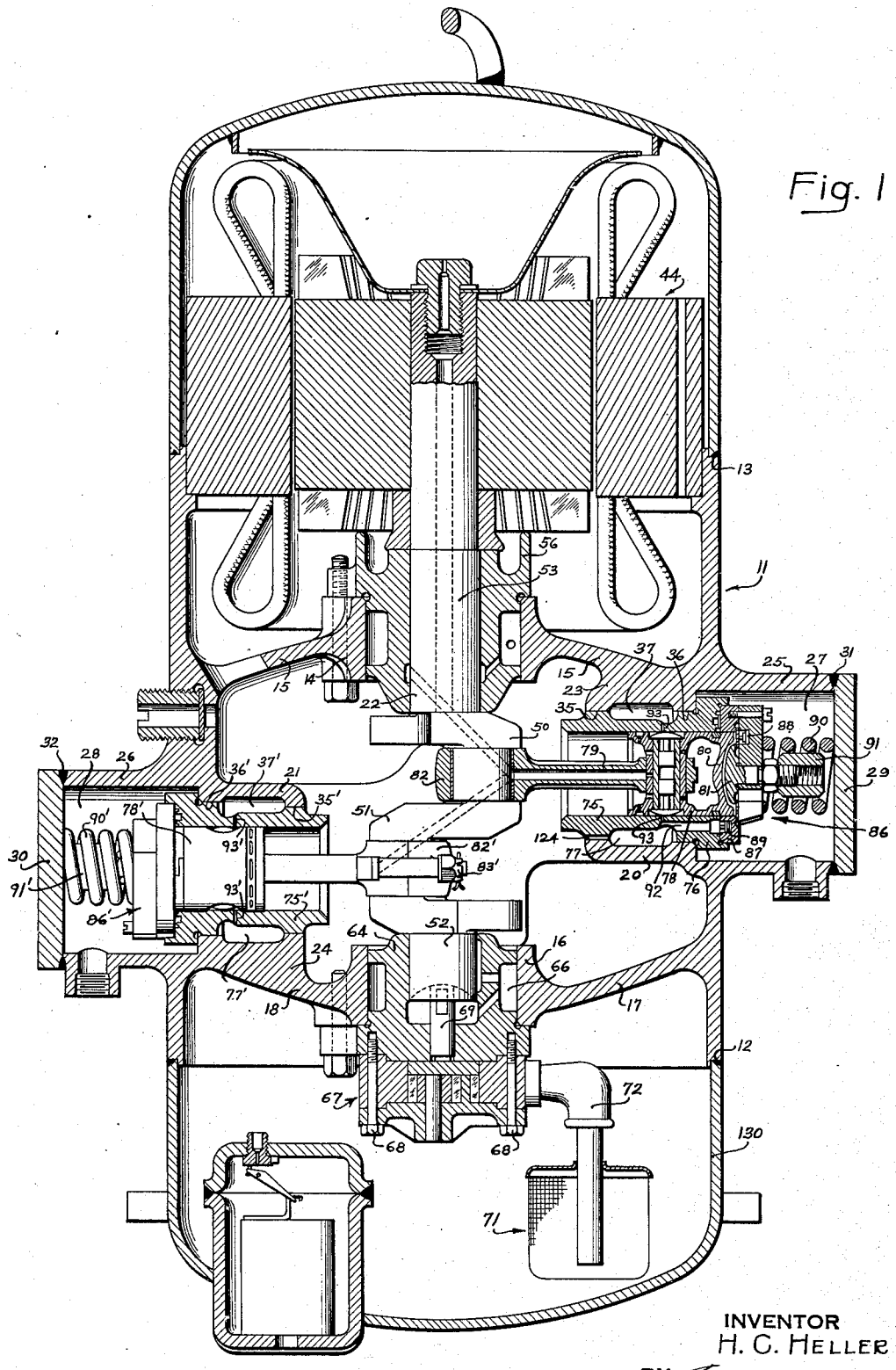
May 2, 1939. H. C. HELLER 2,156,943

COMPRESSION-UNLOADER STRUCTURE

