

June 20, 1939.

B. S. AIKMAN

2,163,391

FLUID COMPRESSOR

Filed March 6, 1937

2 Sheets-Sheet 1

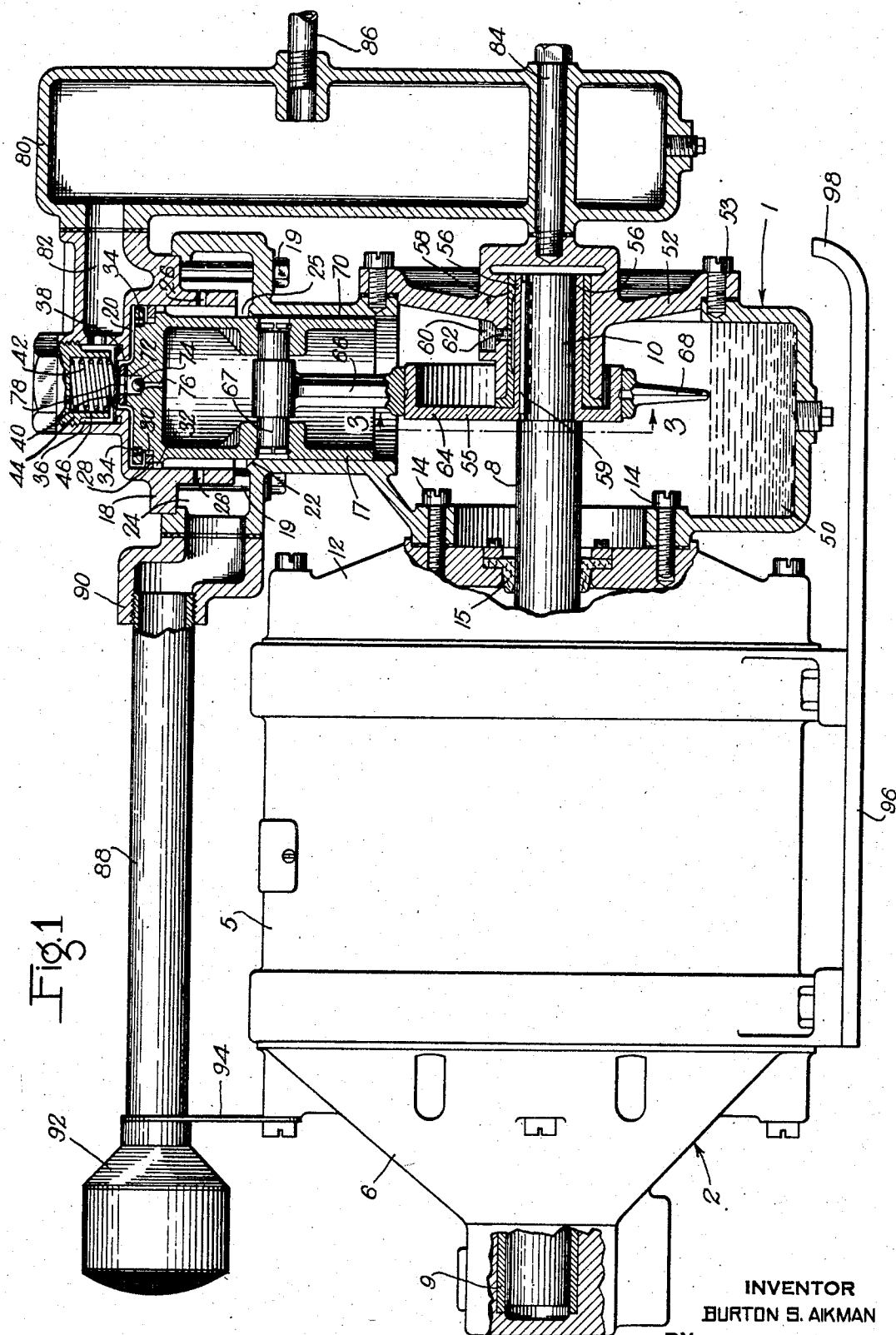


Fig. 1

INVENTOR
BURTON S. AIKMAN

BY *D. M. Higgins*
ATTORNEY

June 20, 1939.

