

(12)

EUROPEAN PATENT APPLICATION

(21) Application number: 83400888.0

(51) Int. Cl.³: F 04 B 39/10

(22) Date of filing: 03.05.83

(30) Priority: 05.05.82 US 375054

(43) Date of publication of application:
09.11.83 Bulletin 83/45

(84) Designated Contracting States:
DE FR GB IT SE

(71) Applicant: **THE BENDIX CORPORATION**
Executive Offices Bendix Center
Southfield Michigan 48037(US)

(72) Inventor: **Reisinger, Paul G.**
1823 Tower Blvd.
Lorain Ohio 44053(US)

(74) Representative: **Huchet, André et al,**
Service Brevets Bendix 44, rue François 1er
F-75008 Paris(FR)

(54) **Compressor.**

(57) A compressor having bores (16, 18) in a housing, pistons (38, 40) reciprocally mounted in said bores, a head assembly (106) with inlet and outlet ports, and a valve assembly interposed between the housing (12) and said head assembly for controlling fluid flow to the bores and discharge of fluid from the bores.

According to the invention, the valve assembly consists of a plate (54) provided with inlet and outlet openings, of a reed assembly (84) having a metal substrate with a gasket material printed thereon and a plurality of reeds (88, 90) formed therein for controlling fluid flow through said openings, and fasteners (bolts) for aligning and holding said head assembly, reed assembly and plate with respect to the housing.

For use particularly as air compressor.

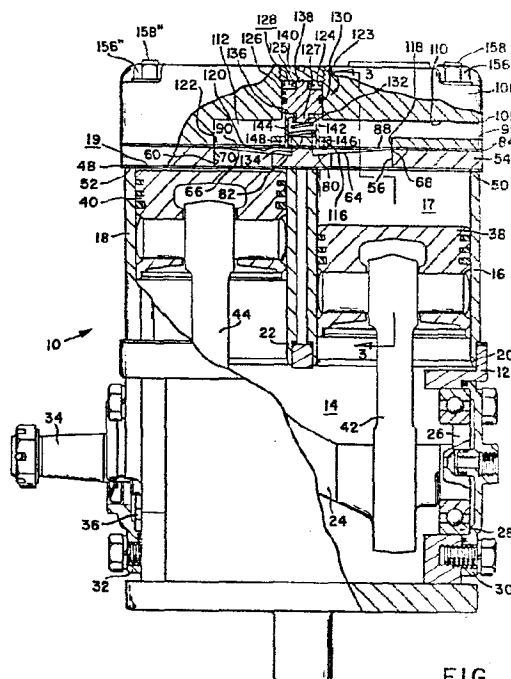


FIG. 1

COMPRESSOR

The present invention relates to a compressor with reciprocating pistons, which, among many other possible applications, can be used as an air compressor on heavy automotive vehicles.

Such a compressor usually comprises a housing with bores formed therein, pistons reciprocally mounted in said bores and defining there-
5 with operational chambers, a head assembly provided with inlet and outlet ports, and a valve assembly interposed between the housing and the head assembly for allowing fluid to flow from said inlet port to said operational chambers in response to movement of said pistons in one direction
10 and for allowing compressed fluid to flow from said operational chambers to said outlet port in response to movement of said pistons in another direction.

In the prior art, control valves for compressors have been separate elements that require individual installation. Such installation is clearly illustrated in U.S. Patents Nos. 1 508 568 and 2 417 246.
15 In today's economy, where efficiency is often the difference between success and failure, such manufacturing cost could make this type of compressor too expensive for most customers.

It is, accordingly, an object of the present invention to
20 extend the field of applications of such compressors by substantially reducing the manufacturing cost of their valve assemblies, while still keeping them liable in operation and easy to disassemble for maintenance or replacement.

This object is achieved, according to the invention, and in a
25 compressor of the kind defined above, thanks to the fact that the valve assembly comprises a plate having inlet and outlet openings for connecting the operational chambers with the inlet and outlet ports, a reed assembly having a metal substrate with a gasket material printed thereon, said metal substrate having a plurality of reeds formed therein
30 which cooperate with said plate and with the head assembly for controlling fluid flow through said inlet and outlet openings, and fastener means for aligning and holding said reed assembly, said plate and said head assembly with respect to the compressor housing. Such a reed assembly is easy and little expensive to manufacture, while the fastener

means (bolts, for instance) provide for accurate alignment of the various reeds over the inlet and outlet openings formed in the plate, and therefore, for a liable operation.

