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3,509,907

COMPRESSOR VALVING ASSEMBLY

Filed Sept. 16, 1968

3 Sheets-Sheet 1

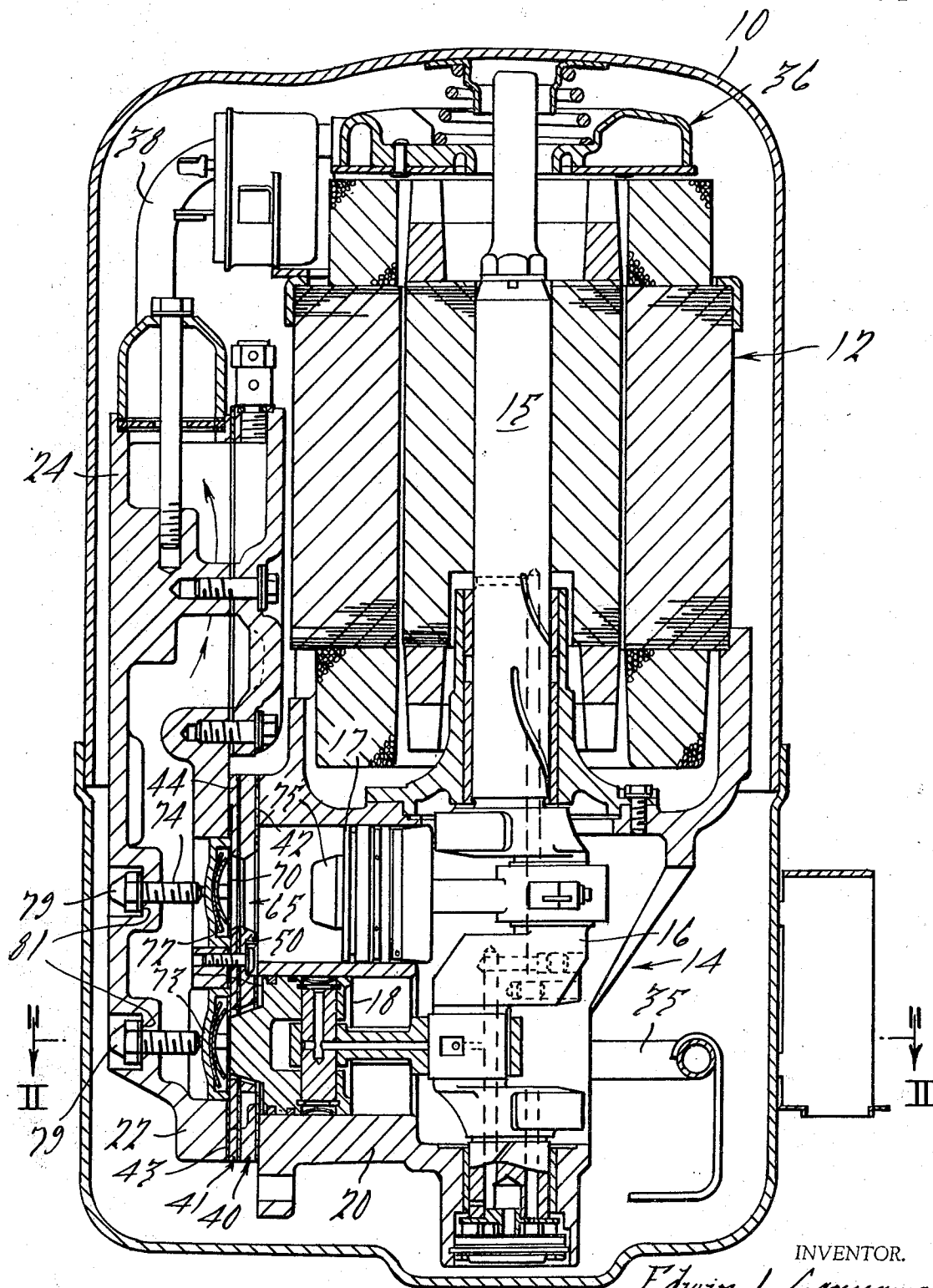


FIG. 1.