B. S. AIKMAN

2,163,391

FLUID COMPRESSOR

Filed March 6, 1937

2 Sheets-Sheet 2

Fig. 3

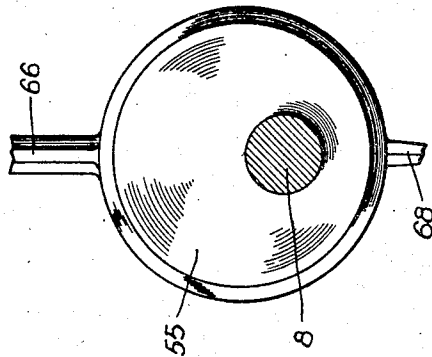
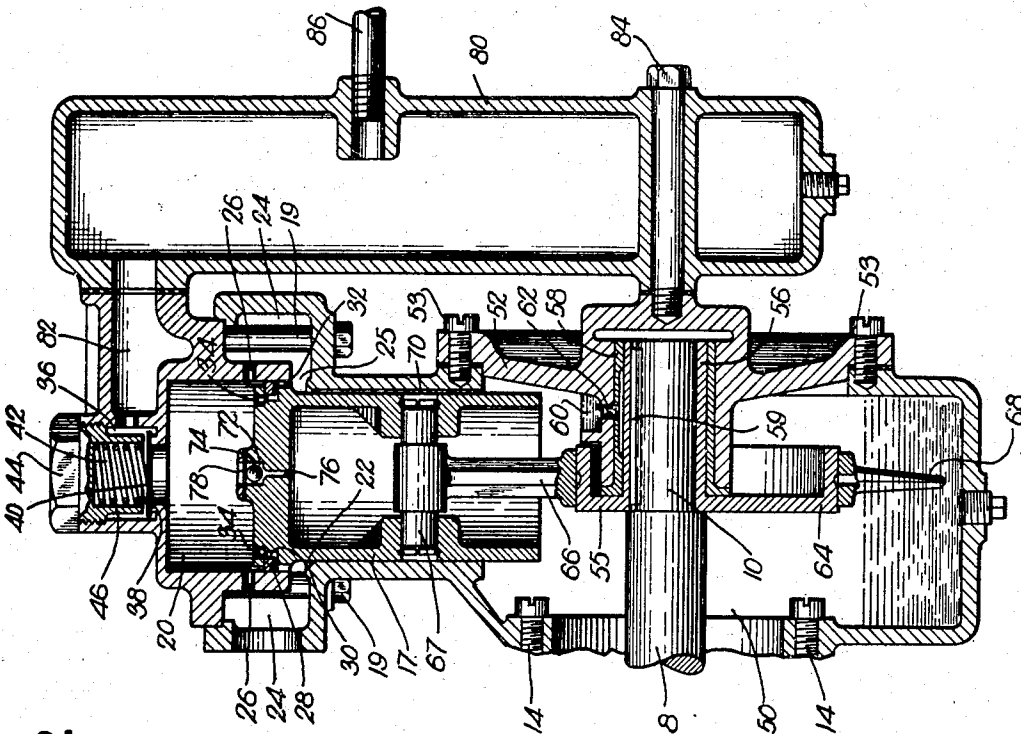


Fig. 2

INVENTOR
BURTON S. AIKMAN
BY *B. S. Aikman*
ATTORNEY

UNITED STATES PATENT OFFICE

2,163,391

FLUID COMPRESSOR

Burton S. Aikman, Wilkensburg, Pa., assignor to
The Westinghouse Air Brake Company,
Wilmerding, Pa., a corporation of Pennsylvania

Application March 6, 1937, Serial No. 129,525

3 Claims. (Cl. 230—58)

This invention relates to a fluid compressor and particularly to an improved compressor driven by an electric motor.

It is an object of this invention to provide a unit comprising a compressor and an electric driving motor which are secured together to form a compact assembly adapted to be carried about by a workman.

A further object of the invention is to provide an improved construction for a fluid compressor driven by an electric motor, the compressor and motor forming a compact unit, the compressor being constructed so that a standard motor may be employed with a minimum of alterations in the motor.

Another object of the invention is to provide a motor driven compressor unit employing a standard electric motor, the motor armature shaft being supported at one end by a bearing associated with the motor frame, and being supported at the other end only by a bearing associated with the compressor.

