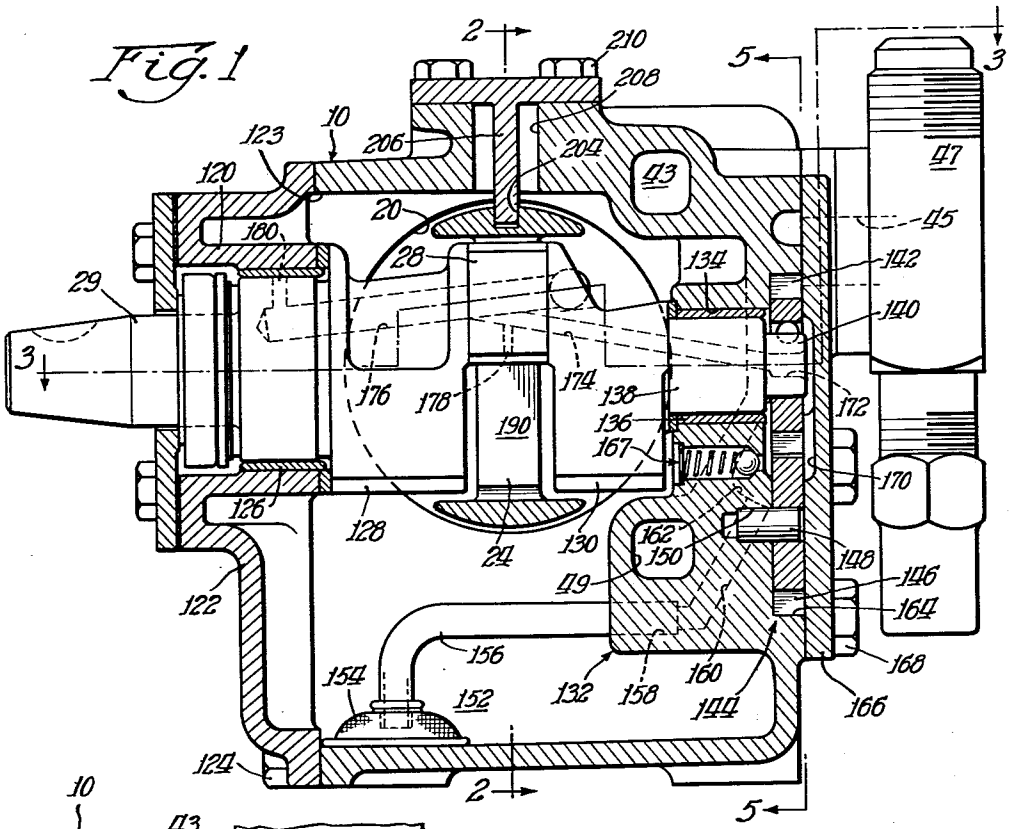
Nov. 28, 1961 R. C. ZEIDLER 3,010,644

COMPRESSOR

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Fig. 1



