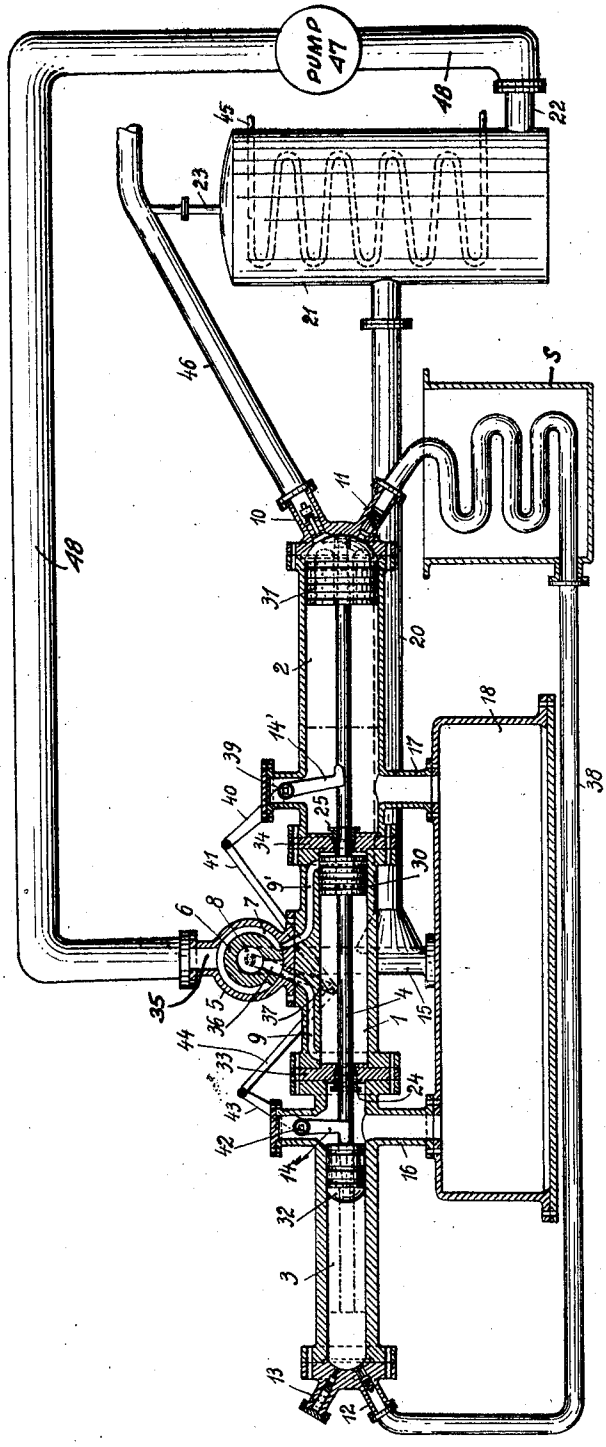
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FLUID COMPRESSOR

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FLUID COMPRESSOR

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My invention relates to improvements in fluid compressors, and more particularly in compressors for compressing gases such as acetylene which when subject to high pressure are liable to be decomposed. The object of the improvements is to provide a compressor which consists of low and high pressure cylinders and a motor cylinder adapted to be operated by means of a suitable liquid under pressure, the said cylinders being arranged in axial alignment and having their pistons or plungers mounted on a common piston rod extending through all the cylinders. In the preferred construction the motor cylinder is located between the low and high pressure cylinders. Another object of the improvements is to provide a compressor in which the pressure liquid is used for cooling and lubricating the walls of the compressor cylinders. With this object in view my invention consists in connecting the compressor cylinders at the end opposite to the compressing chamber thereof with the tank in which the oil delivered from the motor cylinder is collected.

Other objects of the improvements will appear from the following description of the invention.

For the purpose of explaining the invention an example embodying the same has been illustrated in the accompanying drawing showing a sectional elevation of the compressor.

In the example shown in the drawing my improved compressor comprises a motor cylinder 1, a low pressure cylinder 2 and a high pressure cylinder 3, all of the said cylinders being in axial alignment and connected with each other at their adjacent ends, and the motor cylinder 1 being located between the compressor cylinders 2 and 3. At their inner ends the cylinders 2 and 3 are formed with tubular extensions 16 and 17 by means of which they are supported on a tank 18. The pistons 30, 31 and 32 of the said cylinders are mounted on a common piston rod 4 extending through the motor cylinder 1 and into the compressor cylinders 2 and 3, suitable stuffing boxes 24 and 25 being provided in the cylinder heads 33 and 34. To the motor cylinder 1 a valve chest 5 is fixed in which a valve 6 is mounted. As shown the valve chest and valve are cylindrical in form, and a circumferential passage 7 made in the valve is in communication with an intake passage 35 through which the pressure liquid is supplied to the cylinder 1. The passage 7 is adapted for being alternately thrown into communication with ports 9 and 9′ through which the pressure liquid is alternately supplied to the opposite ends of the cylinder. An axial passage 8 made in the valve body 6 is adapted for communication with the ports 9 and 9′ through a passage 36, and it is connected with the tank 18 by a pipe 15. At the outer end of the low pressure cylinder 2 an intake valve 10 and a pressure valve 11 of any known or preferred construction are provided. Similar intake and discharge valves 12 and 13 are provided at the outer end of the high pressure cylinder 3. The intake valve 10 is connected by a pipe 46 with the supply for the gas to be compressed. The discharge valve 11 is connected by a pipe 38 with the intake valve 12, a cooler S being preferably provided for cooling the gas delivered from the low pressure cylinder. The discharge valve 13 is connected with a container for the compressed gas.