In a preferred embodiment of the invention, the valve assembly
5 further comprises a plunger or piston having a face connected to receive the fluid pressure from stored compressed fluid and at least one projection that extends toward the reed assembly, and resilient means for urging said piston away from said reed assembly, said fluid pressure of the stored compressed fluid acting on said piston face and overcoming
10 said resilient means to allow said piston to move and engage the inlet reeds in a manner such that the operational chambers are continually connected to the inlet port. Thereafter the work required to move the pistons in their associated bores is substantially reduced while the transmission of compressed fluid to the storage container is terminated.

15 These and other advantageous features of the invention will become readily apparent from reading the following description of a preferred embodiment, given by way of example, and with reference to the accompanying drawings in which :

- Figure 1 is a sectional view of a compressor having a valve
20 arrangement made according to the principles of this invention ;

- Figure 2 is a perspective view of the metal substrate of Figure 1 showing the relationship of intake and exhaust reeds integrally formed therein with respect to openings in the supporting valve plate and the gasket material printed thereon ;

25 - Figure 3 is a sectional view taken along line 3-3 of Figure 1.

The compressor 10 shown in Figure 1 has a housing 12 with a chamber 14 therein. Cylindrical members or sleeves 16 and 18 are aligned over openings 20 and 22 in housing 12. A crankshaft 24 has a first end
30 26 journaled in a bearing 28 retained in an end plate 30 of housing 12 and a second end 34 that extends through an end plate 32. A second bearing 36 retained in end plate 32 allows the crankshaft 24 to rotate in chamber 14 whenever a rotary torque is applied to end 34. In an alternative construction, the cylindrical members 16 and 18 could be replaced
35 by conventional cylindrical bores formed integrally with the housing.

Pistons 38 and 40 which are located in cylindrical members 16 and 18, respectively, are connected to crankshaft 24 by rods 42 and 44. Pistons 38 and 40 are located at 180° from each other on crankshaft 24

so that when one piston is at the top of its stroke the other piston is at the bottom of its stroke.

A gasket 48 is located between ends 50 and 52 of cylindrical members 16 and 18 and a valve plate 54.

5 Valve plate 54 which is best seen in Figure 2 has inlet openings 56 and 58 and outlet openings 72 and 74 for one chamber 17 and inlet openings 60 and 62 and outlet openings 76 and 78 for another chamber 19. Valve plate 54 is flat with the exception of sloping and countoured surfaces 64 and 66 located adjacent to inlet openings 56, 58 and 60, 62.
10 The countoured surfaces 64 and 66 slope from apexes 68 and 70 toward points or stops 80 and 82.

A flat stamped reed valve 84 has a metal substrate with peripheral surface 86 that matches the outline of valve plate 54 and inlet flaps or reeds 88 and 90 and outlet flaps or reeds 92 and 94 that are
15 integrally formed therewith. During manufacture, a gasket material 95 is printed on the metal substrate that makes up the reed valve 84.

A retainer 96 attached to valve plate 54 by bolts 98 and 100 has projections or arms 102 and 104 that extend over the outlet flaps or reeds 92 and 94.

20 A head 106 positioned over reed valve 84 has an entrance port 108 that connects with a passage 110 and a chamber 112. The limits of chamber 112 are defined by the engagement of sealing surfaces 114, 115, 117, 119 and 121 on reed valve 84 with head 106. As shown in Figure 3, for chamber 17, inlet flap 88 extends past seat 116 that surrounds opening 118. Similarly inlet flap or reed 90 extends past seat 120 which
25 surrounds opening 122 to control communication of fluid from chamber 112 into chamber 19.

Head 106 has a bore 124 located therein which is connected to chamber 112. An unloader mechanism 123 which includes a piston 126 is
30 located in bore 124. Piston cooperates with head 106 to define a chamber 128 in bore 124. A passage 125 is connected to a conventional governor control that communicates a pressure signal to chamber 128 when the pressure level in a storage container reaches a predetermined level. A seal 130 on piston 126 prevents communication between chambers 128 and 112.
35 A spring 132 located between the bottom 134 of bore 124 and a retainer 136 and positioned with a boss 127 on the end of piston 126 urges end 138 against a stop 140. Retainer 136 has first and second projections 142 and 144 that extend through slots or holes 146 and 148 to a position

over flaps or reeds 88 and 90.

