Jan. 8, 1952 D. PICA 2,582,157

COMPRESSOR

Filed Sept. 17, 1949 2 SHEETS—SHEET 1

FIG. 1

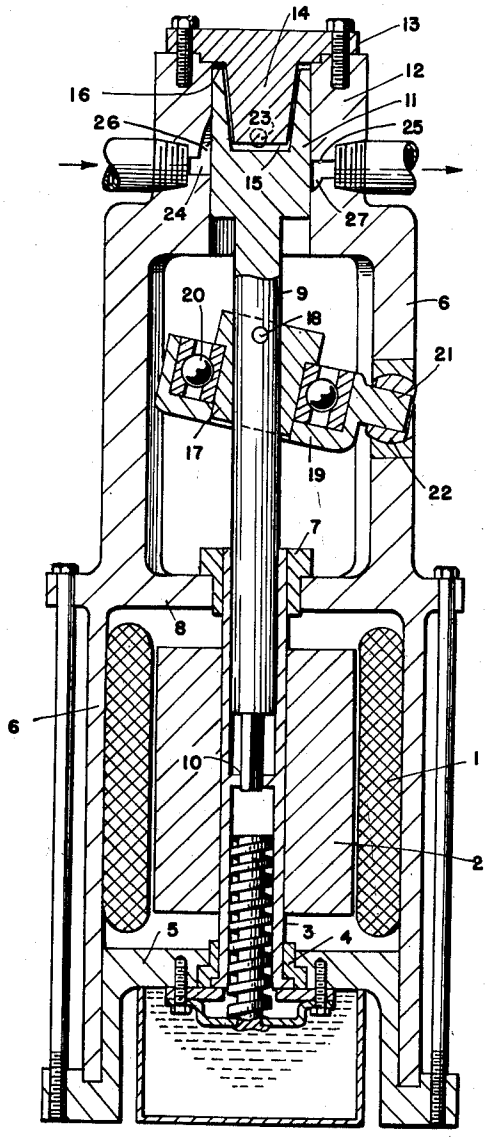

FIG. 2

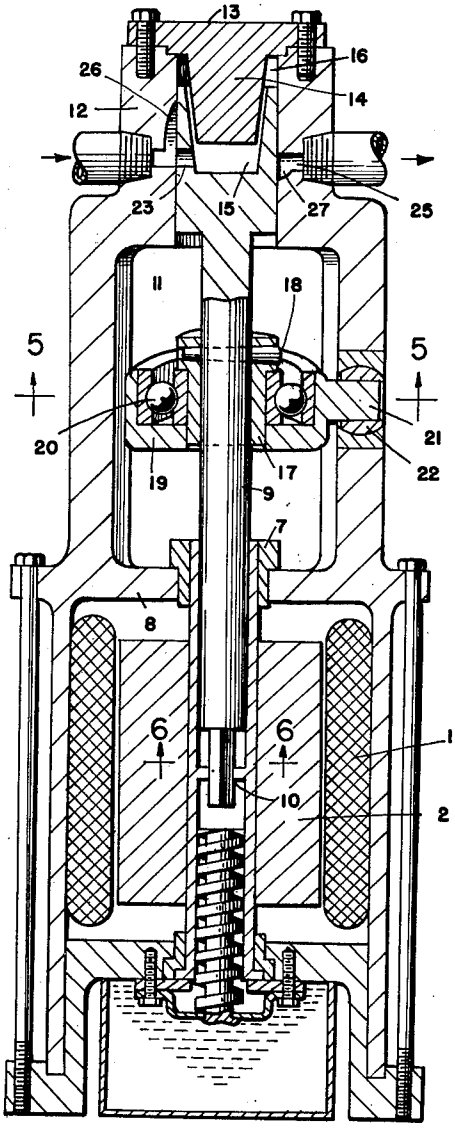

FIG. 5

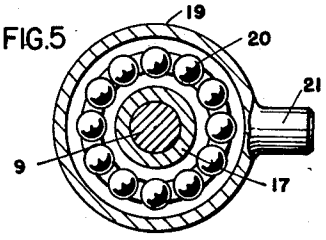

FIG. 6

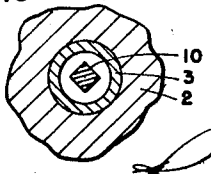

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FIG. 3

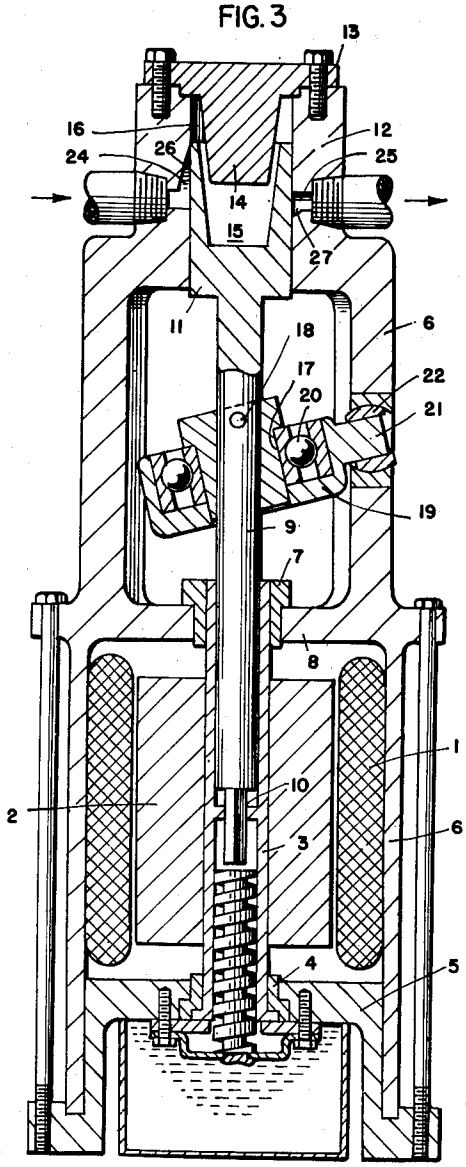


FIG. 4

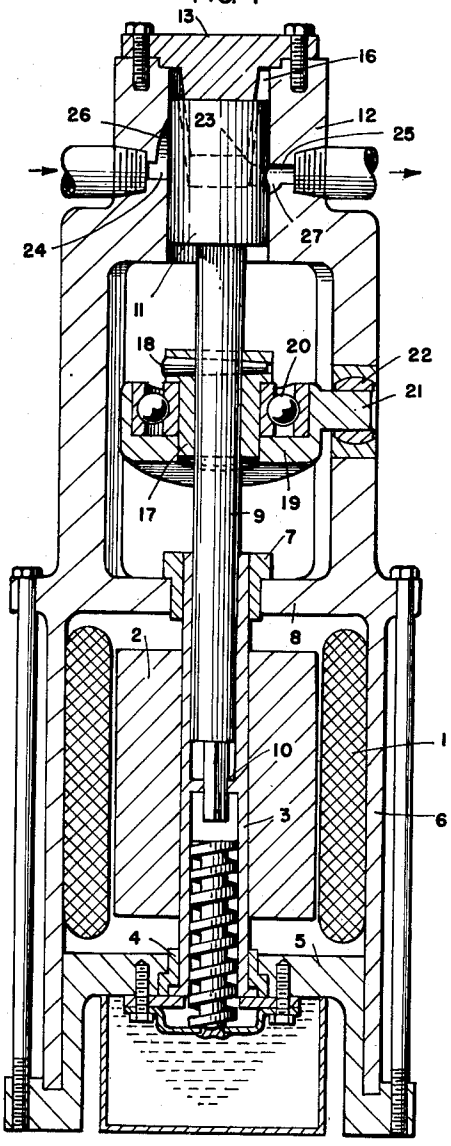


FIG. 7

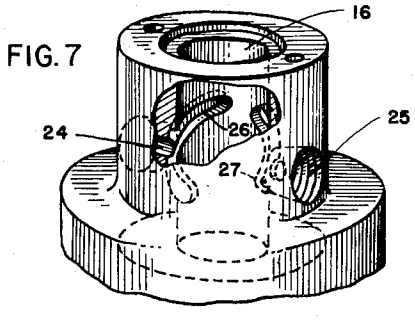
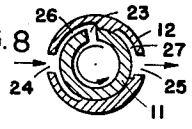


FIG. 8



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Patented Jan. 8, 1952

2,582,157

UNITED STATES PATENT OFFICE

2,582,157

COMPRESSOR

Daniel Pica, Chicago, Ill., assignor of one-half to Frank Kemptner, Silver Lake, Wis.

Application September 17, 1949, Serial No. 116,270

3 Claims. (Cl. 230—173)

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This invention relates to pump-operating mechanism and particularly to a form of electrically driven compressor of extremely simple and compact construction for use in places where the saving of space is of great importance such, for example, as the machine-housing compartments of refrigerators.

The main objects of this invention are to provide an improved form of gas compressing and pumping mechanism; to provide an improved mechanism of this kind that comprises a minimum of parts in space-saving arrangement; and to provide an improved form of pump in which the piston rotates and reciprocates simultaneously and which is of such construction that the piston performs both the compressing function and the valving function.

