Nov. 13, 1951 A. O. CARPENTER 2,574,814

RECIPROCATORY COMPRESSOR

Filed Dec. 28, 1946 2 SHEETS—SHEET 1

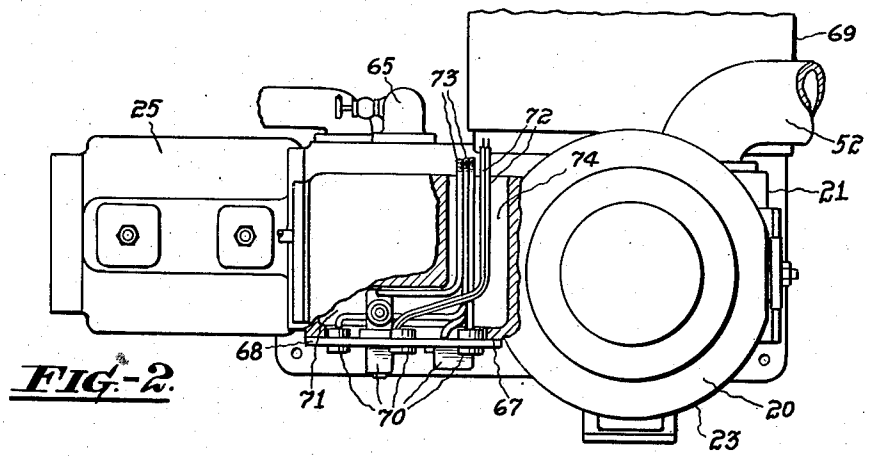


FIG.-2.

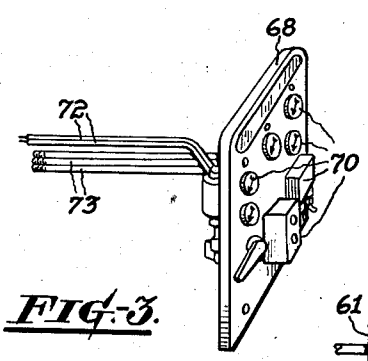


FIG.-3.

FIG.-1.

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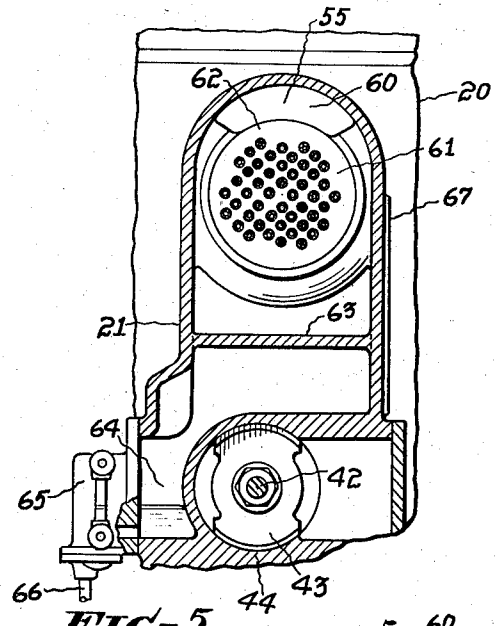


FIG.-5.

FIG.-4.

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RECIPROCATORY COMPRESSOR

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5 Claims. (Cl. 230—26)

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This invention relates to compressors, and more particularly to reciprocatory compressors of the multi-stage type.

One object of the invention is to construct a compact compressor of the multi-stage type requiring only a small area of floor space.

A further object is to render the compressor highly efficient and simplify its construction.

Another object is to provide within the compressor casing the essential channels required for the passage of fluid medium to and from the compressor cylinders.

A more specific object is to connect the inlet and discharge conduits to the main frame of the compressor and thereby obviate the need of disturbing these connections whenever it becomes necessary to service the important bearing surfaces of the movable parts of the compressor.

Other objects will be in part obvious and in part pointed out hereinafter.

In the drawings accompanying this specification and in which similar reference numerals refer to similar parts,

Figure 1 is a longitudinal side elevation of a compressor constructed in accordance with the practice of the invention,

Figure 2 is a plan view of the compressor, partly broken away,

Figure 3 is a perspective view of a detail,

Figure 4 is a longitudinal elevation, partly in section, of the compressor, and

Figure 5 is a transverse view taken through Figure 4 on the line 5—5.