A further object of the invention is to provide a fluid compressor having improved means to return to the lubricant chamber, lubricant which is carried from this chamber by the compressor piston.

Another object of the invention is to provide a fluid compressor having improved means to maintain the lubricant chamber in the compressor at a pressure below atmosphere to prevent leakage of lubricant from this chamber through the joints in the walls of the chamber.

A further object of the invention is to provide an improved portable compressor which is compact in construction, efficient in operation, and is provided with convenient means by which the unit may be carried from one point to another.

Another object of the invention is to provide an improved motor driven fluid compressor.

Other objects of the invention and features of novelty will be apparent from the following description taken in connection with the accompanying drawings, in which

Fig. 1 is a view, partly in section, of a compressor unit provided by my invention,

Fig. 2 is a sectional view of the compressor shown in Fig. 1 and showing the compressor piston at a different point in its range of movement, and

Fig. 3 is a sectional view taken substantially along the line 3—3 of Fig. 1.

Referring to the drawings, the compressor unit shown in Fig. 1 comprises a compressor indicated generally by the reference numeral 1, and

an electric driving motor indicated generally by the reference numeral 2.

The motor 2 is of standard commercial design, and, as supplied commercially had a frame consisting of a central section 5 to which were secured end sections, one of which is indicated at 6. The motor 2 also has an armature having a shaft 8, one end of which is supported by a bearing, such as a bushing 9, carried by the end section 6. The other end of the armature shaft 8 projects from the motor frame and has a reduced portion, indicated at 10, which is adapted to have mounted thereon a driving member for driving mechanism operated by the motor.

The motor 2, as originally designed, included an end section adjacent the end 10 of the armature shaft 8 and provided with a bearing for supporting this end of the armature shaft. In the compressor construction provided by my invention this end section is not employed, and is replaced by a member 12 to which is secured by means of cap screws 14 the body of the compressor 1. The member 12 has an opening therein through which the shaft 8 extends, while a sealing member 15 is secured around the shaft 8 to prevent leakage of lubricant from the compressor lubricant chamber to the motor 2.

The compressor 1 comprises a body having a bore therein which serves as a guide for a piston 17, while a head 18 is secured to the body of the compressor by means of bolts 19. The head 18 has a bore therein adapted to receive the upper end of the piston 17 to provide a compression chamber 20 at the face of the piston. The bore in the head 18 is of somewhat larger diameter than the bore in the body of the compressor, and the upper end of the bore in the compressor body is surrounded by a conical face indicated at 22, the largest portion of which is slightly larger in diameter than the bore in the head 18 so that any lubricant which drains from the wall of the bore in the head 18 will drop into the trough formed by the surface 20 and the piston 17.

The head 18 and the body of the compressor cooperate to form an annular inlet chamber 24 surrounding the bore in the head 18, while this chamber communicates with the lower end of the bore in the head 18 by means of an annular passage 25 between the lower end of the wall of the bore in the cylinder head and the upper face of the compressor body. The inlet chamber 24 also communicates with the bore in the head 18 by means of ports 26 extending through the wall of this bore and spaced apart circumferentially thereof. The ports 26 are so positioned that they

open to the bore in the head 18 at one side of a piston ring 28 carried by the piston 17 as the ring passes over the ports on the up stroke of the piston, and so that they open to the bore in the head 18 at the opposite side of the ring 28 as the ring passes over the ports on the down stroke of the piston.

The piston ring 28 is mounted in a ring groove 30 formed in the piston 17, while the ring is held in engagement with the face of the bore in the head 18 by the inherent resiliency of the material of which it is constructed. The ring groove 30 is somewhat wider than the piston ring 28, while the portion of the piston forming the lower face of this groove has recesses, indicated at 32, formed therein at points spaced apart circumferentially of the piston. The piston 17 also has formed therein ports 34 which communicate with the compression chamber 20 and with the ring groove 30 at points radially inwardly of the piston ring 28.

The head 18 has an exhaust chamber 36 formed therein which communicates with the compression chamber 20 by way of a passage surrounded by an annular seat rib 38 which is engaged by an exhaust valve in the form of a disc 40, which is yieldingly pressed into engagement with the seat rib 38 by a coil spring 42 which extends between the valve disc and a threaded plug 44 which closes the upper end of the exhaust chamber 36. The plug 44 has an annular shoulder 46 formed thereon which is adapted to be engaged by the valve disc 40 to limit movement of this valve disc away from the seat rib 38.