Original Filed July 28, 1934 3 Sheets-Sheet 1

Fig. 1



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Fig. 2

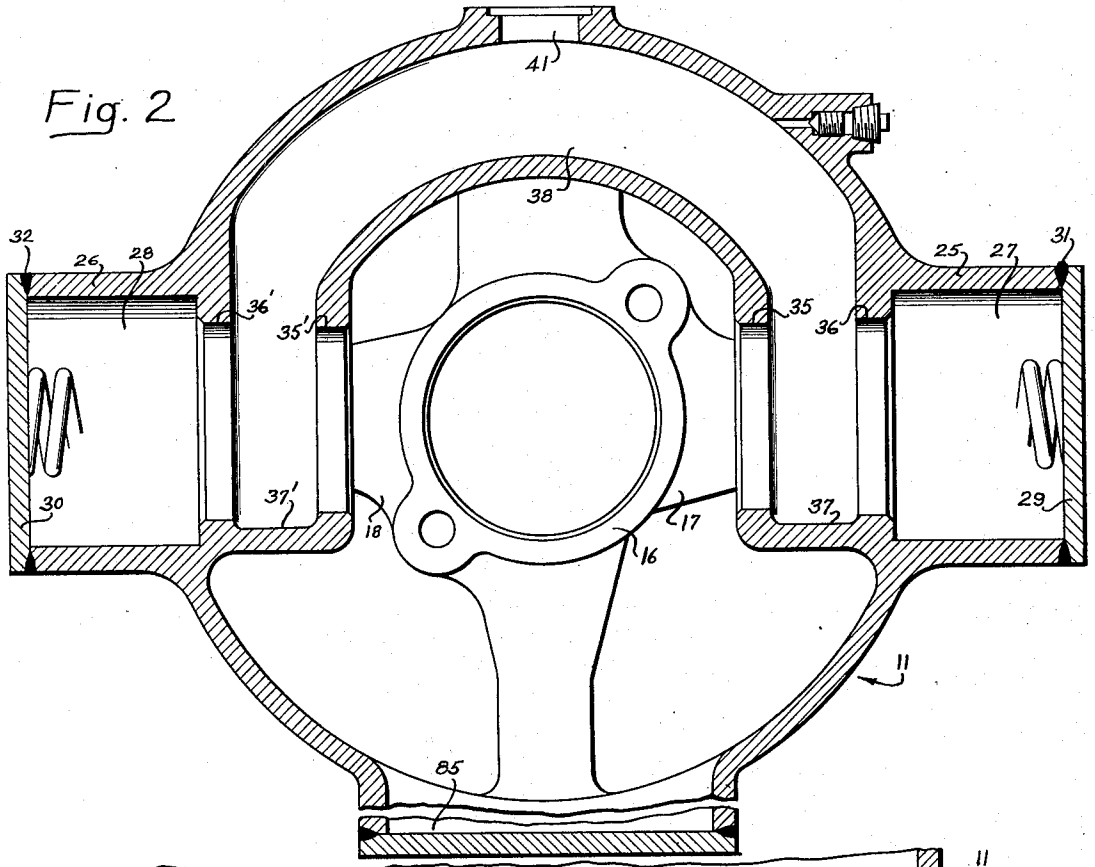
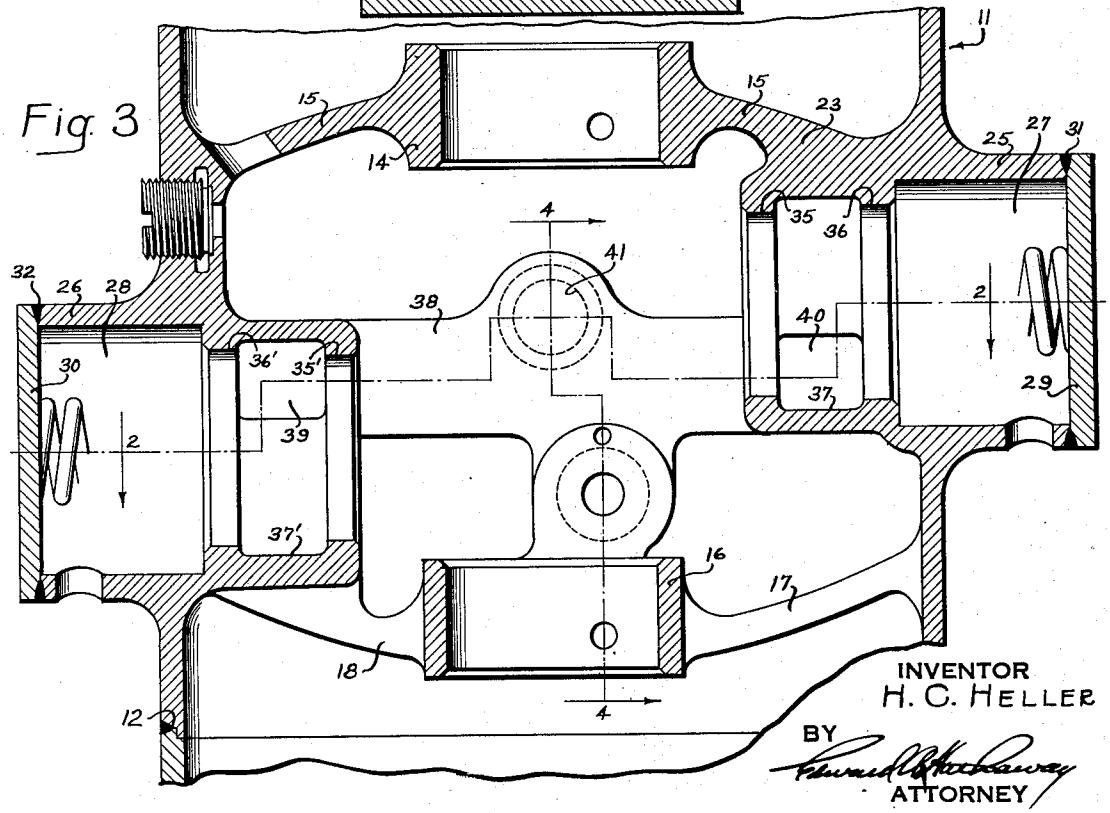