Referring more particularly to the drawings, the compressor, designated in general by 20, comprises a frame 21 of box-like form having a seat 22 on and adjacent one end of its uppermost surface to support a vertical initial stage cylinder 23 and having a seat 24 on the side surface remote from the cylinder 23 to support a horizontal second stage cylinder 25.

The cylinders 23 and 25 are each provided with a face which abuts the seats 22 and 24 and the cylinders are secured to the frame 21 by bolts 26 and in their respective piston chambers 27 and 28 are pistons 29 and 30 that are reciprocated by a crank shaft 31 supported by the frame. Such movement is imparted to the piston 29 by a connecting rod 32 having one end pivotally attached to a crank 33 of the shaft 31 and its other end connected to a crosshead 34 slidable upon guides 35 in the frame 21.

The crosshead 34 is, in turn, connected to the piston 29 by a rod 36 slidable through the lowermost head 37 of the cylinder and through a

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packing device 38 in said head. The rod also slides through a second packing device 39 in a wall 40 spaced from the packing device 38, and in the side of the frame 21 is an opening 41 to admit of access to the packing devices 38 and 39.

The piston 30 is connected in a like manner to the crank 33, its rod 42 being attached to a crosshead 43 slidable upon guides 44, and a connecting rod 45 pivotally connected to the crosshead 43 and the crank 33 transmits movement from the shaft 31 to the piston. Packing devices 46 and 47 are arranged, respectively, at the innermost end of the cylinder 25 and in a wall 48 of the frame 21 suitably spaced with respect to the packing device 46 to prevent leakage of fluid medium along the rod 42 and are accessible through an opening 49 in the side of the frame.

The pistons are double acting. The fluid medium intended to be compressed in the ends of the piston chambers 27 and 28 passes thereinto through inlet valve mechanisms 50 and is discharged through valve mechanisms 51. Such fluid medium is conveyed to the compressor by a conduit 52 that is secured to the frame 21 by bolts 53 and opens into a passage 54 extending through the upper part of the frame 21 at a point within the boundary of the seat 22 and through the wall of the cylinder 23 at a point within the face abutting the seat 22 to convey fluid medium to the inlet valve mechanisms 50 at both ends of the cylinder. The compressed fluid discharged through the valves 51 from the piston chamber 27 is conveyed therefrom to the piston chamber 28 by a passage 55 in the walls of the cylinders 23 and 25 and in the upper portion of the frame 21 lying within the angle defined by the longitudinal axes of the cylinders. The passage 55, similarly to the passage 54, lies within the boundary of the joint between the cylinder 20 and the frame at the point where it passes through the frame into the cylinder 20. The compressed fluid discharged from the piston chamber 28, through its discharge valves 51, passes through a discharge passage 56, formed within the wall of the cylinder 25 and extending through the cylinder wall and frame at a point within the joint therebetween and into the lower portion of the frame 21, to a port 57 that opens into a discharge conduit 58 connected to the side of the frame 21 by bolts 59.

As will be readily apparent from the foregoing description, the fluid medium delivered to the compressor passes through channels located only within the casing parts of the compressor and, owing to this arrangement, the need of conduits

exteriorly of the compressor, other than the inlet and discharge conduits 52 and 58, is thus entirely eliminated. The conduits 52 and 58 are connected only to the frame 21, and this arrangement has the advantage that the cylinders may be conveniently removed and replaced for purposes of inspection and repairs without disturbing the seals between the inlet and discharge conduits and the frame or, as in many instances, the seals at the joints along the lengths of said conduits.

In order to further avoid the need of protuberances and the arrangement of auxiliary devices on the exterior of the compressor a portion 60 of the part of the passage 55 lying within the frame 21 is utilized as a receptacle for an intercooler 61 serving to reduce the temperature of the compressed fluid discharged from the piston chamber 27. This portion 60 lies in parallelism with the axis of the cylinder 25 and at a sufficiently higher elevation than said cylinder to permit of the insertion of the intercooler 61 into and its removal from the portion 60 without interference by the cylinder 25 or any of the parts that may be attached thereto. The intercooler 61, as shown, is of less length than the portion 60 so as to require the compressed fluid to come into contact with the entire length of the intercooler in passing through the portion 60.

The intercooler, which may be of any suitable type, extends longitudinally of the portion 60 of the passage and has the usual baffles 62 for deflecting the compressed fluid into repeated and intimate contact with the cold surfaces of the intercooler.

