United States Patent

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[54] **COMPRESSOR**
12 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **91/498**
[51] **Int. Cl.** **F04b 1/10**
[50] **Field of Search** ..... 103/161; 230/177; 123/44 E; 91/205; 92/58

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ABSTRACT: A compressor having a housing and an eccentrically mounted rotor in the housing. A plurality of pistons reciprocate in the rotor and bear against the housing. Passages in the pistons allow gas to flow underneath the pistons when the pistons are in the extended position, and the gas is compressed in the cylinders as the pistons move inwardly and expelled through a port at the inner end of each cylinder.

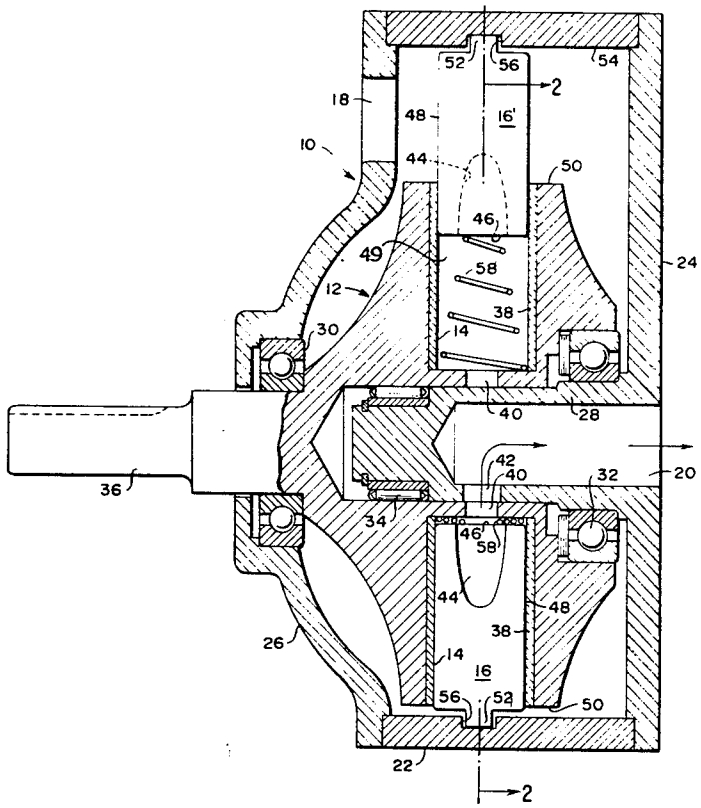


FIG. 1

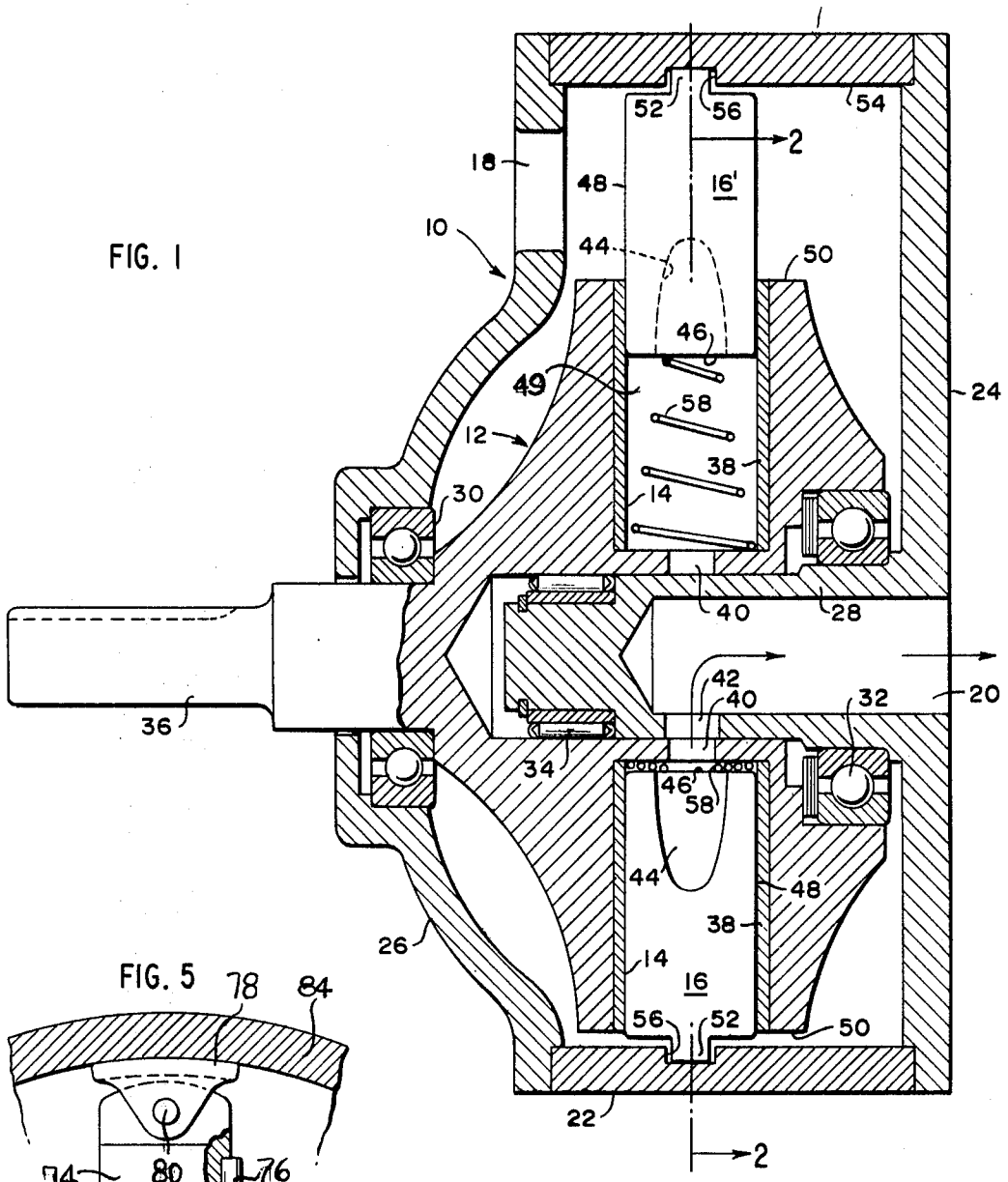
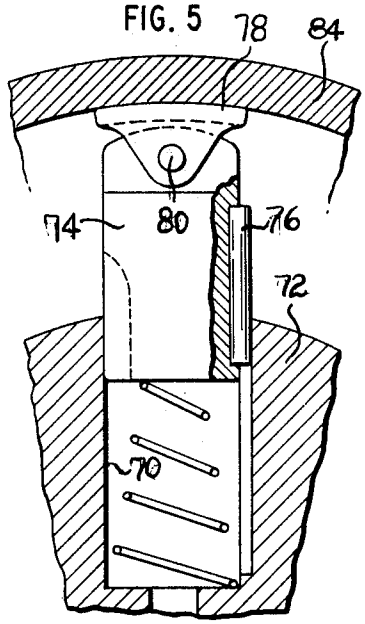