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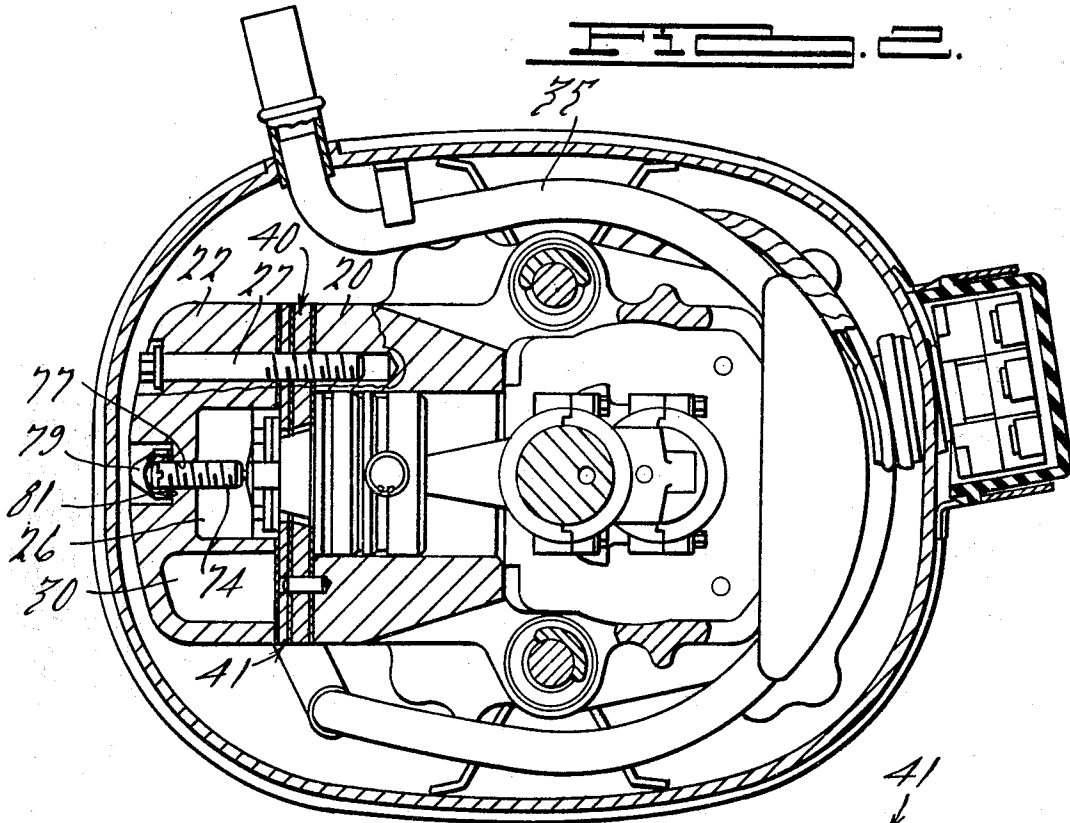
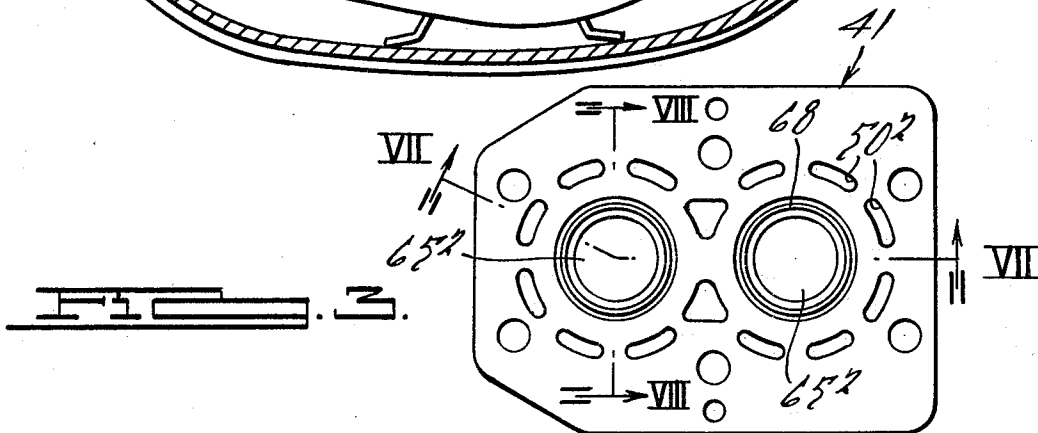
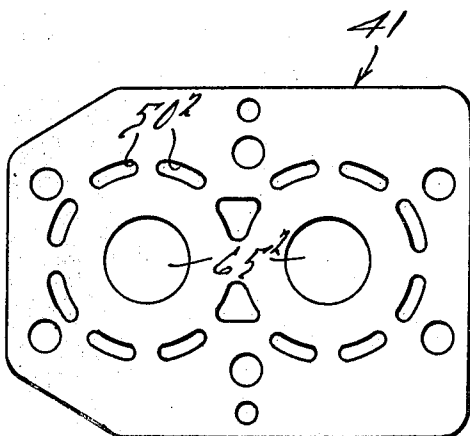
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3 Sheets-Sheet 2