The body of the compressor 1 has a lubricant chamber 50 formed therein and adapted to contain a quantity of lubricant to lubricate the compressor. This lubricant chamber has spaced walls having aligned openings therein, one of the walls being secured against the end section 12 of the motor 1 so that the motor armature shaft 8 extends through the opening in this wall. The opening in the other wall of the lubricant chamber 50 is closed by means of a cover plate 52 which is secured in position by means of cap screws 53.

The reduced end portion 10 of the armature shaft 8 has secured thereon an element indicated generally by the reference numeral 55, and having a hub portion 56 which extends into and is supported on a suitable bearing, such as a bushing 58, mounted in a bore in a boss formed on the cover plate 52. The element 55 is secured on the shaft 8 by means of a key 59, while the cover plate 52 has a lubricant well 60 formed thereon above the bushing 58 and communicating with lubricant passages in the bushing 58 by means of a passage 62.

The element 55 includes an eccentric portion 64 having a peripheral portion which extends over the end of the boss on the cover plate 52 and is provided with a bearing surface on which is mounted the lower end of a connecting rod 66, the upper end of which is secured to the piston 17 by means of a piston pin 67. The lower end of the connecting rod 66 is provided with an oil dipper 68 which is adapted to extend into lubricant contained in the lower portion of the lubricant reservoir 50 to supply lubricant to the bearing surface on the eccentric 64, while lubricant thrown about the lubricant chamber will reach the surfaces of the bore in the compressor body in which the piston 17 reciprocates, and will also reach the lubricant well 60.

The compressor provided by this invention has

improved means to maintain the pressure in the lubricant chamber 50 below the pressure of the atmosphere to prevent leakage of lubricant from this chamber, and to insure the return to this chamber of lubricant which is carried by the piston 17 beyond the top of the bore in the compressor body.

The bore in the compressor body has a groove 70 formed therein and extending from the conical surface 22 to the lubricant chamber 50. If any lubricant is carried by the piston 17 to a point above the conical surface 22 on the compressor body this lubricant will flow to the channel formed by the surface 22 and the face of the piston, and thence to the passage formed by the groove 70 and to the crankcase chamber 50.

The head of the piston 17 has a valve chamber 72 formed therein in which is mounted a ball valve element 74, which is adapted to seat upon a seat surrounding a passage 76 communicating with the piston 17 and thereby with the lubricant chamber 50. The ball valve 74 is held in the valve chamber 72 by means of a retainer 78 having openings therein providing communication between the valve chamber 72 and the compression chamber 20 at the upper face of the piston 17.

The motor-compressor assembly may have associated therewith a reservoir 80 having a chamber therein adapted to receive fluid under pressure, while this chamber communicates with an opening surrounded by a mounting face which is adapted to be secured against a similar mounting face surrounding an exhaust passage 82 formed in the head 18 and leading from the exhaust chamber 36. The reservoir 80 is also adapted to be secured to the cover plate 52 by means of a bolt 84, while a discharge pipe 86 is secured in a threaded opening in a wall of the reservoir 80.

This motor-compressor assembly has associated therewith means by which it may be readily carried from one location to another. This means comprises a tubular body, such as a piece of pipe indicated at 88, having one end thereof secured in a hollow member 90 which is secured by means of bolts, not shown, to the body of the compressor 1 so that the passage through the pipe 88 and the member 90 communicates with the inlet chamber 24. The other end of the pipe 88 has secured thereon an air strainer and silencer indicated generally by the reference numeral 92. The device 92 may be of any suitable well known construction. In addition, the end of the pipe to which the air strainer 92 is secured is connected by means of a member 94 to one of the bolts by which the frame end section 6 of the motor 2 is secured to the motor central frame portion 5. The pipe 88 is spaced from the adjacent portion of the motor 5 so that a workman's fingers may readily pass between the pipe 88 and the motor 2 in order that the workman may grasp the pipe 88 to carry the motor-compressor assembly.

In the operation of the device, the fluid to be compressed by the compressor is drawn through the air strainer 92 and the pipe 88 so that the pipe 88 is constantly cooled and will always remain substantially at atmospheric temperature and will not become heated as the result of operation of the compressor so that it is uncomfortable to grasp.