FIG. 5



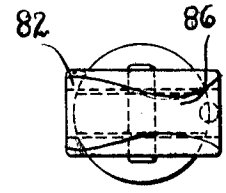


FIG. 6

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FIG. 2

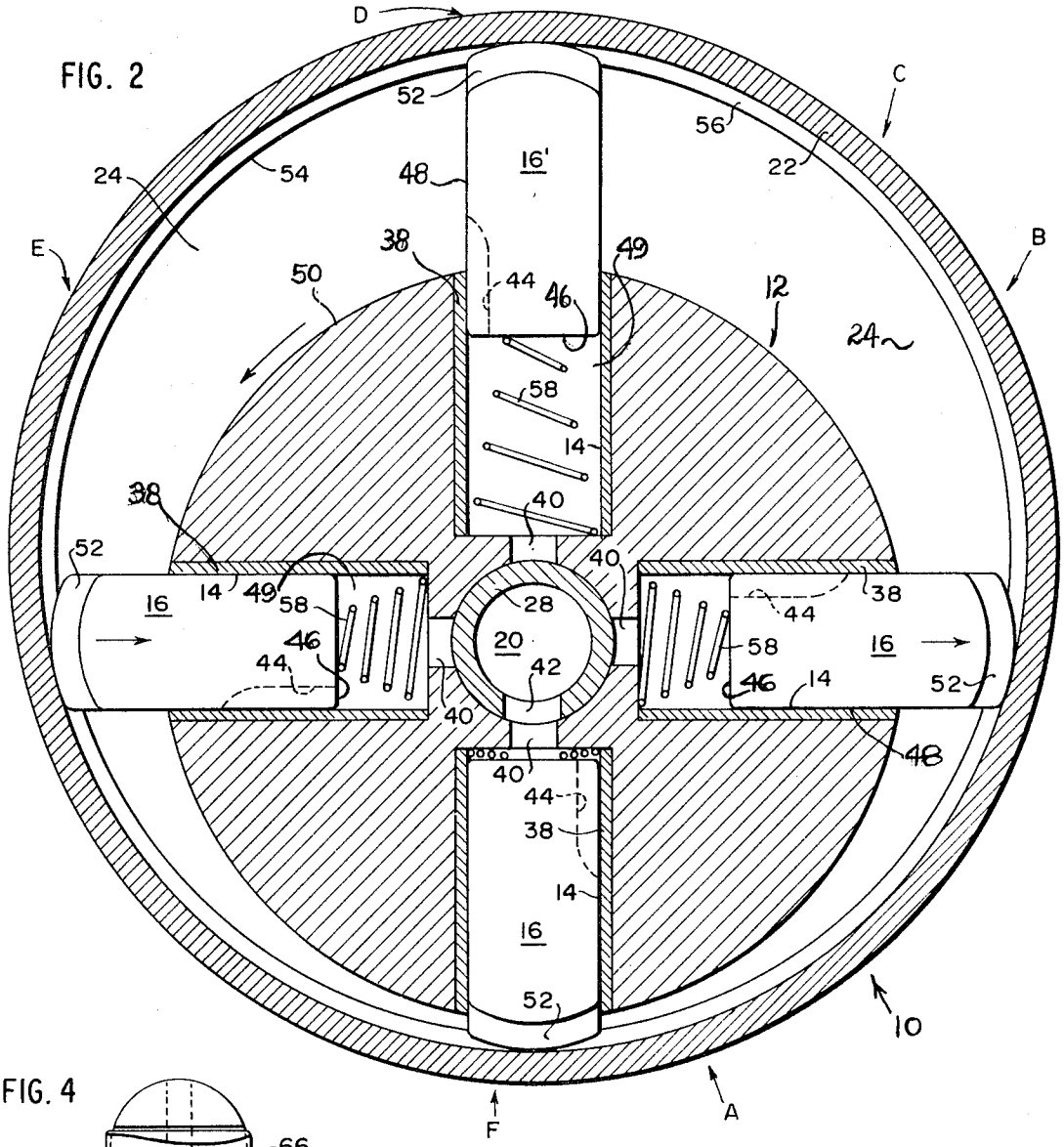


FIG. 4

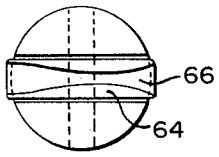
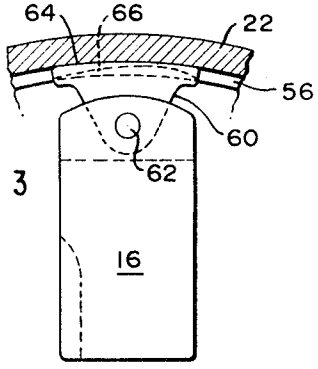