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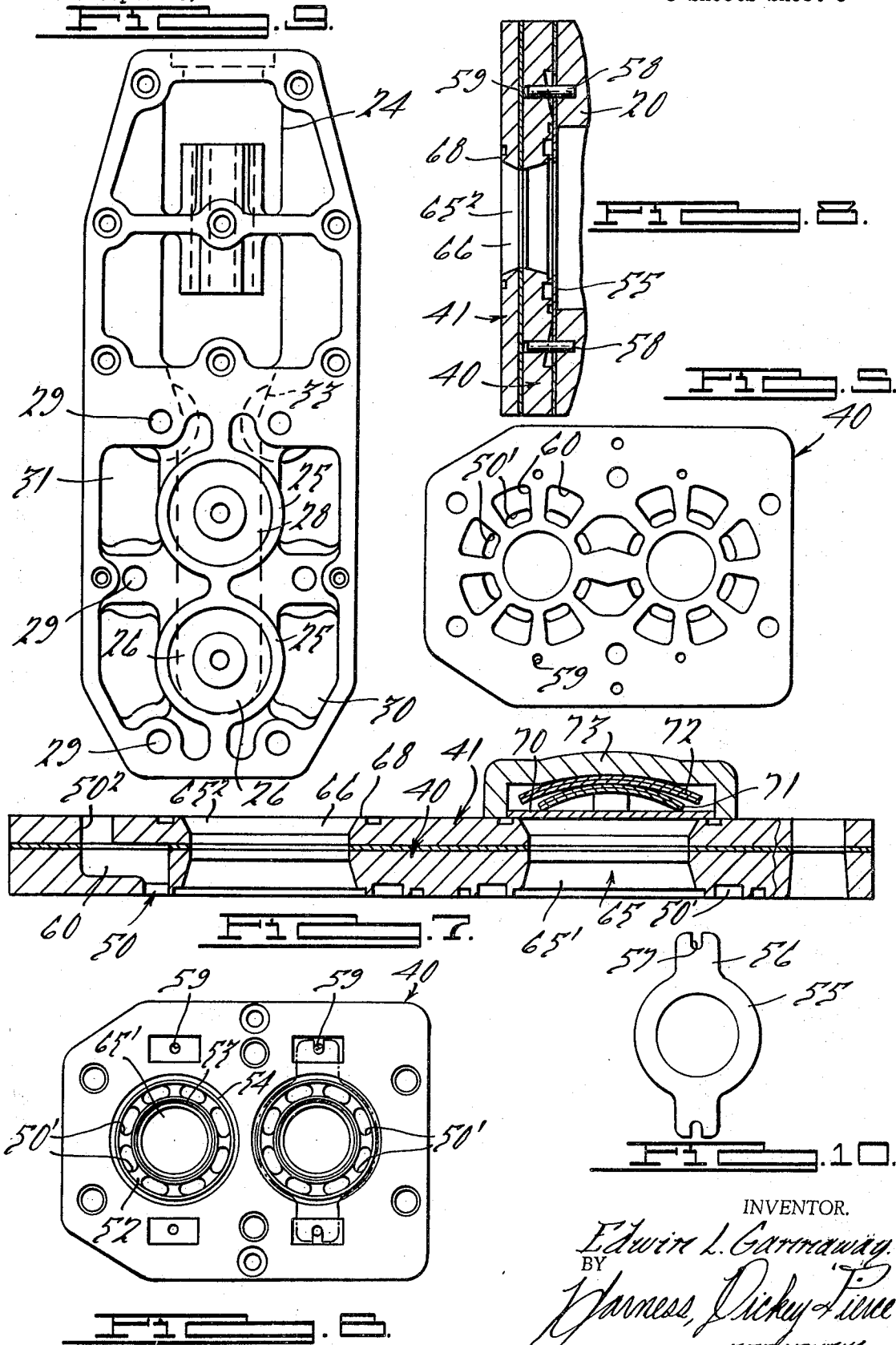
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COMPRESSOR VALVING ASSEMBLY