The valve 6 is adapted to be rocked by suitable means for alternately supplying the pressure liquid to opposite ends of the cylinder 1. To show what may be done, an arm 14′ fixed to a rock shaft 39 is located within the cylinder 2 at the inner side of the piston 31 and in position for being engaged by the said piston. To the said rock shaft 39 a lever 40 is keyed which is connected by a link 41 with a lever 37 connected with the valve 6 and adapted to impart rocking movement thereto. A similar arm 14 is located within the cylinder 3, which arm is keyed to a rock shaft 42 having a lever 43 keyed thereto, which lever is connected by a link 44 with the said lever 37.

The pipe 15 is connected by a pipe 20 with a tank 21 in which the pressure liquid is collected. The said tank is connected at 22 with a power operated pump 47 for returning the liquid under pressure through pipe 48 to the

valve chest 5. Preferably, cooling means are provided for cooling the liquid contained within the tank 21. To show what may be done, a coil 45 is located within the said tank through which a suitable cooling liquid is circulated. Further, in some cases, the said tank is connected at its top through a pipe 23 with the intake pipe 46 connected with the valve 10.

In describing the operation of the machine, it will be assumed that acetylene is to be compressed. As is known, at high pressure acetylene gas tends to be decomposed, and further, care must be taken, that the acetylene gas be not brought in contact with other fluids such as water which by decomposition might spoil the acetylene gas. For this reason I use oil, and preferably a hydrocarbon oil, as a pressure fluid for operating the machine.

In the operation of the machine the said oil is stored within the tank 21, and it is supplied therefrom through the discharge 22 of the said tank by the pump to the valve chest 5. In the position of the valve shown in the figure the oil under pressure flows through the circumferential passage 7 and the port 9′ to the right hand side of the piston 30, which is thereby forced to the left, the oil contained within the cylinder 1 being simultaneously removed through the port 9, the passages 36 and 8, and the pipe 15, to the tank 18. By the movement of the piston 30 to the left, the piston 31 of the low pressure cylinder 2 is likewise moved to the left, so that a new charge of acetylene gas is taken in through the intake pipe 46 and the valve 10. Further, the piston 32 of the cylinder 3 is forced to the left, thus compressing the gas previously taken into the said cylinder and delivering the same under pressure through the valve 13 and into the storage tank. Near the end of its stroke the piston 31 engages the arm 14′ thus rocking the same to the left, while the arm 40 is rocked to the right. Thereby the valve 6 is rocked into the position for connecting the right hand part of the cylinder 1 with the discharge passages 36 and 8, and the left hand part with the supply 35 of oil under pressure. Therefore, the pistons 30, 31 and 32 are forced to the right. Thereby the acetylene gas taken into the low pressure cylinder 2 is partly compressed and delivered through the cooler S, the pipe 38 and the valve 12 into the high pressure cylinder 3, the piston 32 of which is moving to the right. Since the acetylene gas supplied to the cylinder 3 has been partly compressed, it assists the movement of the pistons to the right.

When the pistons arrive at the end of their strokes, the piston 32 engages the arm 14 so that the valve 6 is rocked into the position shown in the figure by means of the rock shaft 42, the arm 43, the link 44 and the lever 37, whereupon the operation is repeated in the manner described above.

The tank 18 serves as a foundation for the compressor and as an oil reserve tank, for receiving the oil after its use in the motor cylinders and for delivering the oil again to the motor cylinders. If either compressor piston advances towards the valves a vacuum is generated behind said piston and oil is drawn into said compressor cylinder from the tank 18.

This oil acts simultaneously as a cooling means and as a lubricating means for the inner wall of the cylinder. If, as shown in the drawing, the high pressure piston is just beginning to advance towards the valves, a relatively small amount of oil is drawn from the vessel 18 owing to the comparatively small volume of the high pressure cylinder. If, on the other side, later on, the low pressure piston is advancing towards the valves, a much larger volume of oil is drawn from the vessel 18. There is a pipe connection between the higher oil level in the main oil tank 21 and the tank 18 consisting in the pipes 15 and 20 for delivering sufficient oil to the low pressure cylinder if and when the oil contents of the tank 18 are not sufficient per se. On the other hand, this pipe connection 15, 20 is used for conducting any surplus of oil from the tank 18 to the tank 21 when the high pressure piston is compressing, that is a comparatively large quantity of oil is delivered from the low pressure cylinder to the tank 18. By these means applicant insures that no empty space will occur behind the two cylinders but that these spaces will always be filled with oil for the purpose of cooling and lubricating, as stated above.