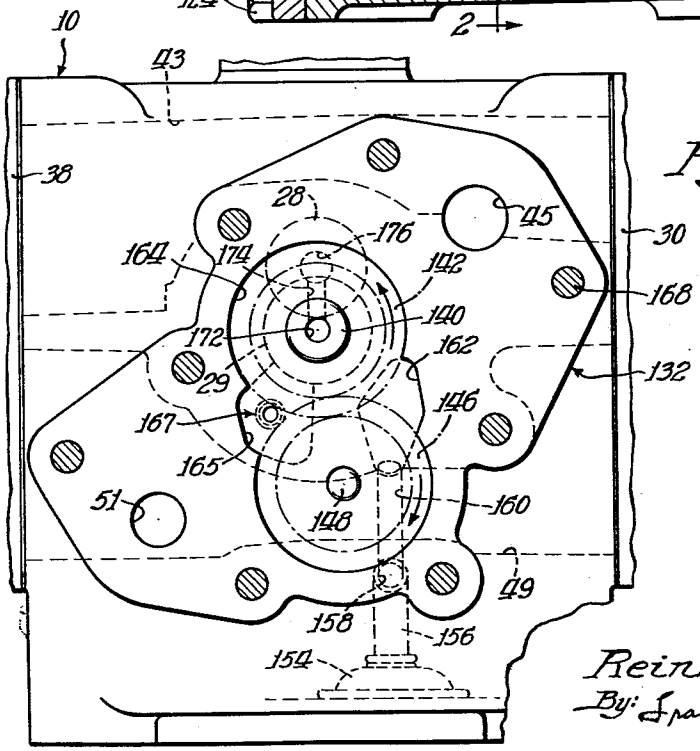


Fig. 5

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Fig. 2

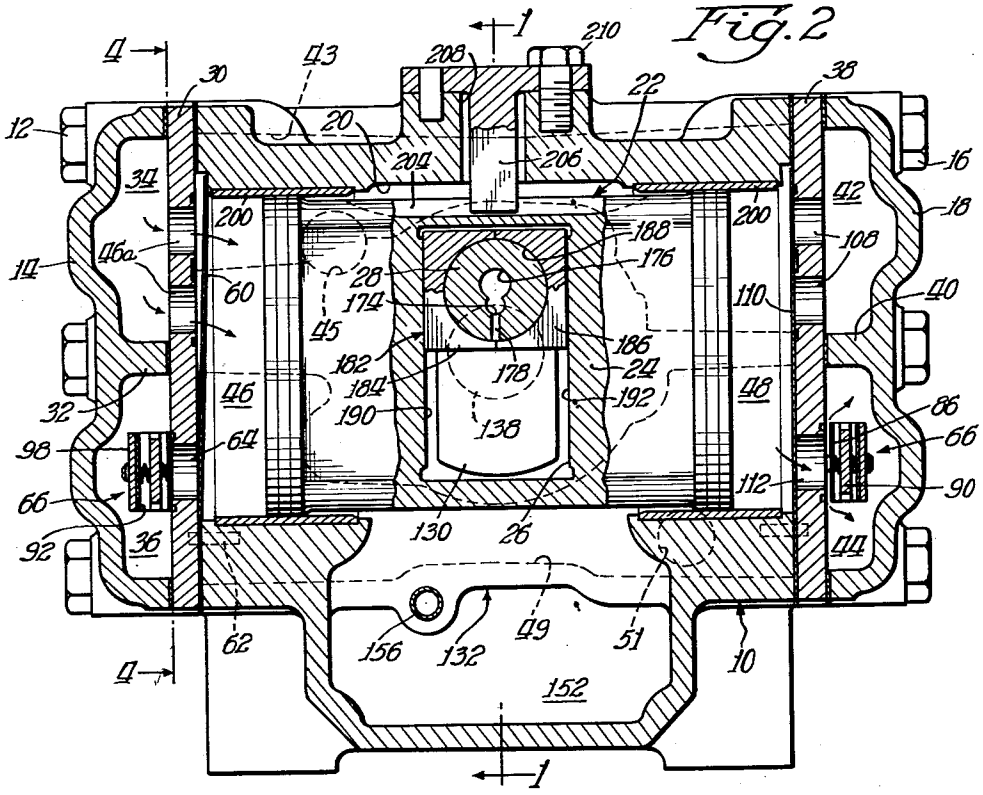
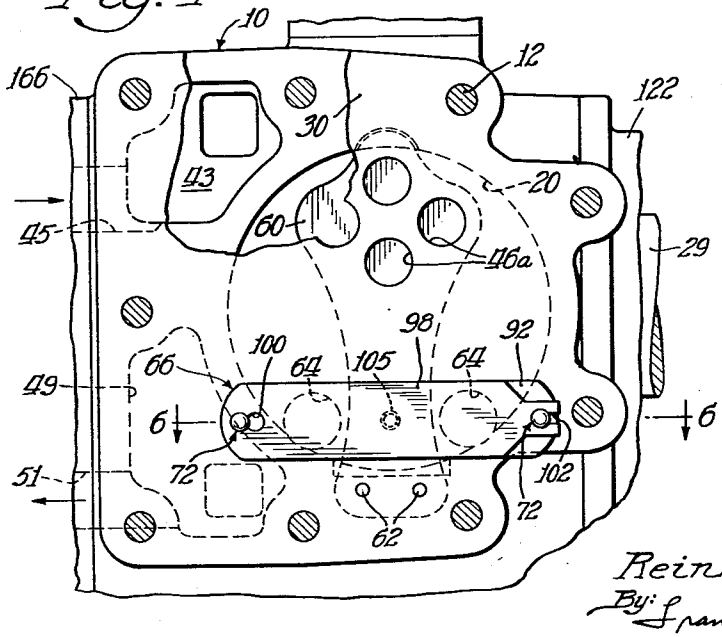