Means are provided for preventing the condensate produced by the cooling of the compressed fluid from being carried into the piston chamber 28. The frame 21, accordingly, has a horizontal baffle 63 that extends transversely into the path of the fluid flowing through the passage 55. The baffle 63 is located below the intercooler 61, and the condensate projected thereagainst is deflected out of the fluid stream whence it passes downwardly into a well 64 at one side of the crosshead guide 44 and opening into the side of the frame 21. The open side of the well is covered by a condensate removal device 65 of any well known type, as for example one employing a float actuated valve for communicating the well 64 with a drain pipe 66 whenever the condensate in the well 64 reaches a predetermined high level.

On one side of the frame 21 is a seating surface 67 for a panel 68 upon which are arranged the pressure and load indicating gages and the switches which control the motor 69 driving the compressor and which gages and switches are collectively designated 70. The panel 68 seats flush against the surface 67, and in the portion of the frame covered by the panel is a recess 71 for the accommodation of such portions of the gages and switches 70 as may lie on the reverse side of the panel and for the electrical conduits 72 and the fluid conduits 73 leading to the instruments on the panel. At one end of the recess 71 is a passage 74 that extends transversely through the frame to the opposite side thereof to receive the conduits 72 and 73 which are preferably of such length as to project slightly beyond the end of the passage 74 for connection with suitable conduit extensions (not shown).

By thus seating the panel 68 flush against the side of and extending the conduits 72 and 73 through the frame 21 the need of brackets or the like for supporting the panel will be eliminated and the conduits will be well protected against damage and of greatly reduced length as compared with arrangements wherein these conduits are trained along the exterior of the compressor.

I claim:

1. In a multi-stage compressor, the combination of a frame having a pair of seats, first and second stage cylinders mounted on said seats and exteriorly of the frame, an inlet passage in the frame and the first stage cylinder for said first stage cylinder, said passage passing through the frame at a point within the boundary of one of said seats, a channel wholly in the frame and the cylinders and passing through the frame at points lying within the boundaries of said seats for conveying compressed fluid from the first stage to the second stage cylinder, a discharge passage in the second stage cylinder and the frame for said second stage cylinder, conduits for the inlet passage and the discharge passage, and means for securing the conduits to the frame.

2. In a multi-stage compressor, the combination of a frame, first and second stage cylinders mounted exteriorly of and on the frame, an inlet passage in the frame and the first stage cylinder for the said first stage cylinder, a channel wholly in the frame and the cylinders for conveying compressed fluid from the first stage to the second stage cylinder, an intercooler mounted within the channel for reducing the temperature of the compressed fluid flowing therethrough, a discharge passage wholly in the second stage cylinder and the frame for said second stage cylinder, conduits for the inlet and discharge passages, and means for securing the conduits to the frame.

3. In a multi-stage compressor, the combination of a frame having a pair of seats thereon, a vertical cylinder having a face mounted on one of said seats on the frame, an inlet passage in the frame and the cylinder lying within said face for conveying fluid medium to the cylinder, a horizontal cylinder having a face mounted on the other of said seats on the side of the frame, a channel wholly in the cylinders and the frame and lying within said faces for conveying compressed fluid from the vertical cylinder to the horizontal cylinder and the portion of the channel lying in the frame being located within the angle defined by the longitudinal planes of the cylinders, an intercooler in the portion of the channel lying within the frame for cooling the compressed fluid flowing to the horizontal cylinder, a discharge passage in the horizontal cylinder and the frame, conduits for the inlet and discharge passages, and means for securing the conduits to the frame.

4. In a multi-stage compressor, the combination of a frame, first and second stage cylinders on the frame, an inlet passage in the frame and the first stage cylinder for said first stage cylinder, a channel wholly in the frame and the cylinders for conveying compressed fluid from the first stage to the second stage cylinder, an intercooler in the channel, means in the channel for causing the separation of condensate from the compressed fluid, means for controlling the flow of condensate from the compressor, a discharge passage in the second stage cylinder and the frame for the second stage cylinder, conduits for the inlet and discharge passages, and means for securing the conduits to the frame.

5. In a multi-stage compressor, the combination of a frame, first and second stage cylinders on the frame, an inlet passage in the frame and the first stage cylinder for said first stage cylinder, a channel wholly in the frame and the cylinders for conveying compressed fluid from the first stage to the second stage cylinder, an intercooler in the channel, a deflector in the channel for deflecting condensate from the compressed fluid flowing from the intercooler to the second stage cylinder, a well in the frame to receive such condensate, means for controlling the flow of condensate from the well, a discharge passage in the second stage cylinder and the frame, conduits for the inlet and discharge passages, and means for securing the conduits to the frame.

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