A. O. CARPENTER.

COMPRESSOR.

APPLICATION FILED JAN. 6, 1921.

1,393,085.

Patented Oct. 11, 1921.

2 SHEETS—SHEET 1.

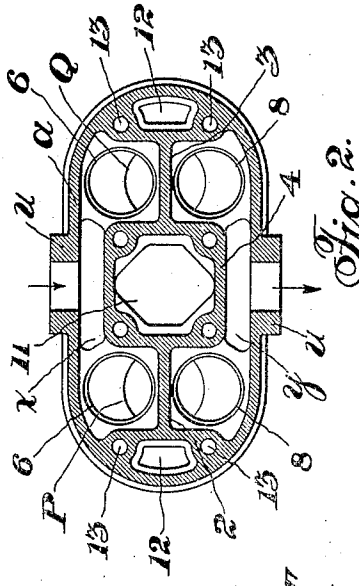


Fig. 2.

Fig. 1.

INVENTOR

Allan O. Carpenter

BY

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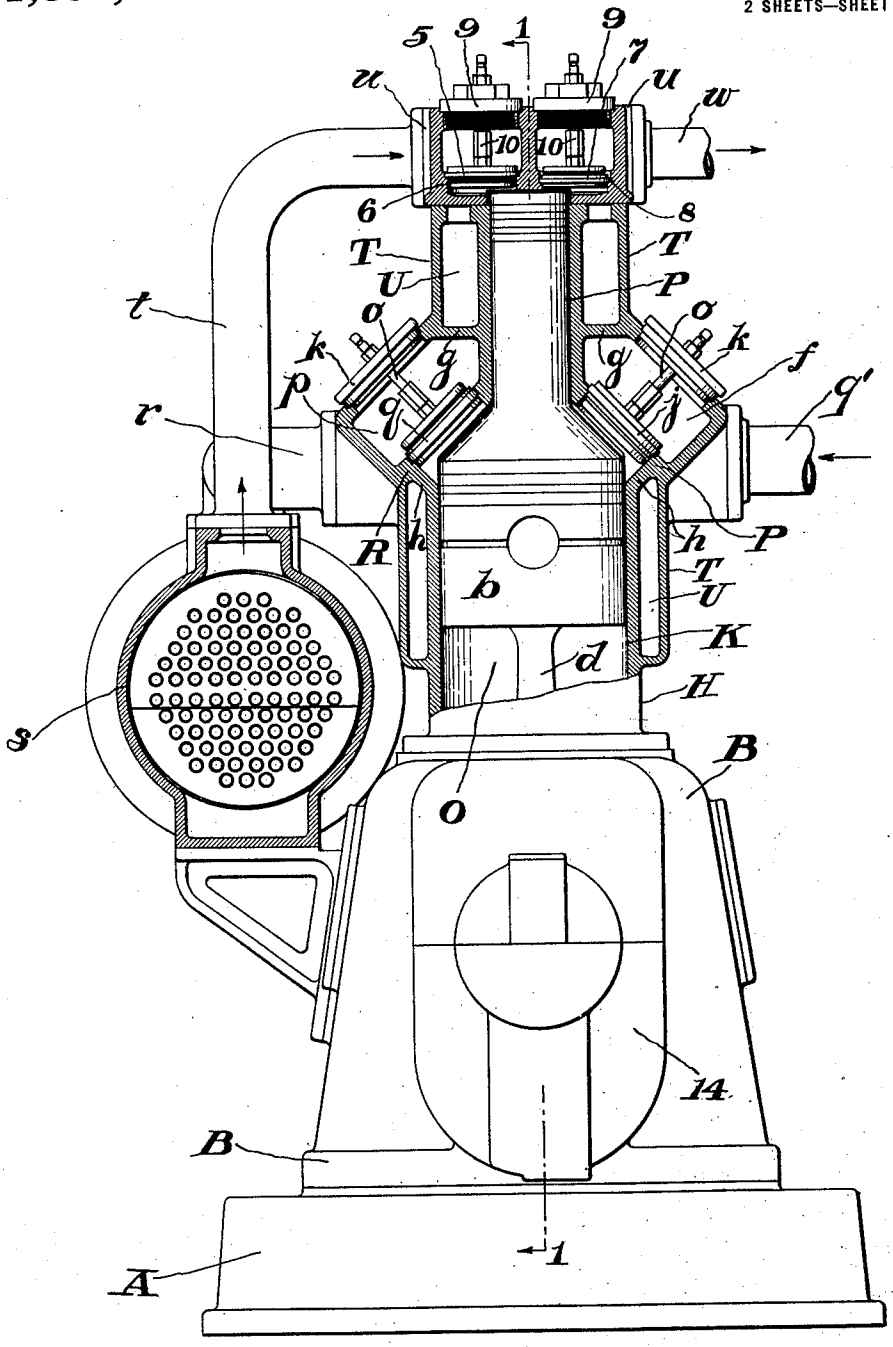


Fig. 3

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COMPRESSOR.