In addition, head 106 has a passage 150, see Figure 3, with a port 152 that is connected to the storage container. Head 106 engages gasket material 154 printed on the metal substrate of reed valve 84 to assure that passage 150 is separated from chamber 112 and the surrounding environment.

Nuts 156, 156'....156^N, only two of which are shown, and head bolts 158, 158', 158"....158^N (three of which are shown) attach head 106 to housing 12. Head bolts 158, 158', 158"....158^N project from housing 12 and align valve plate 54, reed valve 84 and head 106 in a manner such that the inlet flaps or reeds 88 and 90 and outlet flaps or reeds 92 and 94 are over the openings into and out of the chambers 17 and 19.

The above described compressor operates as follows :

Rotary input applied to crankshaft 24 through end 34 causes pistons 38 and 40 to move in chambers 17 and 19. Pistons 38 and 40 are connected to crankshaft 24 such that when piston 38 is at the bottom of its stroke, piston 40 is at the top of its stroke and vice versa.

When piston 38 moves on its down stroke, air from inlet 108 and present in chamber 112 causes flap or reed 88 to move against contour 64 and permit communication of air into chamber 17 by way of openings 56 and 58 in valve plate 54. At the same time flap or reed 92 is drawn against valve plate 54 to seal openings 72 and 74 from passage 150.

At the same time, piston 40 moves on the up or compression stroke to force air from chamber 19 through openings 76 and 78 into passage 150. On the up stroke of piston 40, flap 90 engages seat 120 to prevent air or fluid from being communicated from chamber 19 into chamber 112 while flap 94 moves away from valve plate 54 to allow free communication from chamber 19 to passage 150 through openings 76 and 78.

When a half cycle of operation is completed, pistons 38 and 40 reverse with piston 40 on its down stroke and piston 38 on its up stroke.

After a period of time of supplying a storage container with compressed air, the pressure level therein should reach a predetermined value. This predetermined pressure which is communicated from a governor control by passage 125 to chamber 128 acts on and moves piston 126 after spring 132 is overcome.

When piston 126 moves, projections 142 and 144 move through openings or slots 146 and 148 to engage flaps or reeds 88 and 90. Piston 126 continues to move until end 127 engages the bottom 134 of bore 124. With piston 126 in this position, flaps 88 and 90 are against contoured surfaces 64 and 66. Thereafter on movement of pistons 38 and 40 on the compression stroke, air present in chambers 17 and 19 is returned to chamber 112 rather than outlet passage 150. Thus, the input required to rotate the crankshaft 24 is reduced since energy is conserved as air is no longer compressed.

When compressed air is removed from the storage chamber, the pressure level therein is reduced. At some pressure level the governor control opens a valve and exhausts the air trapped in chamber 128. Thereafter, the force of spring 132 is sufficient to move piston 126 and allow flaps 88 and 90 to again be seated on seats 116 and 120. When pistons 38 and 40 move toward the head 106 air present in cylinders 17 and 19 is compressed. This compressed air is communicated through the outlet flaps 92 and 94 to passage 150 for distribution to the storage chamber. When the fluid pressure in the storage chamber is raised to the predetermined level, piston 126 again moves as spring 132 is overcome and opens inlet flaps 88 and 90. Thus, the compressor only operates when the fluid pressure in the storage chamber is below a predetermined level.

It should be recognized that contour surfaces 64 and 66 which support the flaps or reeds 88 and 90 on the intake of air into chambers 17 and 19, reduce flexing of the hinge of the integrally formed reeds. This should add to the life of the valve arrangement 84. Should the valve arrangement 84 ever need to be replaced, all that is necessary is the removal of head nuts 156, 156'....156^N and head 106. Thereafter, the retainer 96 and the valve arrangement 84 are removed. The retainer 96 is attached to a new valve arrangement 84 which is placed on bolts 158, 158'....158^N. These head bolts align the inlet flaps 88 and 90 and outlet flaps 92 and 94 over the openings in valve plate 54. Thereafter, head 106 is placed on bolts 158, 158'....158^N and nuts 156, 156'....156^N attached to complete the replacement of the valve arrangement 84.