In case of leakage of gas past the pistons 31 and 32 and into the inner chambers of the cylinders 2 and 3, the said gas is carried by the oil into the tank 18 and through the pipe 20 into the tank 21, where it is again separated from the oil and supplied to the suction pipe 46. Thus loss of oil and spoiling of the air of the work shop by the acetylene gas are avoided.

In my improved compressor no stuffing boxes are needed for closing the chambers of the high and low pressure cylinders as against the escape of air. The stuffing boxes 24 and 25 merely have the function to prevent the escape of pressure liquid from the cylinder. Preferably the packing medium consists of leather. Should any oil escape through the said stuffing boxes, the said oil flows directly into the tank 18 from which it is again supplied to the tank 21 of the pump.

In case of an accidental explosion of the acetylene gas in one of the cylinders caused by the compression of the gas, the oil taken into the inner part of the cylinders 2 or 3 takes up the impact imparted by the explosion to the pistons 31 and 32, the body of oil being partly repelled by the impact. Thus any injury to the compressor is avoided. Ex-

perience has shown that explosion is most likely to occur after compression of the acetylene gas, that is within the cylinder 3 and after the piston 32 has completed the greater part of its outward stroke. Thus, if explosion occurs, the piston 32 has a comparatively long way to the right on which it transmits the impact to the body of oil taken into the cylinder, the pistons and the media acting thereon having a function similar to a hydraulic or pneumatic shock absorber. Experience has shown, that after explosion cooling of the gas takes place very rapidly so that the pressure caused by the explosion is reduced to normal pressure before the pistons have arrived at the end of their stroke.

While in describing the invention reference has been made to a particular example embodying the same I wish it to be understood that my invention is not limited to the construction shown in the drawing, and that various changes may be made in the general arrangement of the apparatus and the construction of its parts without departing from the invention. For example I do not limit myself to the use of a rotary valve controlling the supply of pressure fluid to the cylinder, or to the means for reversing the operation of the said valve. It is evident that many changes may be made in the specific construction and arrangement described, and the scope of the invention is to be defined therefore only by the following claims:

What I claim is:—

1. An acetylene compressor comprising a high pressure cylinder, a low pressure cylinder, and a motor cylinder all arranged in axial alignment, pistons reciprocable in said cylinders, a piston rod common to all of the said cylinders and connected with said pistons, intake and delivery valves provided at one end of each of said pressure cylinders, the delivery valve of the low pressure cylinder communicating with the intake valve of the high pressure cylinder, means for regulating a supply of oil under pressure to the motor cylinder, and a receptacle communicating with said motor cylinder, and also communicating with each pressure cylinder behind the piston therein so that each piston on its compressing stroke will draw into its respective pressure cylinder some of the oil.

2. The acetylene compressor recited in claim 1 wherein the regulating means for the supply of oil under pressure comprises a valve plug provided with inlet and outlet passages, ports in the motor cylinder opening into the motor cylinder at opposite ends of the piston therein, and means for moving said valve plug inlet and outlet passages alternately into communication with each of said ports.

3. An acetylene compressor comprising a high pressure cylinder, a low pressure cylinder, and a motor cylinder all arranged in axial alignment, pistons reciprocable in said cylinders, a piston rod common to all of the said cylinders and connected with said pistons, intake and delivery valves provided at one end of each of said pressure cylinders, the delivery valve of the low pressure cylinder communicating with the intake valve of the high pressure cylinder, a valve plug for supplying oil under pressure to the motor cylinder and provided with inlet and outlet passages, ports in the motor cylinder opening into the motor cylinder at opposite ends of the piston therein, means for moving said valve plug inlet and outlet passages alternately into communication with each of said ports, a receptacle communicating with the outlet passage of said valve plug, and also communicating with each pressure cylinder behind the piston therein so that each piston on its compressing stroke will draw into its respective pressure cylinder some of the oil.

4. An acetylene compressor comprising a high pressure cylinder, a low pressure cylinder, and a motor cylinder all arranged in axial alignment, pistons reciprocable in said cylinders, a piston rod common to all of the said cylinders and connected with said pistons, intake and delivery valves provided at one end of each of said pressure cylinders, the delivery valve of the low pressure cylinder communicating with the intake valve of the high pressure cylinder, a conduit for supplying acetylene to the intake valve of the low pressure cylinder, means for regulating a supply of oil under pressure to the motor cylinder, a receptacle communicating with said motor cylinder, and also communicating with each pressure cylinder behind the piston therein, and a tank for the oil communicating at its top with the conduit connected to the intake of the low pressure cylinder and also communicating with said receptacle.

5. In a compressor, the combination, of a high pressure cylinder, a low pressure cylinder, and a motor cylinder all arranged in alignment, pistons reciprocatable in said cylinders, a valve device comprising a plug for supplying oil as a driving medium to the said motor cylinder, intake and delivery valves provided at one of the ends of said high and low pressure cylinders, a receptacle for the oil communicating with said high and low pressure cylinders at the sides opposite to the valves thereof, a conduit connecting the said receptacle with the outlet passage of the said plug, and a pressure balancing tank connected with said receptacle.

In testimony whereof I have affixed my signature.

JOSEF MACHTOLF.