This invention relates to a novel compressor adapted to be used in compressing gases, liquids or air and which is capable of use in refrigerating systems for pumping gases or liquids or for supplying compressed air.

A primary object of the present invention is to provide a compressor having a motor as an integral part thereof thereby eliminating the use of a conventional motor for driving the compressor together with the driving connections such as pulleys, belts, couplings or gears.

Another object of the invention is to provide a compressor having a motor as an integral part thereof and which may be much more economically manufactured and sold than a conventional compressor with a separate motor, which will be much lighter in weight, require less materials and utilize less space.

Still another object of the invention is to provide an electrically operated compressor of extremely simple construction utilizing a solenoid means for actuating a reciprocating pumping element for pumping and compressing a medium and wherein the reciprocating motion of the pumping element is converted to a rotary motion for operating a commutator employed for controlling the flow of the electric current to the solenoid means of the device.

Various other objects and advantages of the invention will hereinafter become more fully apparent from the following description of the drawings, illustrating the presently preferred embodiment thereof, and wherein:

Figure 1 is a side elevational view, partly in vertical section of the electrically operated compressor;

Figure 2 is a side elevational view of the commutator thereof;

Figure 3 is an end elevational view of the compressor looking from left to right of Figure 1;

Figures 4, 5 and 6 are sectional views taken substantially along planes as indicated by the lines 4—4, 5—5, and 6—6, respectively, of Figure 2, and

Figure 7 is a perspective view of one of the brushes of the commutator.

Referring more specifically to the drawings, the novel compressor in its entirety is designated generally 8 and includes a hollow base, designated generally 9 formed of the sections 10 and 11 and having abutting external flanges 12 for receiving fastenings 13 for detachably connecting the base sections 10 and 11. Each of said sections 10 and 11 are provided with one or more depending supporting legs 14 for engaging a supporting surface 15 in which the legs are preferably detachably secured, by any suitable means, not shown. The base 9 is provided with opposite upstanding walls having aligned openings 16 for receiving spaced portions of a crankshaft 17 which portions are journaled in bearings 18 supported by internal annular flanges 19 of said walls. The base 9 forms a hollow chamber 20 in which the crank 21 of the crankshaft 17 is rotatably disposed and to which is connected one end of a piston rod 22.

A cylinder 23 is provided with an externally flanged lower end 24 which is secured by fastenings 25 to the top wall of the base 9 around an opening 26 thereof which registers with the bore of the cylinder 23 through which the piston rod 22 loosely extends. A relatively thick walled piston 27 is reciprocally disposed within the cylinder 23 and is connected to the upper end of the piston rod 22.

The upper, externally flanged end 28 of the cylinder 23 is closed by a cylinder head, designated generally 29 which is detachably secured by fastenings 30 to the external flange thereof and which is composed of superposed bottom and top sections 31 and 32. The sections 31 and 32 are provided with connecting passages forming an inlet port 33 the inner portion of which is enlarged to accommodate a ball valve 34 which is normally urged upwardly and to a closed position by an expansion spring 35 which seats against a perforated stop 36 which is detachably mounted in the lower, inner end of said inlet port 33 so that the valve 34 will admit a medium to be compressed, such as a gas, liquid or air to the upper end of the cylinder 23 but which will prevent such medium from escaping from the cylinder 23 through the port 33. The upper section 32 is externally enlarged to form with the section 31 a chamber 37 which communicates with the cylinder 23 through a port 38 formed in the section 31 and which port is normally closed at its upper end by a valve 39 which is disposed in the chamber 37 and has an upwardly projecting valve stem 40 which is reciprocally guided in a downwardly opening recess 41 of the head section 32 and which carries a spring 43 which normally urges the valve 39 downwardly and into a closed position. The cylinder head section 32 is provided with an outlet port 44 which communicates with the chamber 37 and which is adapted to be connected to a conduit 45 connected with suitable means, not shown, to which the compressed medium is adapted to be supplied.
The cylinder 23 is formed of a non-magnetic metal and the piston 27 is formed of iron. The cylinder 23 is surrounded by relatively long upper and lower solenoids 46 and 47, respectively, between which is interposed a smaller, intermediate solenoid 48.