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3 Sheets-Sheet 3



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COMPRESSOR VALVING ASSEMBLY

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4 Claims

ABSTRACT OF THE DISCLOSURE

A refrigeration compressor of the reciprocating type having a head containing inlet and outlet passages has a laminated valve plate assembly located between the head and cylinder, with inlet valves working against the bottom of the plate assembly and discharge valves working against the top of the plate assembly, the valve plate assembly consisting of a lower section formed of molded material and a top section formed of machined steel, the sections being secured together and to the head and block by the head bolts with interposed gasketing.

BRIEF RESUME OF THE INVENTION

The present invention is concerned with the provision of improved valving structure for compressors of the indicated type wherein the valving means comprises a laminated composite valve plate including a lower section formed of molded material with devious passages therein, directly overlying the cylinders and having an annular valve reed coacting with the bottom of the molded section, and a top section or lamina formed of steel with passages extending directly through the same, discharge valve means being housed within the head on top of the upper lamina and acting directly against the same, the design providing for large port area and efficient operation in a construction which follows proven practices in its basic features but attains both increased reliability and lowered costs of the valving means and related parts, is extremely compact and low in cost.

The objects and advantages of the invention will be more fully realized upon consideration of the present disclosure in its entirety.

IN THE DRAWING

FIG. 1 is a substantially central vertical sectional view of a hermetic refrigeration motor compressor assembly embodying the present invention;

FIG. 2 is a cross section taken substantially on the line II—II of FIG. 1 looking in the direction of the arrows;

FIG. 3 is a top plan view of the laminated valve plate assembly;

FIG. 4 is a bottom plan view of the upper plate section;

FIG. 5 is a top plan view of the lower plate section;

FIG. 6 is a bottom plan view of the valve plate assembly;

FIG. 7 is a longitudinal sectional view of the valve plate assembly, taken substantially on the line VII—VII of FIG. 3 and looking in the direction of the arrows, showing one of the discharge valve and cage assemblies;

FIG. 8 is a cross sectional view of the valve plate assembly, taken substantially on the line VIII—VIII of FIG. 3 and looking in the direction of the arrows;

FIG. 9 is a bottom plan view of the cylinder head; and

FIG. 10 is a plan view of an inlet valve.