An illustrative embodiment of this invention is shown in the accompanying drawings in which:

Figure 1 is an axial section of an electromotor compressor embodying the present invention, showing the parts in positions corresponding to the upper end of the compression stroke of the pump piston.

Fig. 2 is a similar view showing the parts in the relative positions they occupy at the time when the pump piston has reached the mid-position of its downward or suction stroke.

Fig. 3 is a similar view showing the parts in positions corresponding to the end of the downward stroke of the piston.

Fig. 4 shows the parts in the positions occupied when the piston is midway in its upward stroke.

Fig. 5 is a sectional detail taken on the line 5—5 of Fig. 2.

Fig. 6 is a sectional detail taken on the line 6—6 of Fig. 2.

Fig. 7 is a fragmentary perspective view, partly broken away, of the pump cylinder block illustrating the arrangement of ports therein for control by the rotation and the reciprocation of the piston.

Fig. 8 is a schematic diagram of the relation of the ports in the piston and cylinder walls.

In the form shown in the drawings the motor comprises a stator 1 and rotor 2, illustrated somewhat diagrammatically, and arranged for rotation of the rotor about the vertical axis. The rotor core is fast on a tubular driving shaft 3 journaled in a foot-step bearing 4 on a horizontal partition 5 of the frame 6 and upper bearing 7 mounted on a horizontal partition 8 in the frame 6.

A driven shaft 9 extends telescopingly into the driving shaft 3 to which it is splined at 10 so as

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to be free to move axially with respect to the driving shaft 3 but compelled to rotate with said shaft 3. The driven shaft 9 is rigidly fixed to or integral with the pump piston 11 on the upper end of the shaft, which piston is shaped to fit within and move relative to the pump cylinder body 12 which is carried at the upper end of the frame 6.

The cylinder head 13, in the form shown, has a plunger-like body 14 of frusto-conical form tapering convergently away from the cylinder head and which extends into a correspondingly shaped chamber portion 15 which together with clearance space 16 above the piston forms the pump chamber 15, 16 of the cylinder, thus greatly reducing the length of the cylinder body 12 with respect to the piston's stroke. The tapered walls of the chamber cavity 15 in the piston 11 and of the plunger 14 are so related as to provide unobstructed communication between the chamber spaces 15 and 16 in the cylinder and piston respectively, with a minimum of clearance at the end of the compression stroke.

