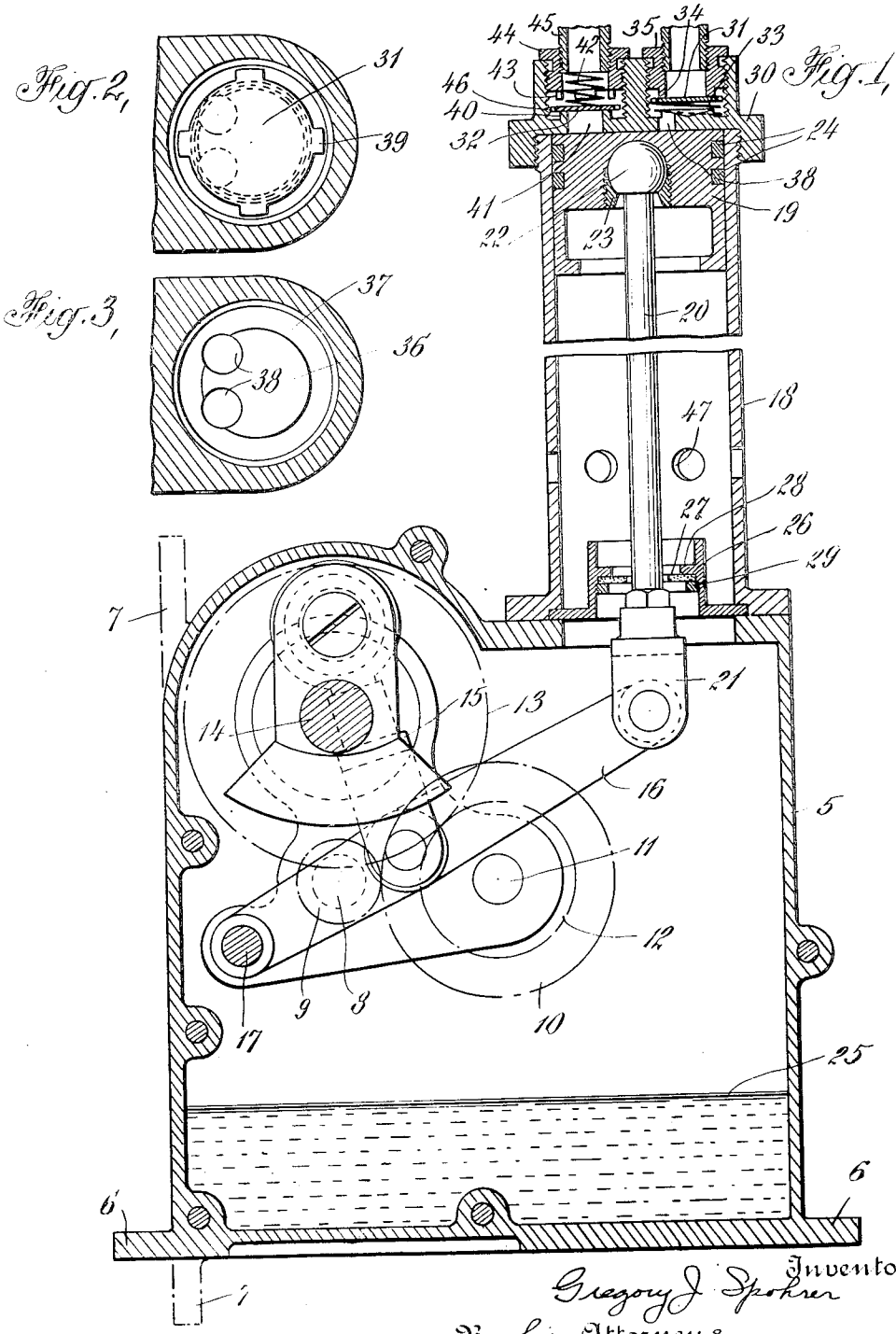
Aug. 26, 1924. 1,505,976

G. J. SPOHRER

COMPRESSOR

Filed Nov. 22, 1919 3 Sheets-Sheet 1



Inventor
Gregory J. Spohrer
By his Attorneys
Pennie Davis Marvin & Edmonds