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DETAILED DESCRIPTION OF PREFERRED FORMS OF THE INVENTION

Referring now to the drawing, reference character 10 designates the hermetically sealed sheet metal shell of a motor compressor assembly whose main constituents comprise the electric motor generally designated 12 and the reciprocating compressor generally designated 14, these constituents having a common shaft 15, the lower portion 16 of which comprises the direct driven crankshaft of the compressor portion. In the illustrative construction the compressor is depicted as of the two-cylinder type, the pistons 17, 18 being mounted in horizontal cylinders in the block 20. Details of the motor, and also many aspects of the compressor component will be recognized as well known in the art, will not require description, and may be varied.

The cylinder head 22 which is bolted to the block in the conventional manner, has an integral upwardly extending muffler section 24 and is provided with internal partitioning walls which divide the interior of the head into inlet and outlet chambers and passages. As best shown in FIG. 9, two partitioning wall portions 25 of circular cross section are provided, one for each cylinder and coaxial therewith, but of lesser diameter than the cylinder, wall portions 25 defining circular outlet chambers 26—28 centrally positioned over each cylinder. Outlet valve chambers 26—28 communicate via internal head passages 33 and outlet muffler portion 24 with discharge tube 35.

Suction gas is drawn by operation of the compressor into inlet chamber portions 30—31 which individually surround the outlet passages 26—28, respectively. Inlet chambers 30—31 communicate with the interior of the shell 10 via a muffler-separator assembly generally designated 36, suction tubes 38 leading from the muffler-separator to the head and chambers 30—31. Muffler-separator assembly 36 is preferably constructed and arranged as shown in patent application Ser. No. 595,762, filed Nov. 21, 1966. All of the inlet and outlet chamber portions 26—28, 30—31 are open on the lower face of the head 22.

A composite laminated valve plate assembly is interposed between the head and the block and retained by the same head bolts 27, which extend through the several bolt holes 29 of the head. The composite valve plate assembly comprises a bottom plate 40 and a top plate 41, a gasket 42 being interposed between plate 40 and the block, gasket 43 between plate 41 and the head, and gasket 44 between the two plates, these parts being clamped together in sealed relation by head bolts 27.

Passages and ports in the plates and in the gaskets are so arranged that when these parts are assembled and clamped together, a central discharge port, generally designated 65, is provided leading from each of the cylinders to head discharge chamber 26 or 28, ports 65 being of the straight through type. Discharge ports 65 are valved on top of the upper plate 41 and are formed by axially registering holes 65¹, 65² in the inner and outer plates 40, 41, respectively. The plate assembly also provides a plurality of suction ports, generally designated 50, encircling and radially outspaced from the discharge ports 65. Suction ports 50 are valved on the under-surface of bottom plate 40.

The outlet ends of the suction ports on the bottom surface of plate 40 are designated 50' and open directly into the cylinders. The suction port exit portions 50' extend part way through the plate 40 parallel to the axis and communicate with radial portions formed by slot-like depressions 60 in the outer surface of plate 40 and which act as radial communicating channels which, when

the plates are assembled, are covered on their open outer sides by the top plate 41, except in out-spaced areas where holes 50² are provided in and extending straight through the outer plate 41. The holes 50² open into the inlet chamber portions 30 and 31 in a circular area spaced outwardly far enough to lie outside the wall portions 25. Each discharge port lies within the area bounded by the circular wall 25, and walls 25 bear against the top gasket, segregating the discharge port areas and suction areas in the head. The inlet chamber portions 30, 31 of the head, lying outside the annular walls 25, deliver suction gas via the out-spaced port areas 50² in the upper plate (and corresponding holes in the upper gasket) and thence via radial channels 60 to the suction ports 50' in the lower plate and into the cylinder, all of the gasket portions being of course appropriately ported.

The bottom plate 40 is preferably formed of a moldable material. Cast aluminum alloy and molded sintered iron, have both been successfully employed, the sintered iron being preferably treated by the known commercial process involving steam-induced oxidation to render it effectively nonporous. The surfaces of the plates engaged by the valve reeds are provided with relatively narrow ribs 53, 54 and 68 which form seats for the valve reeds, in known manner.