A flywheel 49 is fixed to one end of the crank shaft 17, externally of the base 9 and a commutator 50 is fixed to the opposite end of said crankshaft, also externally of the base 9. The commutator 50 comprises a body formed of an electrical insulating material 51 the periphery of which is recessed to accommodate a strip 52 of an electrical conducting material, preferably copper and which has a continuous central portion 53 extending entirely theretround and around the body 51 and staggered edge portions 54 and 55, the ends of which are spaced slightly from one another circumferentially and each of which extends through an arc slightly less than a half circle and approximately equal to 178°. A plate 56 is supported on the outer side of the wall of the base 9 which is located adjacent the commutator 50 by means of rods 57 having threaded ends which extend through aperted extensions of said plate 56 and into threaded recesses 58 of the base 9. One of the rods 57 is disposed above the level of the commutator 50 for supporting three brush elements 59, 60 and 61, each of which is provided with a pair of supporting arms 62 forming integral extensions of a cross bar or bight portion 63 to which the brush element is connected. The pairs of legs 62 are aperted adjacent their free ends for pivotally engaging said upper rod 57 and are held in properly spaced relationship to one another by spacer sleeves 64 which, together with the supporting arms 62 are held to said upper rod 57 by a cotter pin 65. The brush 59 is disposed to contact the uninterrupted intermediate portion 53 of the conductor strip 52, the brush 60 contacts the conductor strip portion 54 only during a portion of each revolution of the commutator 50 and the brush 61 contacts only the conductor strip portion 55 during another portion only of each revolution of the commutator. The brushes 59, 60 and 61 will be held by gravity in engagement with either the commutator body 51 or the strip 52. A single contact brush 66 which is disposed between the armament with the brush 59 contacts the intermediate portion 53 of the strip 52 at all times during rotation of the commutator 50 and is provided with more widely spaced arms 67 forming extensions of an intermediate cross piece 68 to which the brush 66 is attached. The arms 67 may be rigidly supported on the other, lower rod 57 by spacer sleeves 69 and retained thereon by a cotter pin 70 or suitable spring means, not shown, may be provided for urging the brush 66 into engagement with the conductor strip 52.

The brush 68 is connected to an electrical conductor 71 preferably extending from the positive side of a source of electric current such as a storage battery 72. The brush 59 is connected by a conductor 73 to the intermediate solenoid 48. A conductor 74 connects the brush 60 to the upper solenoid 46 and a conductor 75 connects the brush 61 to the lower solenoid 47. The solenoids 48, 46 and 47 are connected by conductors 76, 77 and 78, respectively, to the negative side of the battery 72 to complete the electrical circuit. Assuming that the inlet port 33 is connected to a source of supply of a liquid or gaseous medium to be compressed, not shown, or open to the atmosphere as illustrated for compressing air, and assuming that the piston 27 is in its uppermost position of Figure 1, in this position the brush 60 will have moved out of contact with the conductor portion 54 and the brush 61 will be approaching a position for movement into contact with the conductor portion 55. The periphery of the fly-wheel 49 will carry the crank 21 past this uppermost dead center position so that the brush 61 will contact the conductor strip portion 55 in which positions the solenoids 47, 48 will function as a unit for attracting the iron piston 27 which is caused to move downwardly. During the downstroke of the piston 27 the valve 39 will be closed and the valve 34 will be drawn open to admit the medium to be compressed into the cylinder above the piston in response to the vacuum created by the downstroke of the piston. As the piston approaches the lower extremity of its movement the conductor strip portion 55 will move out of contact with the brush 61 and the flywheel will carry said piston and crank 21 slightly past their lowermost dead center positions and until the conducting portions of the fly-wheel 49 and the conductor strip 52 whereupon the upper solenoid 46 will be energized to function with the intermediate solenoid 48 as a single unit for drawing the piston 27 upwardly and back to its position of Figure 1.

During the upstroke of the piston 27 the inlet valve 34 will be held in a closed position and the valve 39 will be unseated for expelling the compressed medium through the outlet port 38, chamber 37 and passage 44 into the conduit 45. As the piston 27 substantially reaches the upper extremity of its movement, the operation previously described will be repeated.

It will be apparent that an extremely simple compressor has been provided wherein the prime mover constitutes an integral part thereof.

Various modifications and changes are contemplated and may obviously be resorted to, without departing from the spirit or scope of the invention as hereinafter defined by the appended claim.

I claim as my invention:

A self-starting solenoid control means comprising a cylinder, a pair of solenoids disposed one above and in vertical alignment and reciprocally mounted in the cylinder and formed of a material capable of being attracted by an energized electromagnet, a rotary electric switch adapted to be interposed in an electric circuit of the solenoids including spaced conductor portions one connected to each solenoid for alternately energizing the solenoids and for maintaining each solenoid energized during a portion of rotation of the switch equal to slightly less than one-half of a complete revolution, means forming a driving connection between the piston and switch whereby the switch will complete one revolution to each two strokes of the piston, said switch rotating in timed relationship to the reciprocating movement of the piston for de-energizing each of the solenoids as the piston approaches its extreme movement in a direction toward said solenoid and for thereafter energizing the other solenoid to move the piston in the opposite direction, and a third solenoid disposed around the cylinder between the first mentioned solenoids and adapted to be constantly energized by the electric current source for functioning with either of the first mentioned solenoids, when energized, and functioning when
both of the first mentioned solenoids are de-
energized to move the piston from a substantially
dead center position at either extremity of its
movement toward a position intermediate of its
extremities of movement whereby the rotary
switch is moved, by movement of the piston from
either extremity of its movement, into a position
to energize the first mentioned solenoid, disposed
remote to the piston, to thereby provide a self-
starting unit.

JAMES P. NORTON.

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file of this patent:

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