Aug. 26, 1924. 1,505,976

G. J. SPOHRER

COMPRESSOR

Filed Nov. 22, 1919 3 Sheets-Sheet 2

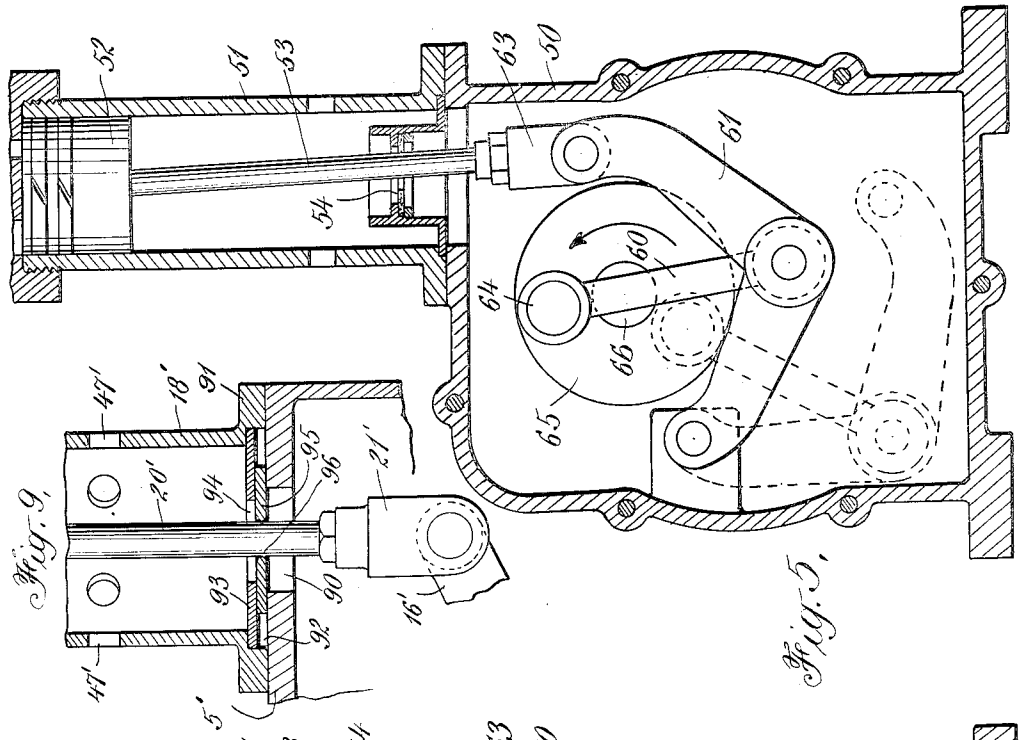
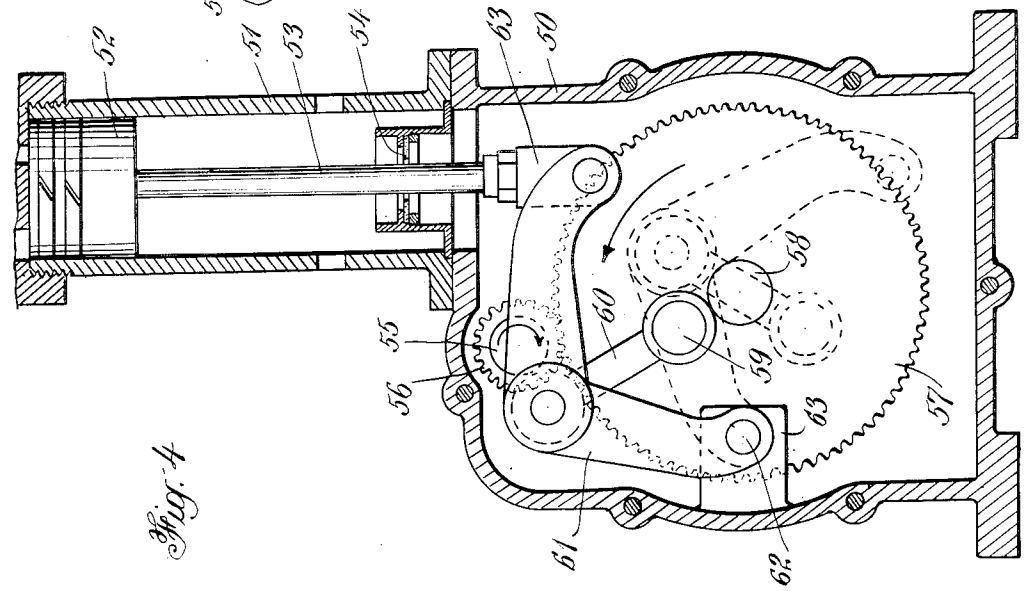


Fig. 5.

Fig. 4.