Fig. 3



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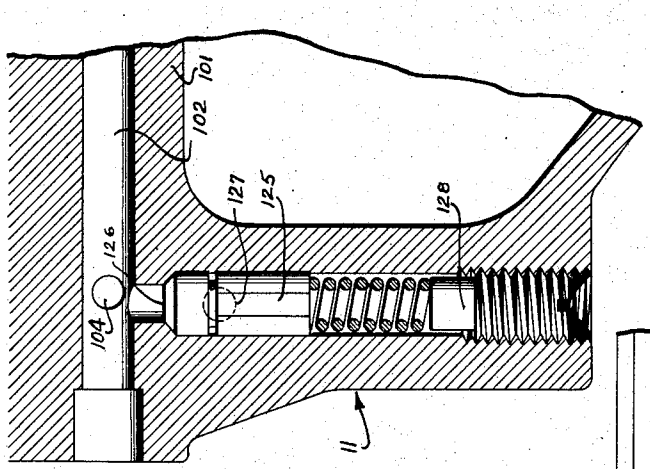


Fig. 5

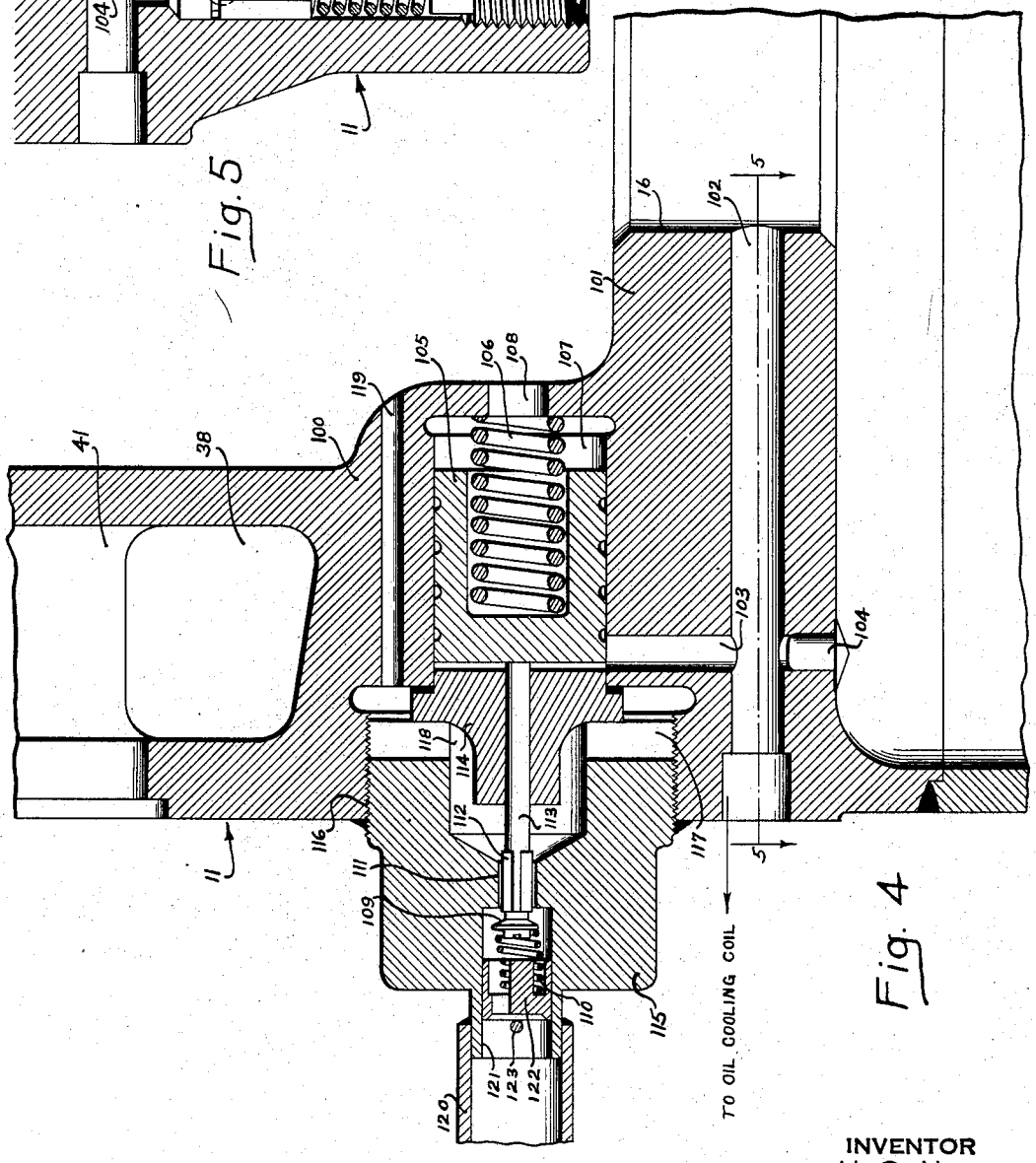


Fig. 4

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2,156,943

COMPRESSOR-UNLOADER STRUCTURE

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Original application July 28, 1934, Serial No. 737,426. Divided and this application April 28, 1937, Serial No. 139,432

3 Claims. (Cl. 230—30)

This invention relates generally to compressors and more particularly to unloaders for compressors. This application is a division of my copending application Serial No. 737,426, filed July 28, 1934 for Compressor, now Patent No. 2,113,691, April 12, 1938.

Many attempts heretofore have been made to provide simple and effective motor-compressor units especially of the sealed type, but the same have been suitable primarily for small domestic household refrigerators, it being understood that the present invention is particularly adapted for air conditioning purposes such as room coolers or for railway air conditioning thus requiring relatively large horsepower together with quiet operation, ruggedness and dependability and comparatively light weight.

It is an object of my invention to provide an improved unloader, and a more specific object is to provide an improved unloader supported in an improved relation to the main compressor housing, thereby to effect a relatively simple and yet very durable and rigid construction.