Fig. 4



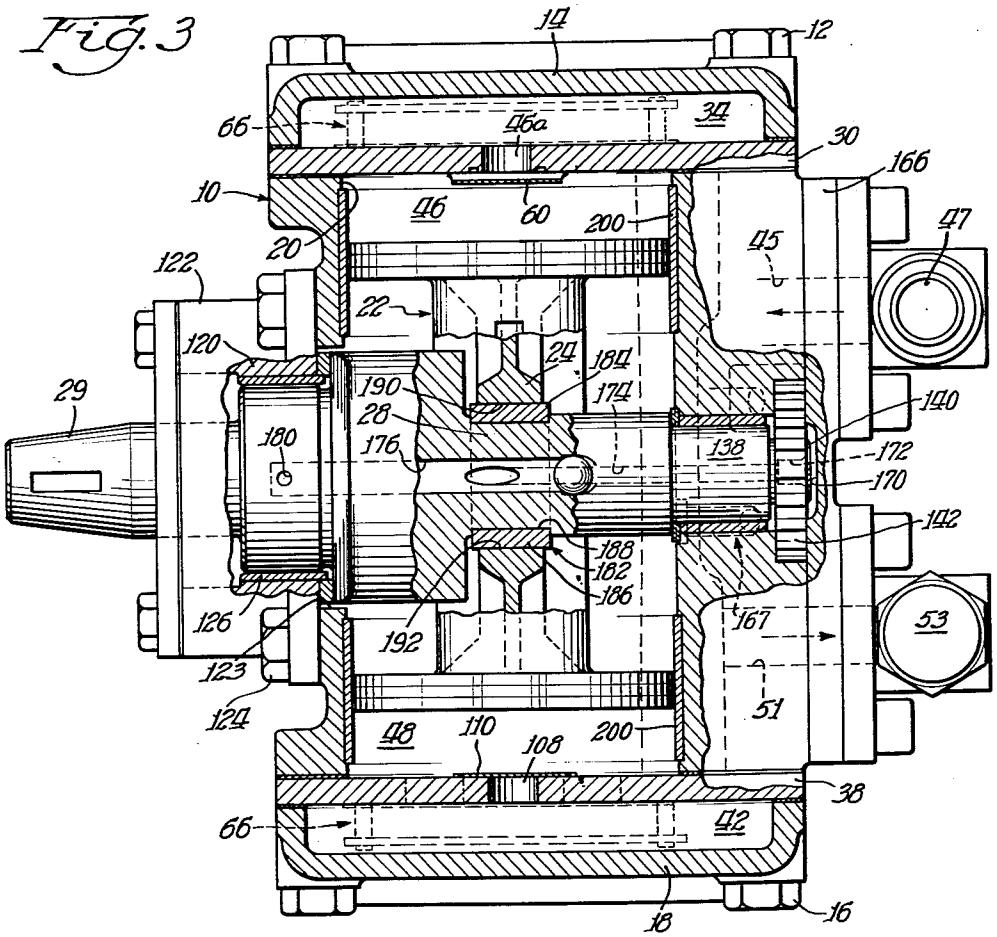
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COMPRESSOR

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Fig. 3



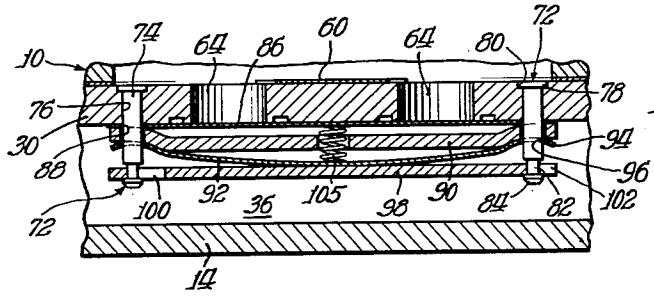


Fig. 6

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United States Patent Office 3,010,644 Patented Nov. 28, 1961

3,010,644
COMPRESSOR

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Filed Nov. 5, 1959, Ser. No. 851,098
4 Claims. (Cl. 230—185)

This invention relates to gas compressors and more particularly to a gas compressor especially suited for a refrigerant system for automotive vehicles.