Gregory J. Spohrer Inventor

By his Attorneys

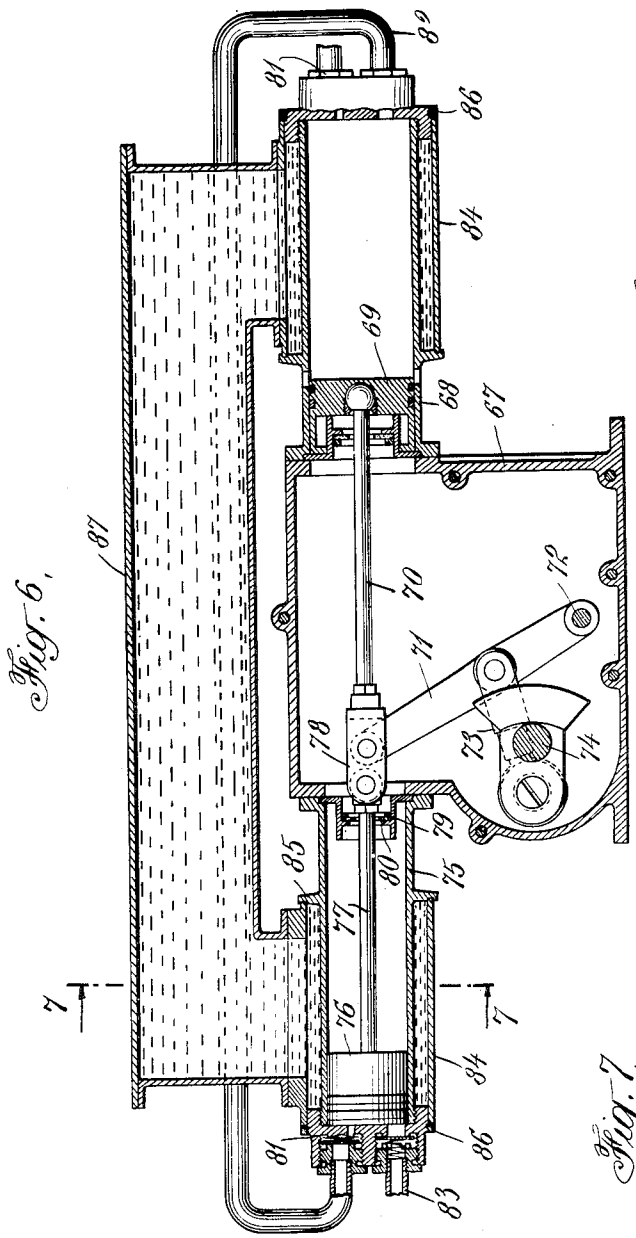
Finnie Davis Neavin & Edmonds

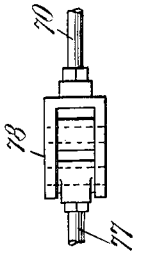
Aug. 26, 1924. 1,505,976

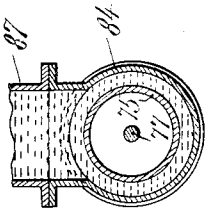
G. J. SPOHRER

COMPRESSOR

Filed Nov. 22, 1919 3 Sheets-Sheet 3







Inventor
Gregory J. Spohrer
By his Attorneys
Finnie Davis Marvin & Edmonds

Patented Aug. 26, 1924.

1,505,976

UNITED STATES PATENT OFFICE.

GREGORY JOHN SPOHRER, OF EAST ORANGE, NEW JERSEY.

COMPRESSOR.

Application filed November 22, 1919. Serial No. 339,986.

To all whom it may concern:

Be it known that I, GREGORY JOHN SPOHRER, a citizen of the United States, residing at East Orange, in the county of Essex, State of New Jersey, have invented certain new and useful Improvements in Compressors; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to compressors, particularly such as are employed in compressing air for use in inflating automobile tires.

A compressor for this purpose must be capable of continued operation with relatively slight attention and being subject to more or less abuse and exposure, it must be of sturdy construction with the working parts enclosed to exclude dirt. Generally, such a compressor must operate at relatively high speeds and arrangement must be made for thoroughly lubricating the parts. Nevertheless, as rubber is rapidly deteriorated by contact of oil therewith, the lubrication of the compressor must be accomplished without permitting the oil employed to pass from the compressor with the air compressed.

Among the objects of the present invention, therefore, is the provision of a compact compressor having the desirable characteristics above enumerated and being so constructed, moreover, that a relatively long stroke is imparted to the piston and a full charge of air is drawn into and ejected from the cylinder at every stroke to ensure the highest efficiency, the piston being cushioned on the return stroke by air trapped behind the piston for this purpose, and the admission of air to the cylinder behind the piston preventing the formation of a vacuum during the working stroke, which would tend to draw lubricating oil into the cylinder.