1,393,085. Specification of Letters Patent. Patented Oct. 11, 1921.

Application filed January 6, 1921. Serial No. 435,479.

To all whom it may concern:

Be it known that I, ALLAN O. CARPENTER, a citizen of the United States, and a resident of Corning, county of Steuben, State of New York, have invented a certain Compressor, of which the following is a specification accompanied by drawings.

This invention relates to vertical multi-stage compressors, but more particularly to an improved unitary cylinder construction in the form of duplex differential cylinders adapted for high pressures.

The objects of the invention are primarily to conserve space without reduction of power or loss of efficiency and enable the compressor to be used for instance, as a Diesel engine starter for marine work and for other purposes in which a high pressure compressor is particularly necessary or desirable, but the space permissible for the compressor is limited.

In carrying out my invention, I have produced a unitary block cylinder construction in which duplex high pressure differential cylinders are cast or constructed in block form in one piece, the low pressure cylinder bores of larger diameter being located side by side and consequently having a cylinder wall partly in common. The cylinders are preferably water jacketed, and the water jacket casing forms an integral part of the unitary cylinder construction. Suitable valve controlled inlet and discharge chambers are provided for the high and low pressure cylinder bores and the whole construction including the inter-cooler and driving mechanism is designed as compactly as possible compatible with efficient results.

Further objects of the invention will hereinafter appear and to all of these ends the invention consists of the apparatus shown in one of its preferred forms in the accompanying drawings in which—

Figure 1 is a longitudinal sectional elevation of a compressor embodying the invention taken on the line 1—1 of Fig. 3 looking in the direction of the arrows.

Fig. 2 is an enlarged detail transverse sectional plan view taken on the line 2—2 of Fig. 1 through the cover or head for the high pressure cylinder portions and

Fig. 3 is an end elevation of the compressor partly in transverse vertical section looking at the left hand end of the machine as illustrated in Fig. 1.

Referring to the drawings, the machine is provided with a suitable base A upon which is mounted the compressor frame B having the crank shaft bearings C for the crank shaft D adapted to be driven by any suitable motor E. The bearings are preferably provided with the usual sleeves F and main bearing caps G of any suitable construction.

In this instance the unitary cylinder construction comprises two duplex high pressure differential cylinders H and J constructed in block form in one piece, although I am not to be understood as limiting the invention to two cylinders. The low pressure cylinder bores K and L of larger diameter are located side by side and have a cylinder dividing wall O partly in common. The high pressure cylinder portions P and Q of smaller diameter are shown in this instance connected to the low pressure portions K and L as by means of the inclined walls R and S, which permits a convenient construction of valve chambers and valves for the low pressure cylinder portions.

The differential cylinders H and J are provided with an outer integral casing T preferably conforming substantially to the contour of the cylinders in order to reduce space, and this outer casing forms a water jacket for the cylinders. The water jacket includes the space U between the casing of the cylinders and the space V between the high pressure cylinder portions. The water jacket is preferably closed at the bottom W but open at the top at the points X, Y and Z. The block cylinder is mounted as shown on the compressor frame B and a removable cover *a* forms a head for the upper ends of the high pressure cylinder portions P and Q. The differential cylinders H and J are provided with the differential pistons *b* and *c* suitably connected as by means of the connecting rods *d* and *e* to the crank D.

An inlet chamber *f* having the inlet *g'* is formed in the walls of the cylinders and casing at the inclined portions of the cylinder walls and separated from the water jacket space as by means of the partitions *g* and *h*. This inlet chamber *f* is common to both of the low pressure cylinder portions and suitable inlet valves *j*, preferably plate valves are arranged on valve seats on the inclined portions of the cylinder walls. The inlet valves *j* are held in position by the usual covers *k* and studs *o*.

A discharge chamber p for the low pressure cylinder portions is similarly located in the walls of the casing and cylinders and separated from the water jacket space by means of the partitions g and h. This discharge chamber p is common to the low pressure cylinder portions and suitable discharge valves q are held in position as by means of the covers k and studs o. The discharge chamber p communicates by means of the pipe r with the inter-cooler s mounted on the frame of the machine, which inter-cooler is in turn connected by the pipe t to the inlet for the high pressure cylinder portions.