FIG. 3



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COMPRESSOR

This invention relates to a new and improved compressor. One important object of this invention is to provide a relatively small compressor capable of generating higher pressures at greater volumes than units of comparable size and cost now available. At the present time compressors are generally of two varieties, namely, reciprocating pump-type units and vane-type pumps. Reciprocating pump-type compressors usually require a two stage operation to generate pressures in the range of 100 p.s.i., while the vane-type units now available are incapable of delivering pressures of that magnitude.

Another important object of this invention is to provide a compressor having a plurality of reciprocating pistons to achieve greater compressor capacity.

Another important object of this invention is to provide a compressor which is free from leakage problems commonly encountered in rotary pumps.

Yet another important object of this invention is to provide a compressor of high rated capacity, which is inexpensive to manufacture.

Yet another important object of this invention is to provide a compressor requiring no lubrication and which compresses gaseous materials without introducing any oil or other lubricant into the compressed gas.

To accomplish these and other objects, the compressor of this invention includes a housing with an eccentrically mounted rotor. A number of pistons are reciprocally movable in the rotor and are forced inwardly against the centrifugal force of the unit by the action of the sidewalls of the housing acting upon them. When each piston is in its extended position a passage is opened which allows gas to flow beneath the piston in its cylinder. As the rotor turns, the pistons are forced inwardly and the passages are closed to compress the gas which lies beneath the pistons. Each of the cylinders is sequentially open at the bottom to allow the compressed gas to escape during each revolution of the rotor.

These and other objects and features of this invention along with its incident advantages will be better understood and appreciated from the following detailed description of two embodiments thereof, selected for purposes of illustration and shown in the accompanying drawing, in which:

FIG. 1 is a cross-sectional view of a compressor constructed in accordance with this invention;

FIG. 2 is a cross-sectional view taken along the section line 2–2 of FIG. 1;

FIG. 3 is a fragmentary detail view of a modification of the compressor shown in FIGS. 1 and 2;

FIG. 4 is an end view of a portion of the detail shown in FIG. 3;

FIG. 5 is a fragmentary detail view of another modification of the compressor; and

FIG. 6 is an end view of a portion of the detail shown in FIG. 5.

The compressor shown in FIGS. 1 and 2 includes a housing 10 within which is eccentrically mounted a rotor 12. In the embodiment shown four cylinders 14 are formed in the rotor, and each contains a piston 16 which reciprocates in the cylinder as the rotor turns in the housing 10. An inlet 18 and an outlet 20 are provided in the housing.

The housing 10 includes a cylindrical peripheral wall 22 joining end walls 24 and 26. Wall 24 is generally flat but includes an inwardly extending sleeve 28 on which the rotor 12 turns and through which the compressed gas is exhausted. Bearings 30 and 32 are shown in the drawing to support the rotor, and needle bearings 34 are provided to insure its free rotation.

The rotor 12 includes a shaft 36 that extends out of the housing 10 and which may be driven by a motor or some other prime mover. Each cylinder 14 is shown with and can be provided with a liner 38 to reduce friction as its piston reciprocates. The liner 38 may be nylon or some similar self lubricating material. The bottom of each cylinder 14 is provided with a port 40 through which the gas in the cylinder below the piston may discharge. It will be noted in FIGS. 1 and 2 that a passage 42 is provided in the wall of the sleeve 28, and as the rotor turns, the ports 40 in the cylinders sequentially come into alignment with the passage 42. Gas discharged from ports 40 through passage 42 will flow axially out the sleeve 28 through the main discharge passage 20 in the housing 10.

