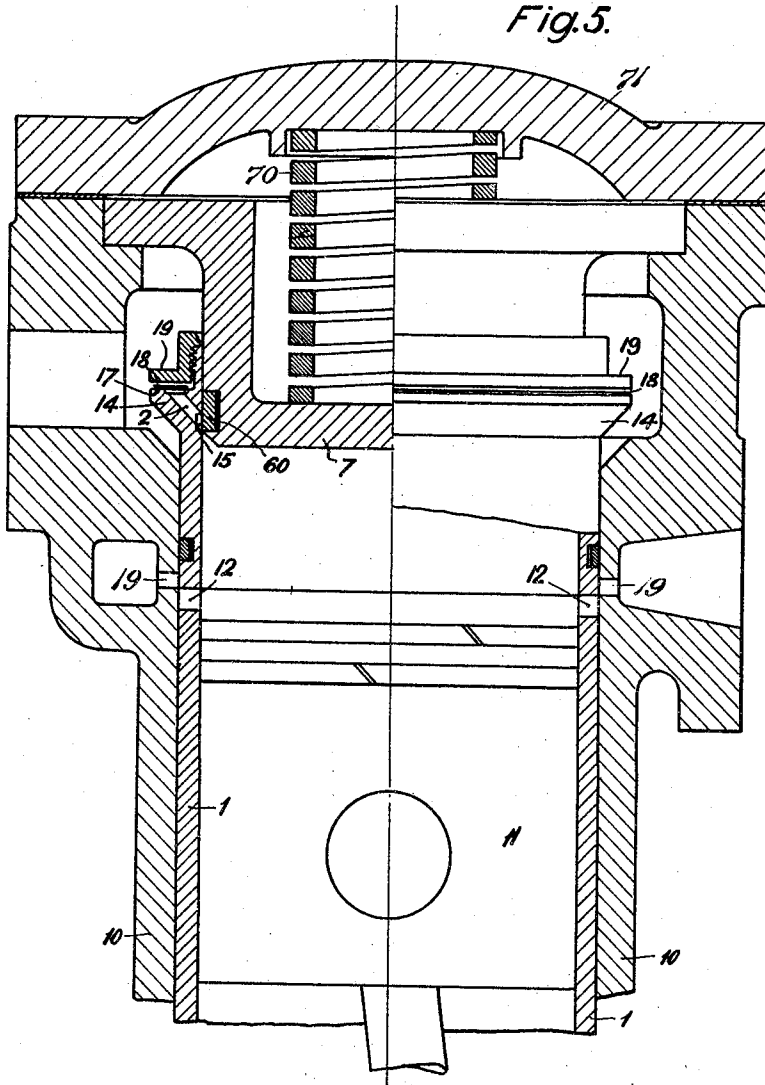
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HIGH PRESSURE GAS COMPRESSOR

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Fig. 5.



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UNITED STATES PATENT OFFICE

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HIGH PRESSURE GAS COMPRESSOR

Application filed March 12, 1930, Serial No. 435,246, and in Great Britain June 27, 1929.

The present invention relates to improvements in those high pressure gas compressors in which a sleeve valve is arranged between the piston and the cylinder and reciprocated in a partly contrary direction to the piston. This sleeve valve may be provided with both inlet and outlet ports controlling both the entry of air or gas to the cylinder and the exit from the cylinder or this sleeve may be combined with an outlet valve of the automatic type mounted in the cylinder head. Experience has shown that both these forms of outlet valve have advantages and disadvantages when used in high speed compressors. In the first form the discharge ports or openings in the sleeve, while shutting immediately the piston gets to the end of its stroke, do not admit of automatic opening to suit the varying pressures which may occur due to differences in the compression ratio. For instance when air only is being compressed from say 15 lbs. per square inch up to 100 lbs. per square inch giving a ratio of about 6:5, the discharge ports open too early, the result being that the discharge pressure is allowed to flow back during the latter part of the stroke into the cylinder before this pressure would be arrived at due to the normal compression of the air or gas, thus increasing the load on the piston and the power required to drive the machine. The automatic outlet valve in the cylinder head adjusts to varying pressures in the cylinder but has the disadvantage always experienced with such valves when a compressor is run at high speeds. In addition to valve slip or chatter such a valve tends to break up at higher speeds than about 300 R. P. M.