Other objects and advantages will be more apparent to those skilled in the art from the following description of the accompanying drawings in which:

Fig. 1 is a vertical section of a motor-compressor unit embodying my improved unloader structure;

Fig. 2 is a horizontal sectional view of the compressor frame taken substantially on line 2—2 of Fig. 3, with the various operating elements omitted for sake of clarity;

Fig. 3 is an enlarged vertical section of the compressor frame similar to that shown in Fig. 1 but with operating elements omitted to show certain passages more clearly;

Fig. 4 is a fragmentary vertical section taken substantially on the line 4—4 of Fig. 3 to show details of construction of the unloader and its relation to the compressor structure;

Fig. 5 is a horizontal section taken on the line 5—5 of Fig. 4.

In the specific embodiment of the invention such as is shown herein merely for the purpose of illustrating certain specific forms among possible others that the invention might take in practice, I have provided as disclosed in Fig. 1 a cast compressor frame generally indicated at 11 of substantially straight cylindrical form throughout its length which extends from the lower edge 12 to an upper edge 13. An upper bearing support or guide 14 is supported by a preferably slightly inclined crown or conical disc-like member 15 extending inwardly from the upper portion of the compressor frame. A lower bearing support or guide 16 is supported by a pair of ribs 17 and 18 extending preferably slightly downwardly from a lower portion of the compressor frame. A pair of cylinder housings 20 and 21 preferably disposed on opposite sides of a crankshaft 22 project inwardly from the cylindrical wall of the compressor frame, it being noted that the upper portion 23 of cylinder housing 20 substantially merges with the upper radial support or crown 15, while the lower portion 24 of cylinder 21 similarly merges with rib 18, thereby effecting a mutual reinforcing relation between the cylinder housings and the radial supports for the bearing guides. Projecting outwardly from the wall of the compressor frame and in axial alignment with the cylinder housings 20 and 21 are housings 25 and 26 preferably of circular cross-section, these housings providing chambers 27 and 28 adapted to perform multiple functions for housing the valve mechanism, of providing a chamber for a safety mechanism and of providing a discharge chamber. After the valve and safety elements, which will be described later, are assembled with the compressor frame, said chambers 27 and 28 are closed by flat disc end covers 29 and 30 and are peripherally welded at 31 and 32 to the housings 25 and 26.

The cylinder housings 20 and 21 are each provided with liner supporting walls 35 and 36 (corresponding primed numbers being used for cylinder 21) having an annular inlet recess 37 therebetween. As shown in Figs. 2 and 3, these annular recesses are interconnected by a suction passage 38 formed around the inner wall of the compressor frame. This interconnecting passage communicates as at 39 near the top of the annular recess 37' and at 40 with the lower side of annular recess 37. This construction materially adds to the strength of the circular walls and other parts of the compressor. A suction inlet 41 extends through the compressor frame for communication with passage 38.

The remaining elements of the compressor will be described in the order of their assembly together with certain further detailed features of construction employed in the compressor frame.

The electric motor generally indicated at 44 is suitably supported in the compressor frame. The motor rotor is secured to the crankshaft 22 which is provided with two crank throws 50 and 51 supported by a lower stub journal 52 and an upper elongated journal 53. These journals

are suitably supported in upper and lower bearings 56 and 64 respectively and suitably supported in transverse members 15 and 17. An annular groove 66 formed in bearing 64 provides an oil passage and also provides proper supporting contact between the bearing and guide. An oil pump generally indicated at 67 may be of any suitable rotary or piston type, but is herein shown preferably as of the gear type whose casing is secured to the bearing 64 by bolts 68. A driving connection is provided between crankshaft 22 and the gear pump, this connection comprising a pump shaft 69 having a flat portion axially insertable in a transverse lot in the lower end of the crankshaft. An oil strainer generally indicated at 71 of any suitable type is carried by the oil pump through an elbow nipple 72 connected into the inlet of the pump. The pump and strainer elements are secured to bearing 64 before the lower end of the compressor frame is closed, in a manner to be described shortly.