Each piston 16 is provided with a slot 44 that extends from the inner end 46 of each piston to a point on the sidewall 48 intermediate the piston ends. It is evident in FIG. 2 that each slot 44 cooperates with the inner surface of its respective cylinder 14 to form a passage for gas contained in the housing 10 to flow into the chamber 49 in the cylinder beneath the piston 16. When the piston is in its extended position as is the uppermost piston 16' shown in FIGS. 1 and 2, the outer end of the slot 44 is disposed beyond the periphery 50 of the rotor 12 so that gas contained in the housing may flow through the slot into the chamber 49. However, as the piston is forced inwardly to a withdrawn position in the cylinder under the influence of the peripheral wall 22, the passage 44 ultimately closes at its outer end and the piston begins to compress the gas below it in the chamber 48. It will be noted in FIG. 2 that the inlet or outer ends of the passages 44 face in the direction of rotation of the rotor, and therefore, they form scoops to direct gas in the housing through the slots and into the chambers 49.

The outer end of each piston 16 is provided with an arcuate runner 52 of a radius somewhat smaller than the radius of the inner surface 54 of peripheral wall 22 of the housing. A groove on the inner surface 54 of the peripheral wall defines a track 56 for the runner, and the cooperation of the runners and track prevents the pistons 16 from rotating about their own axes in the cylinder 14. The smaller radius of the runner 52 establishes substantially line contacts between the piston and the wall 22 to reduce the friction area. The track 54 may be lined with a material to further reduce friction.

From the foregoing description it is evident that as the rotor 12 rotates by means of some input applied to the shaft 36, the pistons 16 under the influence of centrifugal force remain in contact with the wall 22 with the rails 52 within the tack 56. A spring 58 in each cylinder also constantly urges the pistons against the wall. As each piston passes through region A as shown in FIG. 2, immediately after it exhausts its chamber 49 through alignment port 40 with the port 42, the piston begins to move outwardly in its chamber until it reaches region B where the outer end of the passage 44 extends beyond the periphery 50 of the rotor. Continued rotation of the rotor to position C maintains the passage 44 in the open condition and gas in the housing which enters through the inlet 18 is allowed to enter the chamber 48 in the cylinder beneath the piston. The piston reaches its outermost position at region D. At region E the passage 44 closes because the inlet end slips below the periphery 50 of the rotor, and continued rotation of the rotor drives the piston 16 inwardly so as to compress the gas in the chamber 49. When each piston reaches region F, the port 40 at the bottom of the chamber aligns itself with the passage 42, and the gas compressed in the chamber 49 is allowed to discharge through the outlet 20. Depending upon the particular use to which the compressor is put, the outlet 20 may be connected to a heat exchanger to reduce the gas temperature.

In FIGS. 3 and 4 a slight modification of the invention shown in FIGS. 1 and 2 is illustrated. In that figure the housing, rotor, cylinders, and pistons are virtually the same, but a special foot 60 is carried by the end of each piston and serves as the runner. Each foot 60 is pivotally pinned to the outer end of each piston by peg 62, and the outer surface 64 of the foot bears against the track 56 on the inner surface of the peripheral wall 22 of the housing. The surface 64 of the foot 60 can be provided with a venturi-shaped recess 66 that defines a passage for air between the surface 64 of the foot and the surface of the track 56 in peripheral wall 22. Consequently, as the rotor turns and the foot slides along the track, the passage 66 acts as a scoop and creates a pressure build up between the track and foot which will form an air

bearing for the surface 64 of the foot. Consequently friction is markedly reduced as the rotor turns. Except for that difference in the embodiment of FIGS. 3 and 4, the compressor functions in precisely the same manner as the compressor of the embodiment shown in FIGS. 1 and 2. The refinement shown in the embodiment of 3 and 4 reduces friction losses so as to increase the efficiency of the compressor, and the track liner which reduces friction further improves the operation.

In FIGS. 5 and 6, yet another modification of the invention is shown, which closely resembles the embodiment of FIGS. 3 and 4. In this modification, the track in the peripheral wall of the housing is eliminated, and other means are used to prevent rotation of the cylinder. In the drawing cylinder 70 is shown to have a key way 72 formed in its cylindrical wall, and piston 74 carries a wear pin 76 in its wall that extends into the key way. Consequently the piston is restrained against rotary motion in the cylinder and is free to move axially in it.