The present invention is designed to provide a form of outlet valve for a sleeve valve high pressure gas compressor which gives in use the advantages of both forms of outlet valve hitherto used in such a compressor without their disadvantages.

Briefly stated the present invention provides an outlet valve carried on and moving with the sleeve valve comprised of a series of outlet ports cut through the wall of said sleeve valve and co-acting with a series of

wafer valves or with a diaphragm ring valve covering the mouths of said ports.

My invention is illustrated by way of example in the accompanying drawings, in which—

Figure 1 shows a sectional elevation of the compressor cylinder with a portion of the sleeve valve and cylinder head shown in full.

Figure 2 shows a transverse section on the line A—B of Figure 1.

Figure 3 shows a detail view of a portion of the upper part of the sleeve valve shown in Figures 1 and 2 with the housing broken away to show a wafer valve in position over the mouth of a port.

Figure 4 shows a section on the line C—D of Figure 3.

Figure 5 shows a half sectional elevation of an alternative form of the invention.

Figure 6 shows a plan view of a portion of the port enlargement at the upper end of the sleeve valve with the guard plate broken away to show the diaphragm ring, and

Figure 7 shows a section on the line E—F of Figure 6.

The drawings show partial views of two forms of a sleeve valve high pressure gas compressor of the character described in which a sleeve valve 1 with inlet ports 12 is reciprocated within the cylinder 10 in a partly contrary direction to the piston 11 and said ports 12 are adapted to open to the fluid inlets 19 spaced around the wall of said cylinder 10 during said movement of the sleeve valve. As shown this cylinder 10 is preferably fitted with a false head 7 held down by a strongly coiled spring 70 placed between it and the cylinder cover 71. A sufficient clearance is provided between this false head and the cylinder cover to allow of the lifting of the cylinder head and the expulsion by the piston through the discharge ports of any oil or other foreign matter which may have passed into the cylinder.

In Figures 1 to 4 a construction is shown in which a series of spaced horizontal slots are cut through the upper end of the sleeve valve 1 and form the outlet ports 2 for the compressed air or gas. A series of spaced horizontal slots are cut through the upper

end of the sleeve valve 1 and form the outlet ports 2 for the compressed air or gas. A series of horizontal flats or grooves are milled out around said slots on the external surface of the sleeve valve thus forming recesses 3 in the external surface of the sleeve valve which are adapted to receive a series of correspondingly shaped wafer or feather valves 4 when seated in said recesses to close the air or gas outlet ports 2 formed by the said horizontal slots. In order to allow said wafer valves 4 to lift off their seatings and yet be retained in the recesses 3 in which they move, these valve recesses are surrounded by a retaining ring or housing 5 conveniently fastened by the screws 6 as shown to the upper end of the sleeve valve 1. It will be readily understood that such a retaining ring 5 will allow of a small outward movement to the ends of the wafer valves 4 and a larger movement to their central portions thus allowing them to bow outwards under air or gas pressure from the interior of the sleeve valve when the ports 2 are in open position below the junk ring 60 on the compressor head 7. As shown in Figure 1 this junk ring 60 shuts off the ports 2 from communication with the cylinder 10 when these ports are raised to the position shown owing to the upward movement of the sleeve as the piston 11 reaches the position in its stroke which opens the inlet ports 12.

In order to allow of a free outlet for the air or gas I prefer to provide in the outer surface of the sleeve valve a corresponding series of relatively narrow vertical slots 13 extending across said outlet ports 2 from the upper end of said sleeve valve 1 well below the retaining ring or housing 5 enclosing the series of wafer valves 4.

In the construction shown the outlet valves formed by the ports and their wafer valves are carried on and move with the sleeve valve 1. The said wafer valves 4 prevent any back rush of air or gas when the pressure in the cylinder 10 is lower than the pressure outside the sleeve valve while these wafer valves open automatically when the pressure in the cylinder is higher than the external pressure. As the cut off is accomplished by the upward movement of the sleeve valve in the cylinder and does not depend upon the wafer valves, even at very high speeds, these latter return to their seatings before they are again required to open and consequently do not allow of any slip of air or gas back into the cylinder owing to late closing.