This invention is primarily directed to a refrigerant gas compressor of the reciprocating type in which a double ended piston is reciprocated in a cylinder directly by an eccentric in the form of a crank throw.

A primary object of the invention is to provide a refrigerant compressor of the stated type characterized by a piston of improved type which is formed with a diametrically extending web provided with a centrally disposed slot for reception of the eccentric and in which friction is minimized by the use of a split bearing which engages the edges of the web defining the slot.

A further object of the invention is to provide a refrigerant compressor of the mentioned character in which the piston is formed of a light weight metal such as aluminum or the like and in which counterweights are employed in limited spaced relation to the piston mass to balance the inertia of the piston.

Another object of the invention is to provide a refrigerant compressor of the type described which is characterized by reliability, light weight, compactness, relatively few parts, ease of manufacture and facility of use.

Another object of the invention is to provide a refrigerant compressor in accordance with the preceding objects in which compression may be effected at the beginning and at the end of each cycle of the piston, and in which the gas under pressure is ported to a pressure manifold capable of muffling gas pulsations.

A further object of the invention is to provide a compressor of the stated type wherein chambers are provided in communication with the intake and exhaust ports of sufficient volumetric capacity to muffle gas pulsations.

A further object of the invention is to provide a compressor of the character described in which the ratio of piston diameter to stroke falls within the range 1.8:1 to 3.5:1.

This invention consists of the novel constructions, arrangements and devices to be hereinafter described and claimed for carrying out the above stated objects and such other objects as will be apparent from the following description of preferred forms of the invention, illustrated with reference to the accompanying drawings, wherein:

FIGURE 1 is a vertical elevational view of a compressor made in accordance with the present invention and taken substantially on line 1—1 of FIGURE 2;

FIGURE 2 is a vertical sectional view taken substantially on line 2—2 of FIGURE 1;

FIGURE 3 is a sectional plan view taken substantially on line 3—3 of FIGURE 1;

FIGURE 4 is a view taken substantially on line 4—4 of FIGURE 2;

FIGURE 5 is a view taken substantially on line 5—5 of FIGURE 1;

FIGURE 6 is a sectional plan view taken substantially on line 6—6 of FIGURE 4.

Referring to the drawings and more particularly to FIGURES 1 and 2, the compressor of the present invention comprises a body or block 10 to one side of which is secured, by means of cap screws 12 a cylinder head 14, and to the other side of which is secured by means of cap screws 16 a cylinder head 18. Formed in

the block 10 is a cylinder 20 in which is slidably received a piston 22 having a central axially extending web 24 provided with a radially extending slot 26 in which is received an eccentric or throw 28 integrally formed with a drive shaft 29. The drive shaft 29, as will be understood, may be drivingly connected by any suitable means to the engine of an automotive vehicle or to any other power source for revolving the throw 28 to reciprocate the piston 22.

Interposed betwen the cylinder head 14 and the block 10 is a port plate 30. A rib 32, integrally formed with the cylinder head 14, divides the interior thereof into a suction chamber 34 and a pressure chamber 36. So also, an end plate 38 is interposed between the cylinder head 18 and the block 10, at the other end thereof, and the cylinder head 18 has a rib 40 forming a partition dividing the interior thereof into a suction chamber 42 and a pressure chamber 44.

A suction passage or manifold 43, formed in the block 10, connects the suction chambers 34 and 42 and is in fluid communication with a passage 45 which is connected to an inlet 47. Similarly, a pressure passage 49 is formed in the block 10 to afford fluid communication between the pressure chambers 36 and 44. A passage 51 connects the passage 49 to an outlet 53.

The interior of the cylinder 20 is shown as divided by the piston 22 into a first chamber 46 and a second chamber 48. Upon movement of the piston 22 to the left, as viewed in FIGURE 2, the volume of the chamber 46 is diminished while the volume of the chamber 48 is augmented. Conversely, as the piston 22 moves to the right, as viewed in the same figure, the volume of the chamber 48 is diminished and the volume of the chamber 46 is augmented. In the position of the elements illustrated in FIGURE 2, the piston 22 is moving to the right and the volume of the chamber 46 is increasing. Refrigerant gas is drawn into the chamber 46 from the chamber 34 through ports 46*a* the evaporator (not shown) of the refrigerant system and by means of the suction manifold 43 illustrated in solid lines in FIGURES 1 and 4 in dotted lines in FIGURES 2 and 3.