The next assembling step is to make up the piston and cylinder liner sub-assembly comprising a cylinder liner 75 having an enlarged flanged end 76 and an annular recess 77 for cooperation with groove 37 or 37' in the cylinder housing. A piston 78 has a preferably concave head 80 to receive a convex valve seat member 81, thereby reducing cylinder clearance to a minimum. The piston, connecting rod 79 and liners 75, are assembled as a sub-assembly and inserted inwardly through chambers 27 and 28 so that the liner flanges 76 engage the bottom of said chambers, and the spaced annular surfaces of the liners are seated against surfaces 35 and 36 and 35' and 36'. The cap ends 82 and 82' of the connecting rods are then secured to the connecting rods by usual bolts such as 83'. These bolts are accessible, Fig. 2, through a laterally disposed hand opening 85 formed in the side wall of the compressor frame opposite to the suction passage 38, the filter 71 being disposed in the lubricant sump 130 and also being accessible through said hand hole.

After the two pistons or as many pistons as there are cylinders are connected to the crankshaft, then the plate valve mechanism generally indicated at 89 is seated in a suitable recess 87 formed in the flanged end 76. The details of construction of the valve mechanism per se do not constitute a part of my present invention. It will be pointed out, however, that the annular plate discharge valve is generally indicated at 88 and an annular plate intake valve is generally indicated at 89, the cages and retainers for these valves being suitably secured together to form the valve unit 86. A spring 90 is then inserted over a central stud 91 and against the valve mechanism to hold the same in recess 87. The closure plate or cylinder head cover 29 is then seated against spring 90 and forced inwardly to compress the spring until the closure plate seats against chamber housing 25. The plate is held in this position by any suitable mechanism during which time the head is welded as at 31. The pressure created by spring 90 will now permanently hold the valve mechanism and cylinder liner in position but will yield temporarily upon occurrence of abnormal cylinder pressure to relieve the same without injury to the compressor mechanism. The construction and assembly of the various elements for the two cylinders is identical and hence the description for one cylinder will suffice for both. The liner is provided with a series of axially extending intake ports 92 adapted to communicate with the cylinder through the intake valve mechanism 89. A series of radial ports 93 are uncovered by the piston near the end of the piston stroke, thereby to permit admission of additional gas. These ports are substantially immediately recovered upon the return stroke of the piston, and it will be noted that the piston as shown in Fig. 1 overrides to a substantial extent the plane containing plate valve 89.

Unloader mechanism.—Preferably the unloader mechanism is next assembled in the compressor casing as shown in Figs. 3, 4 and 5, although as will be seen later the unloader may be assembled even after the motor-compressor unit is completely sealed. The unloader comprises a housing 100 projecting inwardly from the compressor frame and beneath the walls of passage 38. The lower portion of the unloader housing projects inwardly in the form of a rib 101 to bearing guide 16, thereby effecting a high degree of mutual supporting relation between the various parts of the compressor frame in addition to permitting the functions of such parts to be performed in a simple and efficient manner. The unloader is moved to its loading position by oil pressure created by lubricant pump 67 and is moved to its unloading position preferably by a spring when the pressure falls upon stopping of the compressor. The oil pressure is transmitted from annular recess 66, Fig. 1, through a passage 102, Fig. 4, thence upwardly through a passage 103 formed by drilling entirely through rib 101, the lower end of such passage being closed by a plug 104. The oil pressure transmitted through passage 103 moves an unloader piston 105 against the tension of a spring 106. The inner end of cylinder 107 in which piston 105 is disposed is vented to the crankcase as through a port 108. When the compressor is running so that pump pressure moves piston 105 inwardly against spring 106, then an unloader valve 109 is moved inwardly by a spring 110 to close a passage 111. Valve 109 is guided in passage 111 by a fluted portion 112 of a valve stem 113 formed integrally with valve 109. The valve stem 113 in turn is guided in a piston head 114 held in position by a closure plug 115 in which the unloader valve 109 is disposed. The plug 115 is preferably threadedly secured as at 116 in an enlarged bore and has tranverse slots 117 at its lower end to allow communication between a chamber 118 and a passage 119 for bypassing the high pressure side of the compressor directly to the interior of the motor-compressor unit, specifically into the compressor crankcase or frame. Any suitable point of the high pressure side of the compressor is connected by a pipe 120 to a stepped bore 121 in which unloader valve 109 is disposed. A ported plug 122 provides an abutment for spring 110, said plug being held in position in any suitable manner specifically by a transverse pin 123.