An alternative form of my invention is shown in Figures 5 to 7, in which an enlargement 14 is formed at the upper end of the sleeve valve at the point where the outlet ports are placed and a slot 15 is cut on the inner face of the sleeve valve and a

series of holes forming the outlet ports 2 are drilled down to meet the slot from its upper face 17. A diaphragm ring 18 is then laid on to this face 17 to form a valve and a guard plate 19 is arranged above this ring valve to restrict its lift. In the construction shown the complete valve so formed is carried on and moves with the sleeve valve, so that when the ports 2 in the downward travel of the sleeve valve 1 are exposed to the cylinder 10, the ring valve 18 prevents a backrush of air or gas when the pressure in said cylinder is lower than the pressure above the valve and said ring opens automatically, when the pressure in the cylinder is higher than the pressure above the said valve. The cut-off is accomplished on the upward movement of the sleeve valve in the cylinder by the junk ring 60 on the compressor head 7 and does not depend upon the ring 18, which consequently has plenty of time to come down on to its seat before it is again required to open. Such a valve does not allow of any slip of gas or air back into the cylinder owing to the late closing of the automatic valve, and consequently it can be made particularly light to eliminate noise, and can be worked without a spring above it to eliminate wear.

What I claim is:—

1. A high pressure air or gas compressor comprising a cylinder with fluid inlets spaced around its wall, a piston reciprocating in said cylinder, a cylinder head projecting into said cylinder with a receiving chamber surrounding said head above said cylinder, a sleeve valve reciprocating between said piston and cylinder head and the cylinder provided with inlet ports adapted to open to said fluid inlets and outlet ports adapted to open to said receiving chamber and a cover for the mouths of said outlet ports adapted to prevent a back rush of discharged fluid when the pressure in the cylinder is lower than the pressure in said receiving chamber.

2. A high pressure air or gas compressor comprising a cylinder with fluid inlets spaced around its wall, a piston reciprocating in said cylinder, a cylinder head projecting into said cylinder, a sleeve valve reciprocating between the piston and cylinder head and the cylinder provided with a series of inlet ports adapted to open to said fluid inlets and with a series of outlet ports cut through the wall of said sleeve valve near its upper end and adapted to open to a receiving chamber surrounding said cylinder head when said piston is near the end of its upward stroke and a cover for the mouths of said outlet ports adapted to close said ports to prevent a back rush of discharged fluid when the pressure in the cylinder is lower than the pressure in said receiving chamber.

3. A high pressure air or gas compressor comprising a cylinder with fluid inlets spaced around its wall, a piston reciprocating in said cylinder, a cylinder head projecting into said cylinder, a sleeve valve reciprocating between the piston and cylinder head and the cylinder provided with a series of inlet ports adapted to open to said fluid inlets and with a series of outlet ports cut through the wall of said sleeve valve near its upper end adapted to open to a receiving chamber surrounding said cylinder head when said piston is near the end of its upward stroke, a cover for the mouths of said outlet ports adapted to close said ports to prevent a back rush of discharged fluid when the pressure in the cylinder is lower than the pressure in said receiving chamber, and a guard member adapted to limit the movement of said cover away from the mouths of said outlet ports.

4. A high pressure air or gas compressor comprising a cylinder with fluid inlets spaced around its wall, a piston reciprocating in said cylinder, a cylinder head projecting into said cylinder, a sleeve valve reciprocating between the piston and cylinder head and the cylinder provided with a series of inlet ports adapted to open to said fluid inlets and with a series of outlet ports cut through the wall of said sleeve valve near its upper end adapted to open to a receiving chamber surrounding said cylinder head when said piston is near the end of its upward stroke and a series of wafer valves seated in recesses around the mouths of said outlet ports and adapted to close said ports to prevent a back rush of discharged fluid when the pressure in the cylinder is lower than the pressure in said receiving chamber surrounding the cylinder head.

5. A high pressure air or gas compressor comprising a cylinder with fluid inlets spaced around its wall, a piston reciprocating in said cylinder, a cylinder head projecting into said cylinder, a sleeve valve reciprocating between the piston and cylinder head and the cylinder provided with a series of inlet ports adapted to open to said fluid inlets and with a series of outlet ports cut through the wall of said sleeve valve near its upper end adapted to open to a receiving chamber surrounding said cylinder head when said piston is near the end of its upward stroke, a series of wafer valves seated in recesses around the mouths of said outlet ports and adapted to close said ports to prevent a back rush of discharged fluid when the pressure in the cylinder is lower than the pressure in said receiving chamber and a guard member adapted to limit the movement of said wafer valves away from the mouths of said outlet ports.