A base plate 96 is secured to the feet of the motor central frame section 5 and extends beneath the compressor 1 and terminates in a

curved end portion 98. The base plate 96 provides a rest for the motor-compressor assembly when it is placed upon a floor or other surface.

In the operation of the device, electric current 5 is supplied to the motor 2 from a source, not shown, and on rotation of the motor armature the shaft 8 turns the eccentric element 55 which is supported from the cover plate 52 by means of the bushing 58. On rotation of the eccentric 10 element 55 the piston 17 is moved downwardly from the position in which it is shown in Fig. 1 of the drawings. On initial downward movement of the piston 17 the ring 28 is maintained in the position in which it is shown by its engagement 15 with the inner face of the bore in the head 18 until the piston 17 is moved downwardly relative to the ring 17 far enough for the upper face of the ring groove 30 to engage the upper face of the ring 28. As a result of this movement of the 20 piston 17 relative to the ring 28 communication is opened between the inlet chamber 24 and the compression chamber 20 by way of the passage 25, the space intermediate the piston 17 and the face of the bore in the cylinder head 18, the recesses 32 in the piston 17, past the ring 28 to the 25 portion of the ring groove 30 radially inwardly of the piston ring 28, and thence through the ports 34. As a result, on downward movement of the piston 17, fluid from the atmosphere supplied through the air strainer 92 and the pipe 88 to the inlet chamber 24, flows therefrom to the compression chamber 20.

In addition, on downward movement of the piston 17 there is a reduction in the volume of the 35 chamber 50, and the gaseous fluid contained in the upper portion of this chamber is subjected to a small pressure with the result that fluid flows through the passage 76 in the piston 17, unseats the valve 74 and flows to the valve chamber 72, from which it flows to the compression chamber 20.

On movement of the compressor piston 17 to a point adjacent the lower end of its range of movement, the piston ring 28 is moved past the 45 ports 26 in the wall of the bore in the head 18 so that communication is opened from the inlet chamber 24 to the compression chamber 20 through the ports 26, and fluid is thereafter supplied from the inlet chamber 24 to the compression chamber 20 through the ports 26.

On movement of the piston 17 to the lower end of its range of movement, and upon further rotation of the armature shaft 8 the piston 17 is caused to move upwardly in the bore in the head 55 18. On initial upward movement of the piston 17, the piston ring 28 is held in the position to which it has been moved because of engagement of the ring with the face of the wall of the bore in the head 18. As a result the piston 17 will 60 be moved relative to the ring 28 until the lower surface of the ring groove 30 in the piston engages the lower face of the ring to thereby prevent the flow of fluid from the compression chamber 20 to the inlet chamber 24 through the ports 34 in the piston, the space radially inwardly of the ring 28, and the recesses 32 in the piston.

On upward movement of the piston 17 to a predetermined point in its range of movement, the piston ring 28 is moved past the ports 26 to 70 thereby cut off communication between the inlet chamber 24 and the compression chamber 20 through these ports. Upon further upward movement of the piston 17 the fluid contained in the compression chamber 20 is subjected to pressure 75 and causes the exhaust valve 40 to be moved away

from the seat rib 38 against the spring 42 so that fluid from the compression chamber 20 flows to the exhaust chamber 36 and thence by way of the exhaust passage 82 to the reservoir 80.

Upon upward movement of the piston 17, and 5 on the increase in the pressure of the fluid in the compression chamber 20, the ball valve 74 is moved to the seated position to prevent the flow of fluid from the compression chamber 20 through the passage 76 to the lubricant chamber 50. As 10 a result of upward movement of the piston 17 there is an increase in the volume of the lubricant chamber 50, and a corresponding decrease in the pressure of the fluid contained in this chamber. The pressure of the fluid in this chamber will be 15 reduced to a value substantially below atmospheric pressure and the higher pressure of the atmosphere present in the inlet chamber 24 exerted on any lubricant which has collected in the trough formed by the surface 22 will cause 20 this lubricant to flow through the groove 70 to the lubricant chamber 50. This will insure return to the lubricant chamber of any lubricant which has been carried out of the bore in the compressor body by the piston 17. 25

As the lubricant chamber 50 is maintained at a pressure below the pressure of the atmosphere during operation of the compressor, fluid will tend to flow from the atmosphere through the joints in the wall of the lubricant chamber 50, and 30 will therefore tend to prevent the escape of lubricant through these joints.