A further object of the invention is the provision of a compressor in which the piston travel during the compressing stroke occupies the larger proportion of the time required for a complete stroke, thus insuring the performance of useful work during the maximum time of operation.

A still further object of the invention is the provision of a two-stage compressor of simple construction and capable of compressing air, for example, to higher pressures when such are necessary and of a simple cooling arrangement for the cylinders.

Further objects and advantages of the invention resides in the various combinations hereinafter described and claimed, as will be apparent when the invention is better understood by reference to the following specification, as read in connection with the accompanying drawing illustrating the preferred embodiments thereof. In the drawing,

Fig. 1 is a vertical section illustrating one form of the improved compressor;

Fig. 2 is an enlarged detail in section of the valve controlling the inlets to the cylinder;

Fig. 3 is a similar view illustrating the inlets to the cylinder;

Fig. 4 is a vertical section illustrating a slightly different form of the compressor;

Fig. 5 is a similar view illustrating another form of the compressor;

Fig. 6 is a longitudinal section showing a two-stage compressor with the cooling means therefor;

Fig. 7 is a section on the line 7—7 of Fig. 6;

Fig. 8 is a plan view of the yoke connecting the piston rods to the operating mechanism for the compressor; and

Fig. 9 is a detail in section of the compressor.

Referring to the drawings 5 indicates an enclosing casing for the operating mechanism of the compressor which may be of any desirable form and is provided with lugs 6, so that it may be readily bolted to a supporting structure. Preferably, it is also provided with lugs 7 indicated in dotted lines in Fig. 1. One or the other set of lugs may be removed when the compressors are installed and, as will be readily appreciated, it is possible to mount the compressor with the cylinder vertically disposed as illustrated in the drawing, or horizontally arranged, depending upon the available space or the desire of the individual user.

The compressor is driven through a shaft 8 connected to a suitable source of power,

and carrying a pinion 9 which meshes with a gear 10 on a shaft 11, the shafts being journalled in suitable bearings in the casings 5. A pinion 12 on the shaft 11 meshes with a gear 13 on a crank-shaft 14, also journalled in the casing 5 and connected by a link 15 to a lever 16 which is pivoted at 17 and adapted to be oscillated as the crank shaft rotates.

A cylinder 18 is secured to the casing 5 and a piston 19 is disposed therein and is connected by a piston rod 20 to the lever 16 by a yoke 21. Preferably, a ball and socket joint is provided between the piston 19 and the piston rod 20, as indicated at 22, the ball being secured to the piston by a threaded collar 23 and the arrangement permitting free oscillation of the piston rod. The piston 19 may advantageously be provided with piston rings 24 to prevent leakage of air on the compression stroke.

To insure proper lubrication of the parts, it is my intention to maintain a supply of oil 25, within the casing 5, in which the yoke 21 and the end of the lever 16 are submerged upon the downward stroke. The connection between the piston rod and lever is thus thoroughly lubricated and oil is splashed upon the operating parts within the casing. Unless prevented, it is obvious that the oil would eventually work its way into the cylinder and would be carried with the air, as compressed, into the tires with disastrous results. I consequently provide a thimble 26 within the lower end of the cylinder 18 and surrounding the piston rod 20. A washer 27 of felt or other suitable material is held in the thimble in engagement wth a flange 28 thereof by a threaded ring 29, the opening in the washer 27 permitting free play of the piston rod 20 but preventing the passage of oil into the cylinder.

The upper end of the cylinder is closed by a cap 30 providing housings for the inlet and outlet valves 31 and 32. The valve 31 is normally held by a spring 33 in the position indicated in Fig. 1 against a depending lip 34 of a collar 35 which is threadedly mounted in the cap. When in this position, the piston being on its upward stroke, egress of air through the inlet is prevented. Beneath the valve 31 a seat 36 is surrounded by a channel 37 and two inlets 38 are provided, thus permitting the passage of air on the downward stroke of the piston around the valve 31 which has a plurality of ears 39 to maintain it in properly centralized position and into the cylinder.

The outlet valve 32 rests upon an upwardly projecting lip 40 and covers an outlet port 41, the valve being held by a spring 42 against the lip 40 when the piston is descending. When the piston is ascending, the valve 32 is lifted against the action of the spring 42, its upward travel being limited by depending ears 43 on a threaded collar 44 to which the outlet pipe 45 is connected. The valve 32 is provided with ears 46 which maintain it in properly centralized relation but permit the passage of air about the valve when it is lifted from the lip 40.