Located at a point intermediate of the bearing 7 and the cylinder body 12 there is a yoke journal 17 which is fixed on the driven shaft 9 by a cotter pin 18. The yoke journal 17 has the axis of its bearing surface disposed at an angle to the axis of the driven shaft 9 and has a yoke 19 journaled thereon preferably by means of a ball bearing 20. The yoke 19 is appropriately secured against axial displacement on the bearing surface of the journal 17 and has an arm 21 extending radially from one of its sides and comprising a journal portion which is slidably and rotatably seated in a bearing ring 22 which in turn is journaled in the frame 6 for limited tilting about an axis at right angles to the plane that is defined by the axis of the driven shaft 9 and the yoke arm journal 21.

When the shaft 9 is rotated, the yoke 19, through its connection with the frame at 22 is held against rotation with shaft 9 and through its inclined yoke journal 17 on the shaft 9 is caused to tilt or wobble about the shaft 9 between the various positions in which it is shown in Figs. 1 to 4 of the drawings. Thus the driven shaft 9 is compelled by the yoke 19 to reciprocate axially as it rotates, there being one complete up-and-down stroke for each full rotation of shaft 9 on which the pump piston 11 is fixed.

The pumping chamber portion 15 has a port 23 directed radially outward through the wall of the hollow piston toward the cylinder wall where, through the movements of the piston, it is brought alternately into communication with

an inlet port 24 and an outlet port 25 in the cylinder wall. These ports are extended in the form of spiral grooves 26 and 27 in the cylinder walls, and these grooves are shaped and positioned to register with the piston port 23 in such manner that the port 23 registers with the inlet port 24 during the major portion of the suction stroke of the piston and with the outlet port 25 during part of the compression stroke. The port 23, as will be understood, is out of registry with either the ports 24 or 25 at the extreme ends of the piston stroke.

The degree of compression is determined by the length of the groove 27. If it were to be made of such length and form as to register with the port 23 during the entire exhaust stroke of the piston, there would be no compression and only displacement of fluid as in a pump for liquid. On the other hand, if the exhaust port is open only during a fractional portion of its movement at the end of the compression stroke, the compression will be inversely proportional to this fraction as compared with the full stroke.

Although but one specific embodiment of this invention is herein shown and described, it will be understood that numerous details of the structure shown may be altered or omitted without departing from the spirit of the invention as defined by the following claims.

I claim:

1. A compressor, comprising a cylinder, a piston therein, driving mechanism operatively connected to said piston for rotating and simultaneously reciprocating said piston axially within said cylinder, a head on one end of said cylinder, a plunger on said head, said piston having a chamber formed therein to receive and coact with said plunger for compressing a gaseous medium, a port in said piston leading transversely outward from said chamber adjacent the end of said chamber that is distant from said cylinder head, an outlet port in said cylinder positioned to register with said piston port when said piston is near the end of its compression stroke, and an inlet port in said cylinder positioned to register with said piston port during the suction stroke of said piston.

2. A compressor as specified in claim 1, wherein the plunger on the cylinder head is tapered convergently away from said head and the chamber in the piston is correspondingly tapered for minimum clearance at the end of the piston stroke toward said head.

3. A compressor, comprising a cylinder, a piston therein, driving mechanism operatively connected to said piston for rotating and simultaneously reciprocating said piston axially within said cylinder, a head on one end of said cylinder, a plunger on said head, said piston having a chamber formed therein to receive and coact with said plunger for compressing a gaseous medium, a port in said piston leading transversely outward from said chamber adjacent the end of said chamber that is distant from said cylinder head, an outlet port in said cylinder positioned to register with said piston port during a relatively small portion of the movement of said piston near the end of its compression stroke, and an inlet port in said cylinder positioned to register with said piston port during the major part of the suction stroke of said piston.

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