CLAIMS

1. A compressor having a housing (12) with bores (16, 18) formed therein, pistons (38, 40) reciprocally mounted in said bores and defining therewith operational chambers (17, 19), a head assembly (106) provided
5 with inlet (108) and outlet (152) ports, and a valve assembly interposed between the housing and the head assembly for allowing fluid to flow from said inlet port to said operational chambers in response to movement of said pistons in one direction and for allowing compressed fluid to flow from said operational chambers to said outlet port in response to move-
10 ment of said pistons in another direction, characterized in that the valve assembly comprises a plate (54) having inlet (56, 58) and outlet (72, 74) openings for connecting said operational chambers with said inlet and outlet ports, a reed assembly (84) having a metal substrate with a gas-
15 ket material (95) printed thereon, said metal substrate having a plurality of reeds (88, 90, 92, 94) formed therein which cooperate with said plate and head assembly for controlling fluid flow through said inlet and outlet openings, and fastener means (158....158^N) for aligning and holding said reed assembly, said plate and said head assembly with respect to said housing.

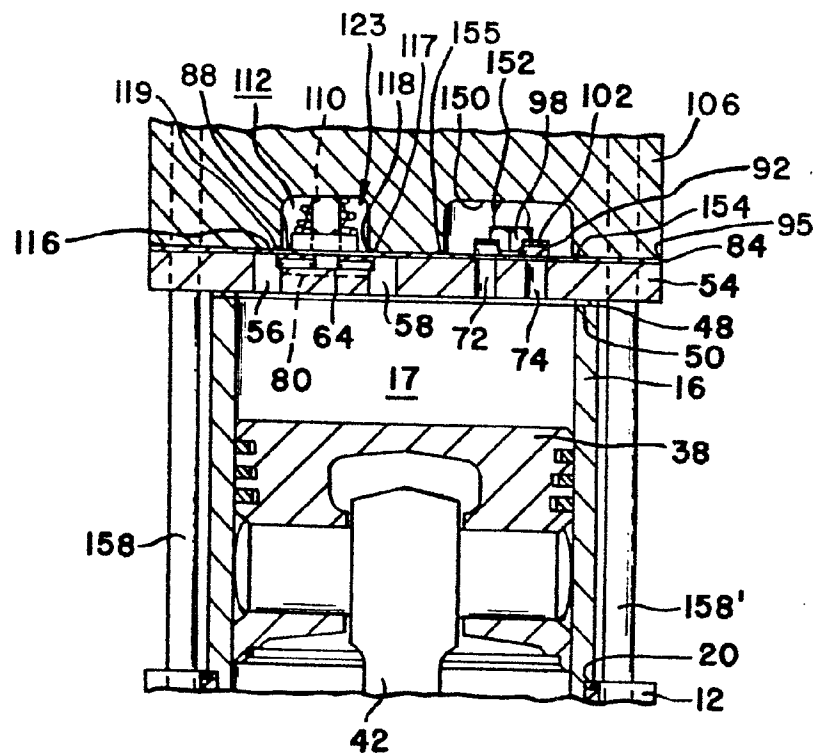
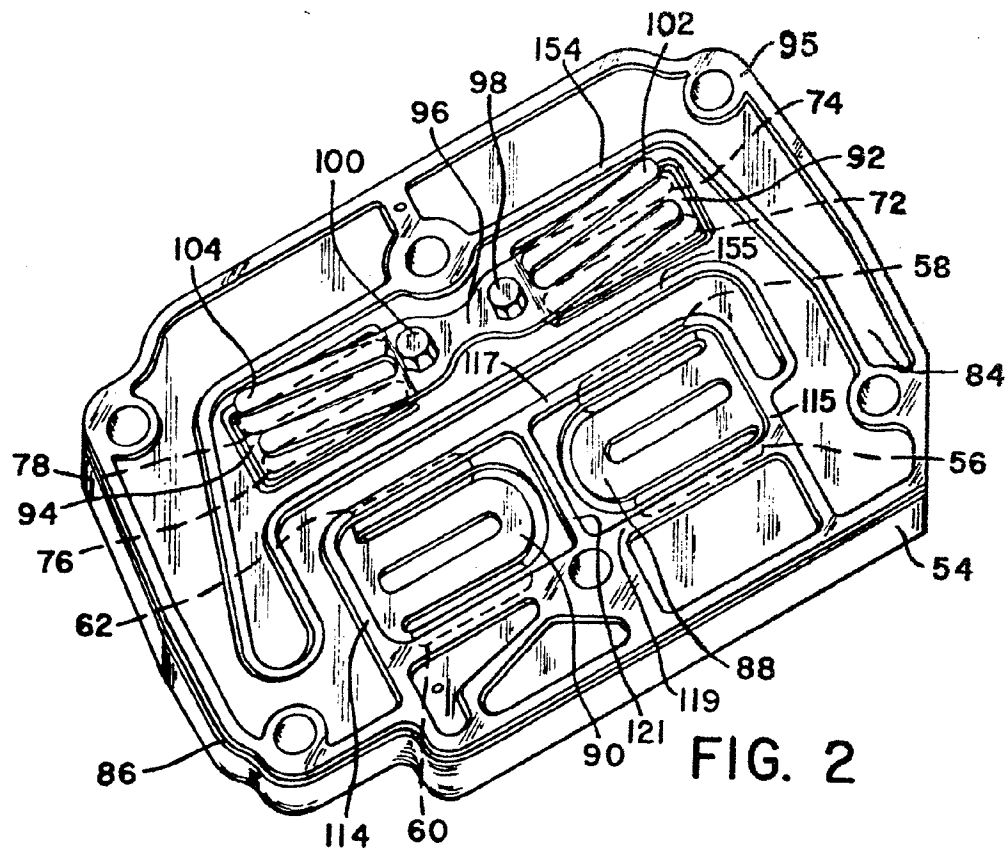
20 2. A compressor according to claim 1, characterized in that the plate (54) is provided with contoured surfaces (64, 66) adjacent each inlet opening (56, 58, 60, 62) to support the associated reeds (88, 90) during the flow of fluid into the operational chambers.