After the piston 22 reaches dead center position it starts to move to the left to compress the gas received in the chamber 46 during the suction stroke. Passage of gas back to the chamber 34 is precluded by means of a valve 60 of the steel reed type. The valve 60 is forced by the pressure of the compressing gas into a position blocking the inlet ports 46*a* and one end thereof is retained in position with respect to the casing 10 and the plate 30 by means of pins 62. The compressed gas is discharged from the chamber 46 to the pressure chamber 36 through exhaust ports 64 in the plate 30. The release of the pressurized gas is controlled by an exhaust valve assembly 66 which will now be described in detail. Communication is afforded between the pressure chamber 36 and a pressure exhaust manifold 49 by means of a port 70 in the plate 30.

The valve assembly 66, as shown best in FIGURE 6, includes a pair of pins 72 in alignment with the axes of the ports 64. Each of the pins 72 includes a body portion 74 received in an opening 76 in the plate 30, a head 78 received in a countersunk bore 80, a reduced portion 82 and a chamfered head 84 of the same diameter as the body portion 74. An elongated gasket 86 extends across the ports 64 and has at each end an opening 88 which received the body portion 74 of each pin 72. The gasket 86 is retained in the position illustrated in FIGURE 6 by means of a plate 90 which is biased to the position illustrated by means of bowed flat spring 92 having at each end an inwardly curved portion 94 provided with an opening 96 through which passes the body portion 74 of each pin 72. A plate 98 affords reaction for the flat

spring 92 and limits the distortion thereof under influence of pressure of the gas passing through the ports 64, as will be understood. The plate 98 is shown as having at one end a bayonet slot 100 for receiving the reduced portion 82 of one of the pins 72, and at the other end an open slot 102 for receiving the reduced portion 82 of the other of the pins 72. The plate 98 may be mounted in the position illustrated by inserting one of the heads 84 in the bayonet slot and moving the other end of the plate to a position where the reduced portion 84 of the opposite pin 72 is embraced. The gasket 86 is also biased to the position shown by means of a coil spring 105, one end of which abuts against the flat spring 92, as clearly shown in FIGURE 6. It will be appreciated that the springs 92 and 105 may be calibrated to yield at a predetermined gas pressure. Gas under pressure flows through the manifold 49, through the passage 51 in the casing 10, and thence through the discharge fitting 53 to the condenser (not shown) of the refrigerant system.

As the compression stroke occurs in the chamber 46, low pressure gas is drawn into the chamber 48 from the suction chamber 42 through suction ports 108. As the piston 22 again moves to the right, passage of pressurized gas through the ports 108 is prevented by a flap valve 110 of the steel reed type and a predetermined degree of pressure may be developed prior to the operation of a pressure valve assembly 66, identical to that associated with the plate 30 for controlling the passage of gas under pressure through exhaust ports 112 to the pressure chamber 44, the pressure manifold 68, the discharge passage 104 and thence through the discharge outlet 106 to the condenser, as will be understood.

The shaft 29 is journalled at one end in an inwardly extending annular boss 120 formed integrally with a front plate 122 which covers an opening 123 and is secured by means of cap screws 124 to the front wall of the casing 10. A bearing or bushing 126 is interposed between the enlarged portion and the annular boss 120. The crank or throw 28 is formed integrally with the shaft 29 and has on each side thereof a pair of counterweights 128 and 130 extending diametrically oppositely from the axis of rotation of the shaft. These counterweights function to balance the inertia forces created by the eccentric movement of the crank or throw 28. The crank shaft 29 may be readily arranged in the operative position shown by passing one end of the shaft through the slot 26 in the web 24 of the piston 22 since the counterweights 128 and 130 are in radial alignment with the crank or throw 28. It will be noted that the counterweights 128 and 130 are shaped generally to conform to the configuration of the slot 26 to afford easy passage of the counterweight 130 through the slot 26. It will be noted also that the counterweights 128 and 130 are disposed as close as possible to the center of mass of the piston 22.