It is particularly desirable that a full charge of air enter the cylinder, before the beginning of the upward stroke, and, for this purpose, I provide a plurality of auxiliary ports 47 in the cylinder, so disposed that when the piston is at the lower limit of its travel, the openings will be uncovered. Consequently, if sufficient air has not already entered the cylinder through the inlet valve, additional air will enter through the ports 47. Furthermore, when the piston 19 has passed the ports 47 on its working stroke, air is permitted to enter the cylinder behind the piston, thus preventing the formation of a vacuum, which would tend to draw lubricating oil into the cylinder. Upon its return stroke, the piston 19 closes the ports 47 before it reaches the lower limit of its travel and air is, therefore, trapped behind the piston and forms a cushion which prevents shock and resultant vibration as the piston reaches the limit of its return movement.

Referring to Fig. 4 of the drawing, a casing for the mechanism is indicated at 50 and a cylinder 51 is mounted thereon to receive a piston 52 which is connected by a piston rod 53 to the operating mechanism. The same valve arrangement, as hereinbefore described, is provided to control the ingress and egress of air from the cylinder and a washer 54 is provided to prevent the entrance of oil to the cylinder. The present form of my invention is distinguished, however, in the provision of operating mechanism which insures the upward or compressing stroke of the piston 52 during two-thirds of the revolution of the actuating crank, while the downward stroke occurs during only one-third of such revolution.

The mechanism is driven from a shaft 55 journalled in suitable bearings in the casing 50 and provided with a pinion 56 which meshes with a gear 57 on a shaft 58, also journalled in the casing 50. The gear 57 is provided with a crank pin 59 and a link 60 connects the crank pin to a lever 61, pivoted at 62 on a projecting lug 63 of the casing 50. The lever 61 is connected by a yoke 63' to the piston rod 53 and the relation of the crank pin 59 to the lever 61 is such that the piston 52 will complete its downward stroke while the crank pin 59 is travelling from the position indicated in full lines in Fig. 4 to that indicated in dotted lines, corresponding to one-third of the revolution of the gear 57. The remaining movement of the crank pin 59 corresponds to the upward stroke of the

piston 52. A sustained working stroke of the piston 52 is thus secured with corresponding beneficial effect in the compression accomplished, whereas, the return stroke is relatively rapid.

In Fig. 5 of the drawing, I have illustrated still another form of my invention which differs from that illustrated in Fig. 4, merely in the elimination of the pinion 56 and gear 57. Corresponding parts in Figs. 3, 4 and 5 are accordingly referred to by similar reference characters. The present embodiment of my invention contemplates the provision of a crank pin 64 connecting the link 60 with a rotating disk 65 on a drive-shaft 66, which may be actuated from any suitable source of power. This particular form of my invention is desirable where the drive shaft rotates in a direction which makes it impossible to connect the mechanism illustrated in Fig. 4 and particularly where the angular velocity of the drive shaft is relatively low. The structure being substantially identical with Fig. 4, the same condition exists as to the travel of the piston, the downward stroke being relatively rapid, whereas the upward or working stroke is sustained. In both of the forms of my invention illustrated in Figs. 4 and 5, a supply of oil is maintained within the casing 50 which insures proper lubrication of the parts and the oil is prevented from entering the cylinder 51 through the provision of the washer 54 as hereinbefore described.

Referring to Fig. 6 of the drawing, the operating mechanism and its enclosing casing is identical with that illustrated in Fig. 1 of the drawing, the casing being, however, so disposed that the cylinders are horizontal. The casing 67 supports a cylinder 68 in which a piston 69 travels, the piston being connected by a piston rod 70 to a lever 71 pivoted at 72 in the casing and connected by a link 73 to a crank shaft 74.

A high pressure cylinder 75 is supported on the casing 67 opposite the cylinder 68 and a piston 76 therein is connected by a piston rod 77 to the yoke 78 which forms a coupling between the piston rods 70 and 77 and the lever 71. Thimbles 79 and washers 80, as previously described, are provided at the junction of each cylinder with the casing 67 to prevent the entrance of oil thereto and each cylinder is provided with a cap 81 housing the inlet and outlet valves which control the passage of air. The outlet from the cylinder 68 is connected by a pipe 82 to the inlet for the cylinder 75 and obviously as the piston advances in the low pressure cylinder, air compressed therein is delivered to the high pressure cylinder, in which the piston is receding, to be compressed and delivered upon the following stroke through the outlet 83. The valves and the supporting structure thereof are substantially identical with the valves illustrated in Fig. 1 and described in connection therewith.