As shown in FIGS. 8 and 10, each suction valve reed 55 has diametrically opposed ear portions 56 provided with end opening notches 57 overfitted on pins 58 fast in the top of the cylinder block 20 and projecting into clearance holes 59 in plate 40. The extent to which the annular valve reed 55 can move inwardly into the cylinder is limited by the trapped ends of the ear portions 56.

Each discharge valve disc 70 is formed of a thin flat circular steel plate and each valve disc is urged toward its seat by a multilaminar spring assembly consisting of four laminations cylindrically arched and presenting their concave sides to the valve. The two lower sections 71 are bowed initially so that in their relaxed condition they are arched to a common radius, and the two upper spring sections 72 are initially arched similarly, but on a greater radius. In the preferred construction shown, the two outer spring sections 72 are also somewhat stiffer, being formed of slightly thicker stock.

The springs and valve are located by a retainer cage 73 of spider form positioned by means of clamping screws 74 each which projects through a suitably tapped hole 77 in the head to bear centrally against the corresponding cage. After screw 74 is tightened it is locked and leakage along the threads is prevented by means of an acorn nut 79 and a sealing washer 81. By virtue of this arrangement of the discharge valve and valve spring assembly, no holes are required either in the valves or in the springs. Stress concentrations due to the presence of such holes are thereby eliminated. By varying the radii and stiffness of the spring sections 71 and 72 in the manner described, the designer is able to so fit the operating characteristics of the springs to the mass of the valve element and the other characteristics that the variable rate of the spring assembly provides for graduated opening acceleration and quick closing of the valve, minimizing inertial resistance to valve movement and permitting quicker valve action.

In the construction shown, the compression ratio is augmented by an axial projection 75 on each piston and which projects into the exhaust valve port area when the piston is in the top dead center range, although this and

other illustrated features of the compressor assembly shown will be recognized as known in the art.

This detailed description of a preferred form of the invention, and the accompanying drawings, have been furnished in compliance with the statutory requirement to set forth the best mode contemplated by the inventor of carrying out the invention. The prior portions consisting of the Abstract of the Disclosure and the Brief Resume of the Invention are furnished without prejudice in an effort to comply with administrative requirements of the Patent Office.

What is claimed is:

1. In a reciprocating compressor of the type having a block with a cylinder therein, a cylinder head, an inlet passage portion in and opening on the bottom of the head, an outlet passage portion in and opening on the bottom of the head, one of said bottom openings overlying the cylinder and the other being laterally outspaced therefrom, a multi-laminar valve plate assembly interposed between the block and head including a top plate section having ports extending axially therethrough and individually communicating with each of said bottom openings and a molded bottom plate section having a port extending axially therethrough from the cylinder to the port in the top plate section which communicates with the bottom opening which overlies the cylinder, and a passage portion extending through and radially in the bottom plate section and leading from the cylinder to the port in the top plate which communicates with said laterally outspaced bottom opening in the head, said head and plate sections being separably clamped together and to the block in sealed relation to each other and to the head and block.

2. A reciprocating compressor as defined in claim 1 wherein the bottom plate section is formed of molded metal.

3. A reciprocating compressor as defined in claim 1 wherein said means for clamping together in sealed relation comprises bolts extending through the head and plates and through gaskets interposed between the head, plates and block and into the block.

4. A reciprocating compressor as defined in claim 1 wherein the bottom opening which overlies the cylinder and the ports in said plate sections communicating with said opening are in substantially coaxial registry with each other and coaxial with the cylinder and define a central outlet from the cylinder and a plurality of registering openings, ports and passages are provided in the head and plate sections radially outspaced from and substantially concentrically arranged around the central outlet to define the inlet to the cylinder, a central outlet valve working against the top of the upper plate section and an annular inlet valve working against the bottom of the bottom plate section.

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U.S. Cl. X.R.

137—493.8; 230—58; 417—312, 419, 571, 902