The casing 10 has a rear wall 132 and a bore 134 in which is positioned a bearing or bushing 136 for journalling a reduced portion 138 of the shaft 29. Integrally formed with the reduced portion 138 is a further reduced portion 140 to which is affixed for rotation a pinion 142 of a gear pump 144. The pinion 142 is in mesh with a gear 146 which is rotatably mounted on a stub shaft 148 received in a bore 150 in the back wall 132. The gear pump 144 forms a part of a lubrication system which will now be described, with particular reference to FIGURES 1 and 5.

Lubricating oil may be drawn from a sump 152, at the bottom of the casing 10, through a screen 154, a suction tube 156, and drilled passages 158 and 160 to a suction recess 162 formed in the back wall 132 of the casing 10. The gears 142 and 146 are rotated in a recess 164 forming a pump chamber. Upon rotation of the gears 142 and 146 in the direction of the arrows in FIGURE 5, the lubricating oil is delivered under pressure to a pressure recess 165 in the wall 132. A plate 166 is secured to the back of the casing 10 by means of cap screws 168 and cooperate with the recess 164 to form the pump chamber 164. A recess 170 is formed in the inner surface of the back plate 166, communicates with the recess 164 and forms a passage in fluid communication with a bore 172 in the portion 140, and a drilled passage 174 extending angularly from the bore 172. Excess pressure in the pressure recess 165 may be relieved to sump by a pressure relief valve 167. Communicating with the passage 174 is a drilled passage 176 extending through the crank or throw 28. A radial passage 178 extends outwardly from the passage 174 to the periphery of the crank or throw 28 and a passage 180 extends radially outwardly from the inner end of the drilled passage 176 for lubrication of the bearing or bushing 126.

According to the present invention, the crank or throw 28 is journalled in a bearing 182 which comprises identical halves 184 and 186 which together form a cube having a bore 188 in which the crank or throw 28 is received. The passage 178 provides lubricating oil to the halves 184 and 186, as will be understood.

The slot 26 and the web 24 of the piston 22 is defined by substantially diametrically extending edges 190 and 192 the left side of the bearing half 184, as viewed in FIGURE 2, bears against the edge 192. As the shaft 29 rotates, the crank or throw 28 revolves in an orbit so that force is exerted alternately aaginst the edge 190 and the edge 192 so that the piston reciprocates alternately to the left and then to the right, an viewed in the same figure. The counterweights 128 and 130, as seen best in FIGURE 1, are disposed adjacent each side of the crank or throw 28 and orbit within the reciprocating space of the piston 22 as well as within the confines of the diameter of the piston.

To facilitate the reciprocation of the piston 22, inserts or lines of steel cast iron or the like, 200 may be mounted within the bore 20. Alternately, the block 10, which is preferably made of aluminum, may be hot sprayed with a line of steel and then subsequently machined to size. It will be appreciated that the cylindrical wall may also be chromium plated. For preventing rotation of the piston 22, a slot 204 is formed in the periphery of the cylinder web for reception of a guide bar 206 which passes through an opening 208 in the block 10 and is preferably T-shaped in configuration and is illustrated as being secured in position by means of cap screws 210.

While I have described my invention in connection with certain specific constructions and arrangements, it is to be understood that this is by way of illustration and not by way of limitation and the scope of my invention is defined solely by the appended claims which should be construed as broadly as the prior art will permit.

I claim:

1. A gas compressor comprises a housing, a cylinder formed in said housing, a piston slidably mounted in said cylinder, said piston comprising spaced cylindrical sections joined by a web of I-shaped cross section, said web being formed with a diametrical extending slot, a crankshaft journalled in said housing, said crankshaft having an eccentric crank received within the slot in the web of said piston, a counterweight formed on said crankshaft on each side of said crank, one of said counterweights being shaped to be passed through said slot and to be received within the confines of said piston, the ratio of piston diameter to stroke falling within the range 1.2:1 to 3.5:1, a port plate arranged at each end of said housing, a cylinder head arranged at each end of said housing outwardly of said port plates, means securing said heads and said port plates to said housing, means dividing the interior of each of said heads into a suction chamber and a pressure chamber, an inlet for admission of gas to said housing, conduit means connecting said inlet to each of said suction chambers, an outlet from said housing, conduit means connecting each of said pressure chambers with said outlet, first valve means cooperating with said port plates to afford passage of gas through said port plates from said suction chambers at each suction stroke

and second valve means operable during the compression stroke when the gas pressure reaches a predetermined valve to afford passage of pressurized gas into said pressure chambers, said pressure conduit means, and through said outlet.