Briefly the operation of the unloader mechanism is that upon starting of the compressor, oil pressure is built up by pump 67 and transmitted from recess 66, Fig. 1, through passages 102 and 103 to piston 105, the outer end of passage 102 leading to an oil cooling coil which returns cooled oil to the compressor crankcase. As the oil pressure moves piston 105 to the right, unloader valve 109 closes thereby preventing bypassing of high pressure gas from the compressor discharge line 120 through opening 111 and passages 118 and 119 to the compressor crankcase. However, when the compressor is stopped, the oil

pressure drops thereby permitting spring 106 to move piston 105 and valve stem 113 outwardly and accordingly unseat unloader valve 109, whereupon the high pressure side of the compressor discharges into the compressor crankcase to equalize the pressure on each side of the pistons, thus permitting the compressor to subsequently start under minimum load. Upon starting of the compressor, the crankcase pressure is reduced by reason of ports 124, Fig. 1, formed in the cylinder liner periphery, allowing refrigerant gas in the crankcase to be drawn into the cylinders through suction ports and passages 77 and 92.

To regulate the degree of oil pressure, a relief valve 125, Fig. 5, yieldably maintains a bypass port 126 closed. Hence when the pressure in passage 102 has reached a predetermined value, valve 125 is moved outwardly to bypass excess oil back to the crankcase through port 127. The tension of the spring may be adjusted by a screw plug 128 suitably hermetically sealed by solder or the like.

From the foregoing disclosure it is seen that I have provided an extremely compact, rugged and yet simple and effective unloader system in which the various parts are coordinated with the compressor structure with a mutual supporting and functional relationship without in any way diminishing the efficiency of the structure or its operation.

It will of course be understood that various changes in details of construction and arrangement of parts may be made by those skilled in the art without departing from the spirit of the invention as set forth in the appended claims.

I claim:

1. A motor-compressor unit of the crankshaft and piston-cylinder type, comprising a cast compressor frame having a wall extending axially of the crankshaft and encircling the same, bearing supporting means extending radially inwardly from said wall and having a bearing in which said crankshaft is journalled, a substantially radial cylinder in said wall, a recess in said wall extending from said cylinder to the outer surface of the wall, a piston insertable in said cylinder through said recess, an unloader valve operable by said piston and located outwardly of the outer end of said piston, a passage communicating with said valve to bypass the high pressure side of the compressor to the interior of said compressor frame a pressure responsive oil circulating pump for supplying fluid pressure to said bearing, and a passage in said bearing supporting means connecting said bearing with said unloader whereby pump fluid is transmitted from said bearing to the unloader to close the same automatically when the pump pressure reaches a predetermined value.

2. A motor-compressor unit of the crankshaft and piston-cylinder type having a discharge passage, comprising a cast compressor frame having a wall extending axially of the crankshaft and encircling the same, an unloader having a cylinder formed in said wall and a recess extending from said cylinder to the outer surface of said wall, a fluid-actuated piston in said cylinder, means for supplying operating fluid to said unloader cylinder automatically in accordance with the crankshaft speed, a combined closure plug and bypass valve housing disposed in said recess and supported by said wall in alignment with said unloader cylinder, said housing having a passage for bypassing fluid from said discharge passage, and a valve operated by said unloader piston for controlling said bypass passage.

3. The combination set forth in claim 2 further characterized by the provision of a head for closing one end of said unloader cylinder and disposed in spaced relation to the closure plug, the space between said head and plug communicating with the bypass valve mechanism in the latter, and a passage formed in the compressor frame wall to allow communication between said space and interior of the compressor frame to conduct bypassed fluid to the interior thereof.

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