25 3. A compressor according to claim 1 or 2, characterized in that the valve assembly further comprises stops (102, 104) attached to said plate to limit the movement of the outlet reeds (92, 94) during the discharge flow of compressed fluid from the operational chambers.

30 4. A compressor according to any of claims 1 to 3, characterized in that the head assembly is provided with seats (116, 120) that engage the inlet reeds (88, 90) to close the inlet openings (56, 58, 60, 62) during the discharge flow of compressed fluid from the operational chambers.

35 5. A compressor according to any of claims 1 to 4, characterized in that the fastener means consist of bolts (158....158^N) that extend through the head assembly, reed assembly, plate and into the housing, said bolts being torqued to compress said gasket material (95) between said head assembly (106) and said housing (12) to seal the operational chambers from the surrounding environment.

6. A compressor according to any of claims 1 to 5, characterized in that the valve assembly further comprises a piston (126) having a face connected to receive the fluid pressure from stored compressed fluid and at least one projection (142, 144) that extends toward the reed assembly, and resilient means (132) for urging said piston away from said reed assembly, said fluid pressure of the stored compressed fluid acting on said piston face and overcoming said resilient means to allow said piston to move and engage the inlet reeds (88, 90) in a manner such that the operational chambers are continually connected to the inlet port (108).





DOCUMENTS CONSIDERED TO BE RELEVANT			EP 83400888.0
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
A	GB - A - 1 246 256 (HOERBIGER VENTILWERKE AG) * Fig. 1-3 *	1,3,5	F 04 B 39/10
A	US - A - 1 633 772 (CLAPP) * Fig. 6,7 *	1-4	
A	US - A - 1 986 831 (LE VALLEY) * Totality *	1,3,5	
A	GB - A - 619 922 (THE LAYCOCK ENGINEERING CO. LTD.) * Totality *	1,3,5	
A	DE - A1 - 2 357 578 (W. BILSTEIN) * Totality *	1,3,6	TECHNICAL FIELDS SEARCHED (Int. Cl. 3) F 04 B 7/00 F 04 B 21/00 F 04 B 39/00 F 04 B 49/00
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 28-07-1983	Examiner WITTMANN
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			