On movement of the piston 17 to the upper end of its range of movement, which is substantially the position in which the piston is 35 shown in Fig. 1 of the drawings, the valve disc 40 is moved to the seated position by the spring 42 to prevent back flow of fluid from the reservoir 80 to the compression chamber 20, while upon further rotation of the motor armature 40 shaft 8 and subsequent downward movement of the piston 17 the cycle of operation described in detail above is again repeated.

It will be seen that the motor-compressor assembly provided by this invention employs an 45 electric motor of standard design and construction, and that the armature shaft of this motor is supported at one end by a bearing associated with the motor, while the armature shaft is supported at the other end only by a bearing asso- 50 ciated with the compressor.

It will be seen also that the eccentric for reciprocating the compressor piston is directly supported on a bearing so that the motor armature shaft is not subjected to forces generated during 55 reciprocation of the compressor piston.

In addition, it will be seen that the compressor incorporates improved means to maintain the lubricant chamber of the compressor at a pressure below the atmosphere to thereby prevent 60 leakage of lubricant from this chamber through the joints in the casing sections forming the lubricant chamber or through the opening through which the motor armature shaft extends.

It will be further seen that the motor-compressor assembly provided by this invention 65 forms a compact unit and is equipped with a convenient handle by which the assembly may be readily carried from one place to another. It will be seen that this handle is constantly cooled 70 during operation of the compressor by the flow of fluid from the atmosphere to the compressor with the result that the handle will never become overheated as a result of operation of the compressor. 75

While one embodiment of the improved motor-compressor assembly provided by this invention has been illustrated and described in detail, it should be understood that the invention is not limited to these details of construction, and that numerous changes and modifications may be made without departing from the scope of the following claims.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a compressor adapted to be driven by an electric motor of a type provided with a frame having a central portion having end sections secured on opposite sides thereof, the motor being also provided with an armature having a shaft supported by bearings carried by said end sections, the compressor comprising a member adapted to be secured to the motor frame central portion in place of one of said end sections and having an opening therein through which the armature shaft is adapted to extend, a compressor body associated with said member and having a bore therein, a piston reciprocable in said bore, the compressor body having therein a chamber having spaced walls, one of which is adjacent the motor and having an opening therein through which the armature shaft is adapted to extend and the other of which is disposed at the end of said armature shaft, an element adapted to be mounted on said armature shaft within said chamber and being supported only by a bearing carried by the chamber wall at the end of the armature shaft, said element being adapted to provide the only support for an end of the motor armature shaft, said element having means thereon for reciprocating said piston, said element and means being spaced from the first mentioned wall adjacent the motor.
2. In a compressor adapted to be driven by an electric motor comprising a frame having a central portion and an end section at one side of said central portion, the motor including an armature having a shaft supported at one end on

a bearing carried by said end section, the compressor comprising a member adapted to be secured to the motor frame central portion at the side thereof opposite from said end section and serving as an end section of said motor frame, a compressor body associated with said member and having a bore therein, a piston reciprocable in said bore, said member and said compressor body having openings therein through which the motor armature shaft is adapted to extend, and an element adapted to be secured on the end of the motor armature shaft for reciprocating said piston, said element being supported on a bearing carried by the compressor body at the adjacent end of the motor armature shaft beyond said element and being adapted to provide the only support for that end of the motor armature shaft.

3. In a compressor adapted to be driven by an electric motor comprising a frame having a central portion and an end section at one side of said central portion, the motor including an armature having a shaft supported at one end on a bearing carried by said end section, the compressor comprising a member adapted to be secured to the motor frame central portion at the side thereof opposite from said end section and serving as an end section of said motor frame, a compressor body secured to said member, said body having a bore therein and having therein a chamber having spaced walls, said member and the wall of said chamber adjacent the motor having openings therein through which the motor armature is adapted to extend without bearing relationship, and an element positioned within said chamber and adapted to be secured on the end of the motor armature shaft for reciprocating said piston, said element being supported only on a bearing carried by the wall of the chamber in the compressor body remote from said motor and being adapted to provide the only support for an end of said motor armature shaft.

BURTON S. AIKMAN.