The shoe 78 which is pivoted on the end of the cylinder by pin 80 has a much wider surface 82 facing the peripheral wall 84 of the housing, and no track is formed to receive it. The passage 86 in the surface 82 is extended to build up pressure between the two surfaces so as to reduce the friction losses by establishing an air bearing for the foot as the rotor rotates. The surfaces may be provided with a low friction material to further achieve this goal.

From the foregoing description it will be appreciated that the embodiments of this invention shown in the drawing achieve the several objects set forth in the introduction. A compressor having a housing diameter of approximately 12 inches with pistons having a stroke of somewhat less than 2 inches is capable of generating approximately 100 p.s.i. pressure. The device is plainly inexpensive to manufacture, has a very substantial capacity because of the plurality of pistons, and provides the high pressure without leakage problems normally found in other forms of pumps.

What I claim is:

1. A compressor comprising:
a housing having a peripheral wall,
a rotor excentrically mounted in the housing for rotation about a fixed, central axis,
a plurality of cylinders formed in the rotor and extending to its periphery,
a piston mounted for reciprocal motion in each cylinder as the rotor rotates, and for rotary motion in unison with said rotor, the housing wall controlling the position of the piston as the rotor rotates,
a passage formed in the side of each piston and extending along the piston to the inner end thereof,
each of said passages being constructed and arranged to be closed by the wall of its cylinder as its piston moves inwardly in the cylinder whereby when said piston is in the extended position, gas in the housing between the peripheral wall and the rotor may move into each cylinder below its associated piston and when said piston moves inwardly in the cylinder said gas will be entrapped and compressed therein, and a discharge port provided at the inner end of each cylinder, each port opening as the piston in each cylinder achieves its inner position.

2. A compressor as defined in claim 1 further characterized by:
said side of said piston in which said passage is formed being exposed when the piston is in the extended position and being closed when the piston is in the inner position
said passage being formed in each piston so that when said side having said passage formed therein is extended, said passage faces in the direction of rotation of said rotor.

3. A compressor as defined in claim 1 further characterized by:
a sleeve about which the rotor rotates,
a discharge opening provided in the sleeve and registering sequentially with each port once each revolution of the rotor.

4. A compressor as defined in claim 3 further characterized by:
said sleeve serving as a conduit to convey the compressed gas discharged through the opening from the housing.

5. A compressor as defined in claim 1 further characterized by:
an arcuate runner formed on the end of each piston having a radius less than that of the housing wall,
and a track in the inner surface of the wall of the housing in which the runner rides as it moves about the housing.

6. A compressor as defined in claim 1 further characterized by:
a foot pivoted to the end of each piston and bearing against the inner surface of the housing wall.

7. A compressor as defined in claim 5 further characterized by:
a foot connected to the piston as a runner with an air passage in the surface of the foot to define an air bearing for the foot on the housing wall.

8. A compressor as defined in claim 6 further characterized by:
an air passage in the surface of the foot to define an air bearing for the foot on the housing wall.

9. A compressor as defined in claim 2 further characterized by:
a sleeve about which the rotor rotates,
a discharge opening provided in the sleeve and registering sequentially with each port once each revolution of the rotor,
said sleeve serving as a conduit to convey the compressed gas discharged through the opening from the housing.

10. A compressor as defined in claim 1 further characterized by:
a keying means provided between the cylinder and piston for preventing the piston from rotating in the cylinder as it reciprocates.

11. A compressor as defined in claim 4 further characterized by:
a wear pin carried by each piston and riding in a key way provided in each cylinder to prevent the pistons from rotating,
and a foot pivoted to the end of each piston and bearing against the inner surface of the housing wall.

12. A compressor as defined in claim 2 further characterized by:
means for maintaining each of said pistons in a position in which the passage thereof faces in the direction of rotor rotation at all times.