To prevent over-heating of the cylinders, they are provided with water jackets 84 which are preferably slipped over the cylinders and brought into engagement with flanges 85 formed integral therewith. Rings 86 threadedly engaging the end caps 81 hold the water jackets in close engagement with the flanges 85 to prevent leakage of water therefrom, the flanges being preferably grooved, as indicated in the drawing, to insure a tight-joint. A water chamber 87 is provided and is of sufficient size to maintain a body of water which will radiate the heat developed to the atmosphere. The water chamber is fastened to the respective water jackets 84, each of which has a clear connection with the water chamber, as indicated in Fig. 7, so that the heated water will readily flow into the chamber and will be replaced by water cooled therein, the operation being continuous while the compressor is developing heat.

In Fig. 9 of the drawing I have illustrated a structure which replaces the thimble 26 and washer 27 as previously described, and which is adapted to produce even better results in preventing access of oil to the cylinder. Referring to Fig. 9, the casing 5′, cylinder 18′, piston rod 20′, lever 16′ and yoke 21′ are substantially identical with the previously described structure. The casing 5′ is provided with a restricted opening 90 through which the piston rod 20′ passes. The cylinder 18′ has a flange 91 at its junction with the casing 5′ and the inner edge of the flange is recessed at 92 to receive a washer 93, the latter having an opening 94 aligned with the opening 90 in the casing 5′. Between the washer 93 and the casing 5′, a washer 95 is arranged to slide as the piston rod 20′ oscillates. The washer 95 is provided with an opening conforming in diameter to the diameter of the piston rod 20′, the edge 96 of the opening being preferably rounded as indicated in the drawing to permit free play of the piston rod. As the piston rod 20′ reciprocates, it moves freely through the opening in the washer 95 and at the same time oscillates, carrying the washer from side to side, but sealing at all times the openings 90 and 94 in the casing 5′ and the washer 93 respectively, so that oil is prevented from entering the cylinder 18′. At the same time, the washer 95 prevents free movement of air trapped in the bottom of the cylinder 18′ into the casing 5′ so that as the piston descends, an air cushion is formed between the piston and the washer 93 which materially improves the operation of the apparatus. The air trapped in the bottom of the cylinder is permitted to enter the cylinder through ports 47′ as in the pre-

ceding embodiments of the invention, and in all respects other than the variations noted, the compressor may conform to the structures illustrated in the preceding figures of the drawing.

From the foregoing description, it will be apparent that I have developed a simple and effective compressor which has manifest advantages, both in its mode of operation and in the ease with which its parts may be assembled. A particular advantage lies in the relatively long stroke of the piston which, operating at high speed, will actually deliver substantially twice as much air as ordinary compressors of corresponding size. The design of the compressor is such that the clearance on the working side of the piston is reduced to a minimum, so that the entire contents of the cylinder is ejected at each working stroke of the piston. Compressors constructed in accordance with my invention may be operated without substantial attention, sufficient oil being maintained in the casing to lubricate the parts for long periods. All of the mechanism is enclosed and protected from dirt and the compressor is accordingly well adapted for use in garages and on motor-driven vehicles.

Various changes may obviously be made in the form, arrangement and construction of the parts without departing from the invention or sacrificing any of its material advantages.

I claim:

1. In a compressor, the combination of a casing having a pair of cylinders connected thereto in oppositely disposed relation, operating mechanism including a pivoted lever within said casing, pistons in said cylinders connected to said lever mechanism, an inlet to and outlet from each cylinder, the outlet from one cylinder being connected to the inlet to the other, a flange on each of said cylinders, a water jacket surrounding said cylinder, means for holding said jacket in water-tight engagement with said flanges and a common water chamber disposed above and communicating with said jacket.

2. In a compressor, the combination of a casing for containing a bath of lubricating oil, a pair of cylinders connected to said casing in oppositely disposed relation, operating mechanism including a pivoted lever within said casing adapted to contact with the oil and be lubricated thereby, pistons in said cylinders connected to said lever mechanism, an inlet to and outlet from each cylinder, the outlet from one cylinder being connected to the inlet to the other, and means near the junction of each cylinder with said casing to prevent escape of oil from the latter.

In testimony whereof I affix my signature.

GREGORY JOHN SPOHRER.