6. A high pressure air or gas compressor comprising a cylinder with fluid inlets

spaced around its wall, a piston reciprocating in said cylinder, a cylinder head projecting into said cylinder, a sleeve valve reciprocating between the piston and cylinder head and the cylinder provided with a series of inlet ports adapted to open to said fluid inlets and with a series of outlet ports cut through the wall of said sleeve valve near its upper end adapted to open to a receiving chamber surrounding said cylinder head when said piston is near the end of its upward stroke, a series of wafer valves seated in recesses around the mouths of said outlet ports and adapted to close said ports to prevent a back rush of discharged fluid when the pressure in the cylinder is lower than the pressure in said receiving chamber, and a housing encircling the upper end of the sleeve valve and adapted to allow a small outward movement to the ends of said wafer valves and a larger outward movement to their central portions.

7. A high pressure air or gas compressor comprising a cylinder with fluid inlets spaced around its wall, a piston reciprocating in said cylinder, a cylinder head projecting into said cylinder, a sleeve valve reciprocating between the piston and cylinder head and the cylinder provided with a series of inlet ports adapted to open to said fluid inlets and with a series of outlet ports cut through the wall of said sleeve valve near its upper end adapted to open to a receiving chamber surrounding said cylinder head when said piston is near the end of its upward stroke, a series of wafer valves seated in recesses around the mouths of said outlet ports and adapted to close said ports to prevent a back rush of discharged fluid when the pressure in the cylinder is lower than the pressure in said receiving chamber and a ring encircling the upper end of the sleeve valve and adapted to allow a small outward movement to the ends of said wafer valves and a larger outward movement to their central portions.

8. A high pressure air or gas compressor comprising a cylinder with fluid inlets spaced around its wall, a piston reciprocating in said cylinder, a cylinder head projecting into said cylinder, a sleeve valve reciprocating between the piston and cylinder head and the cylinder provided with a series of inlet ports adapted to open to said fluid inlets and with a series of spaced horizontal slots forming outlet ports cut through the wall of said sleeve valve near its upper end adapted to open to a receiving chamber surrounding said cylinder head when said piston is near the end of its upward stroke, and a series of wafer valves seated in horizontal recesses around the mouths of said outlet ports and adapted to close said ports to prevent a back rush of discharged fluid when the pressure in the cylinder is lower

than the pressure in said receiving chamber.

9. A high pressure air or gas compressor comprising a cylinder with fluid inlets spaced around its wall, a piston reciprocating in said cylinder, a cylinder head projecting into said cylinder, a sleeve valve reciprocating between the piston and cylinder head and the cylinder provided with a series of inlet ports adapted to open to said fluid inlets and with a series of spaced horizontal slots forming outlet ports cut through the wall of said sleeve valve near its upper end adapted to open to a receiving chamber surrounding said cylinder head when said piston is near the end of its upward stroke, a series of wafer valves seated in horizontal recesses around the mouths of said outlet ports and adapted to close said ports to prevent a back rush of discharged fluid when the pressure in the cylinder is lower than the pressure in said receiving chamber, and a housing encircling the upper end of the sleeve valve and adapted to allow a small outward movement to the ends of said wafer valves and a larger outward movement to their central portions.

10. A high pressure air or gas compressor comprising a cylinder with fluid inlets spaced around its wall, a piston reciprocating in said cylinder, a cylinder head projecting into said cylinder, a sleeve valve reciprocating between the piston and cylinder head and the cylinder provided with a series of inlet ports adapted to open to said fluid inlets and with a series of spaced horizontal slots forming outlet ports cut through the wall of said sleeve valve near its upper end adapted to open to a receiving chamber surrounding said cylinder head when said piston is near the end of its upward stroke, a series of wafer valves seated in horizontal recesses around the mouths of said outlet ports and adapted to close said ports to prevent a back rush of discharged fluid when the pressure in the cylinder is lower than the pressure in said receiving chamber and a ring encircling the upper end of the sleeve valve and adapted to allow a small outward movement to the ends of said wafer valves and a larger outward movement to their central portions.

In testimony whereof I have signed my name to this specification.

EDWIN PRESTAGE.