The cover a forming the head for the cylinders is provided with the inlet u to which the pipe t is connected and the outlet v to which the discharge pipe w is connected. Within the head a is formed the inlet chamber x and the discharge chamber y, and as shown, these inlet and discharge chambers are each common to the high pressure cylinder portions P and Q, but separated from each other by the partitions 2 and 3, and the central partition 4. Suitable inlet valves 5 are seated on the valve seats 6 and suitable discharge valves 7 are seated on the seats 8. These inlet and discharge valves are held in position by the usual covers 9 and studs 10. The central space 11 in the cover a and the end spaces 12 in said cover communicate with the water jacket space for the cylinders and the cover is also provided with the bolt holes 13 for removably securing the cover to the cylinders.

The compressor frame may be closed at one end by the cover 14 and a cam 15 on the crank shaft is adapted to operate an oil pump 16, further details of which will not be described as the oil pump forms no part of this invention. In a machine of the type described, the fly wheel 17 suitably carried by the flange 18 of the crank shaft, is weighted on one side, as at the point 19, for the purpose of counteracting the tendency of the machine to set up vibrations vertically and horizontally. The counter-weighted fly wheel throws out the static balance but produces running balance.

A compressor constructed in accordance with this invention is strong and compact, occupies a minimum of space and has been found to operate satisfactorily and well, in comparatively smaller sizes compressing to pressures from about 350 pounds to about 500 pounds per square inch, but I am not to be understood as limiting the invention to this range of pressures.

Obviously those skilled in the art will be able to devise equivalent constructions within the scope of the appended claims but I am not to be understood as limiting the invention to details of construction other than those claimed herein.

I claim:

1. In a vertical multi-stage compressor, the herein described unitary cylinder construction comprising duplex differential cylinders constructed in block form in one piece, the low pressure cylinder bores of larger diameter being arranged side by side and having a cylinder wall partly in common, the high pressure cylinder portions of smaller diameter being connected to the low pressure portions by inclined walls, the said differential cylinders being provided with an integral outer casing conforming substantially to their contour and forming a water jacket for the cylinders, common inlet and common discharge chambers for the low pressure cylinder portions located at the said inclined connecting walls, and a removable head forming a closure for the high pressure cylinder ends and having common inlet and common discharge chambers for the high pressure portions of the cylinders.

2. A vertical multi-stage compressor comprising a frame forming a crank casing having crank shaft bearings, a crank shaft mounted in said bearings, duplex differential cylinders constructed in block form in one unitary piece and mounted vertically on said frame, the low pressure cylinder bores of said cylinder of larger diameter having a dividing wall partly in common and the said differential cylinders being inclosed by an outer casing formed integrally with the cylinders, the space between the outer casing and the cylinders forming a water jacket including the space between the smaller high pressure portions of the cylinders, said jacket being closed at the bottom but open at the upper end, inlet and discharge valves for the low pressure portions of the cylinders, a removable head forming a closure for the high pressure cylinder ends and having inlet and discharge valves for the high pressure portions of the cylinders, differential pistons in said duplex cylinders operatively connected to said crank shaft, and an inter-cooler mounted on the compressor frame and connected to the discharge of the low pressure cylinder portions and to the inlet of the high pressure cylinder portions.

3. A vertical multi-stage compressor comprising a frame forming a crank casing having crank shaft bearings, a crank shaft mounted longitudinally in said bearings, duplex high pressure differential cylinders constructed in block form in one unitary piece and mounted vertically on said frame, the low pressure cylinder bores of larger diameter being arranged side by side and having a cylinder wall partly in common, the high pressure cylinder portions of smaller diameter being connected to the low pressure portions by inclined walls, the said

differential cylinders being provided with an integral outer casing conforming substantially to their contour and forming a water jacket for the cylinders, common inlet and common discharge chambers for the low pressure cylinder portions located at the said inclined connecting walls, inlet and discharge valves in said chambers, a removable head forming a closure for the high pressure cylinder ends and having common inlet and common discharge chambers for the high pressure portions of the cylinders, inlet and discharge valves in said chambers, differential pistons in said duplex cylinders operatively connected to said crank shaft, and an inter-cooler mounted on said frame and connected to the common discharge chamber of the low pressure cylinder portions and to the common inlet chamber of the high pressure cylinder portions.

In testimony whereof I have signed this specification.

ALLAN O. CARPENTER.