2. A gas compressor comprises a housing a cylinder formed in said housing, a piston slidably mounted in said cylinder, said piston comprising spaced cylindrical sections joined by a web of I-shaped cross section, guide means for preventing rotation of said piston, said web being formed with a diametrical extending slot, a crankshaft journalled in said housing and adapted to be rotated by a power source, said crankshaft having an eccentric crank received within the slot in the web of said piston, said crank being revolvable to afford reciprocation of said piston, a counterweight formed on said crankshaft on each side of said crank, one of said counterweights being shaped to be passed through said slot and to be received within the confines of said piston, the ratio of piston diameter to stroke falling within the range 1.8:1 to 3.5:1, a port plate arranged at each end of said housing, a cylinder head arranged at each end of said housing outwardly of said port plates, means securing said heads and said port plates to said housing, means dividing the interior of each of said heads into a suction chamber and a pressure chamber, an inlet for admission of gas to said housing, conduit means connecting said inlet to each of said suction chambers, an outlet from said housing, conduit means connecting each of said pressure chambers with said outlet, first valve means cooperating with said port plates to afford passage of gas through said port plates from said suction chambers at each suction stroke and second valve means operable during the compression stroke when the gas pressure reaches a predetermined value to afford passage of pressurized gas into said pressure chambers, said pressure conduit means, and through said outlet.

3. A gas compressor comprises a housing, a cylinder formed in said housing, a piston slidably mounted in said cylinder, said piston comprising spaced cylindrical sections joined by a web of I-shaped cross section, guide means for preventing rotation of said piston, said web being formed with a diametrical extending slot, a crankshaft journalled in said housing and adapted to be rotated by a power source, said crankshaft having an eccentric crank received within the slot in the web of said piston, said crank being revolvable to afford reciprocation of said piston, a counterweight formed on said crankshaft on each side of said crank, one of said counterweights being shaped to be passed through said slot and to be received within the confines of said piston, a port plate arranged at each end of said housing, a cylinder head arranged at each end of said housing outwardly of said port plates, means securing said heads and said port plates to said housing, means dividing the interior of each of said heads into a suction chamber and a pressure chamber, an inlet for admission of gas to said housing, conduit means connecting said inlet to each of said suction chambers, an outlet from said housing conduit means connecting each of said pressure chambers with said outlet, first valve means cooperating with said port plates to afford passage of gas through said port plates from said suction chambers at each suction stroke and second valve means operable during the compression stroke when the gas pressure reaches a predetermined value to afford passage of pressurized gas into said pressure chambers, said pressure conduit means, and through said outlet.

4. A gas compressor comprises a housing, a cylinder formed in said housing, a piston slidably mounted in said cylinder, said piston comprising spaced cylindrical sections joined by a web of I-shaped cross section, said web being formed with a diametrical extending slot, a crankshaft journalled in said housing, said crankshaft having an eccentric crank received within the slot in the web of said piston, a counterweight formed on said crankshaft on each side of said crank, one of said counterweights being shaped to be passed through said slot and to be received within the confines of said piston, a port plate arranged at each end of said housing, a cylinder head arranged at each end of said housing outwardly of said port plates, means securing said heads and said port plates to said housing, means dividing the interior of each of said heads into a suction chamber and a pressure chamber, an inlet for admission of gas to said housing, conduit means connecting said inlet to each of said suction chambers, an outlet from said housing, conduit means connecting each of said pressure chambers with said outlet, first valve means cooperating with said port plates to afford passage of gas through said port plates from said suction chambers at each suction stroke and second valve means operable during the compression stroke when the gas pressure reaches a predetermined value to afford passage of pressurized gas into said pressure chambers, said pressure conduit means, and through said outlet.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,010,644 November 28, 1961

Reinhold C. Zeidler

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 63, for "1.2:1" read -- 1.8:1 --.

Signed and sealed this 10th day of April 1962.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents