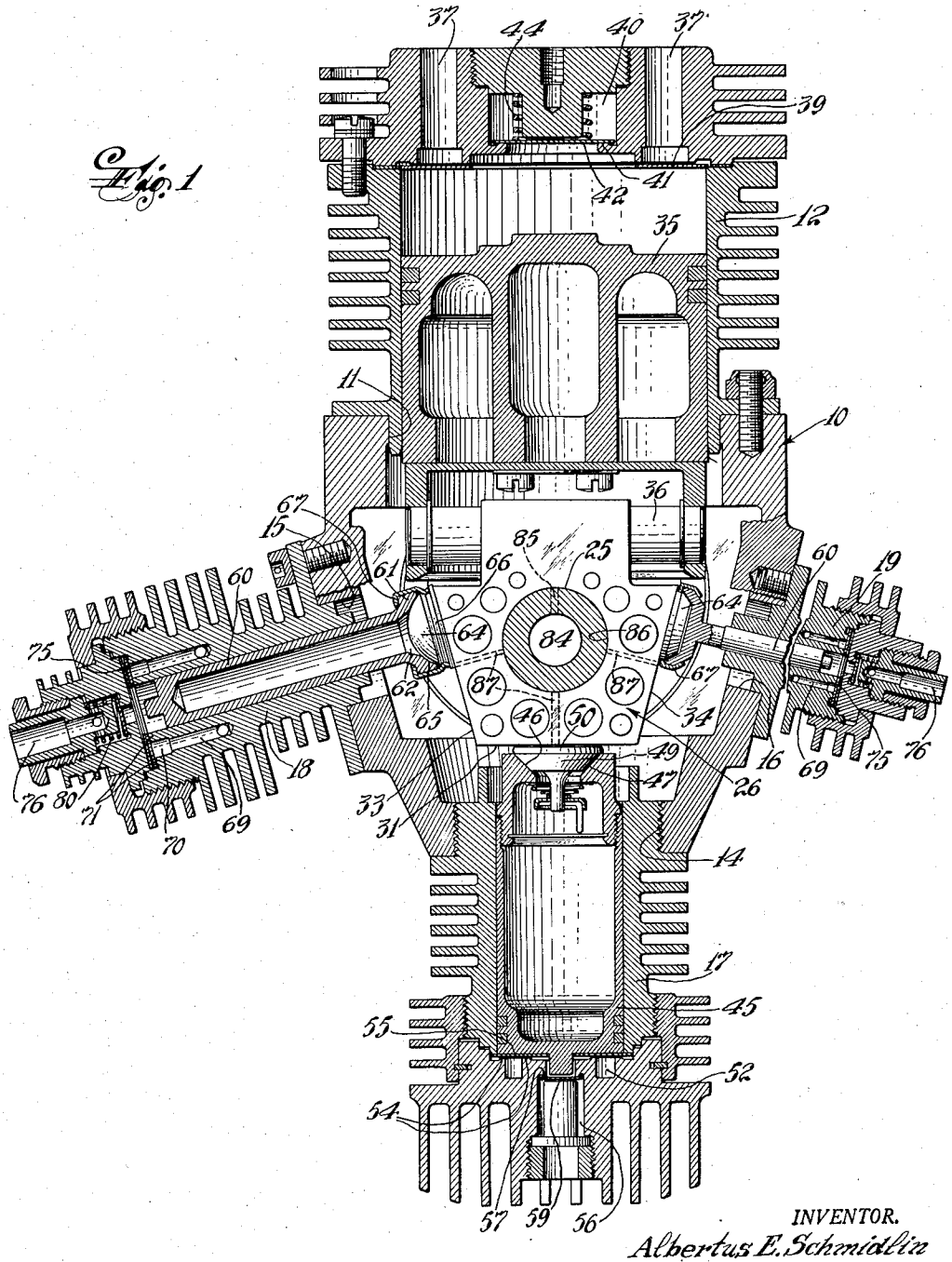
Aug. 7, 1951 A. E. SCHMIDLIN 2,562,954

COMPRESSOR

Filed Feb. 26, 1947 4 Sheets-Sheet 1

Fig. 1



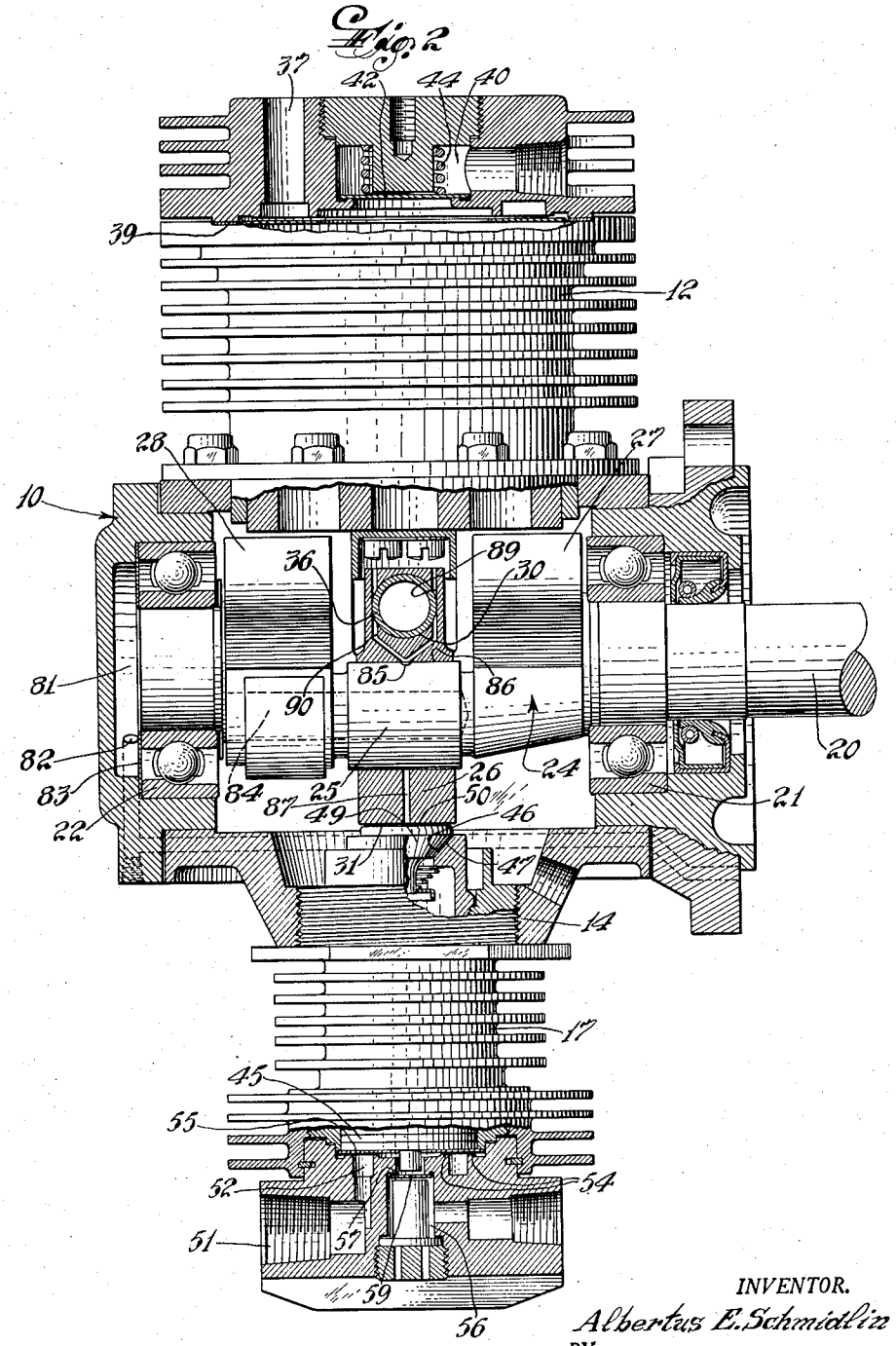
INVENTOR.
Albertus E. Schmidlin
BY
Ernest A. Joerren
ATTORNEY

Aug. 7, 1951 A. E. SCHMIDLIN 2,562,954

COMPRESSOR

Filed Feb. 26, 1947 4 Sheets-Sheet 2

Fig. 2



INVENTOR.
Albertus E. Schmidlin
BY
Ernest A. Jensen
ATTORNEY

Aug. 7, 1951 A. E. SCHMIDLIN 2,562,954

COMPRESSOR

Filed Feb. 26, 1947 4 Sheets-Sheet 3

Fig. 3

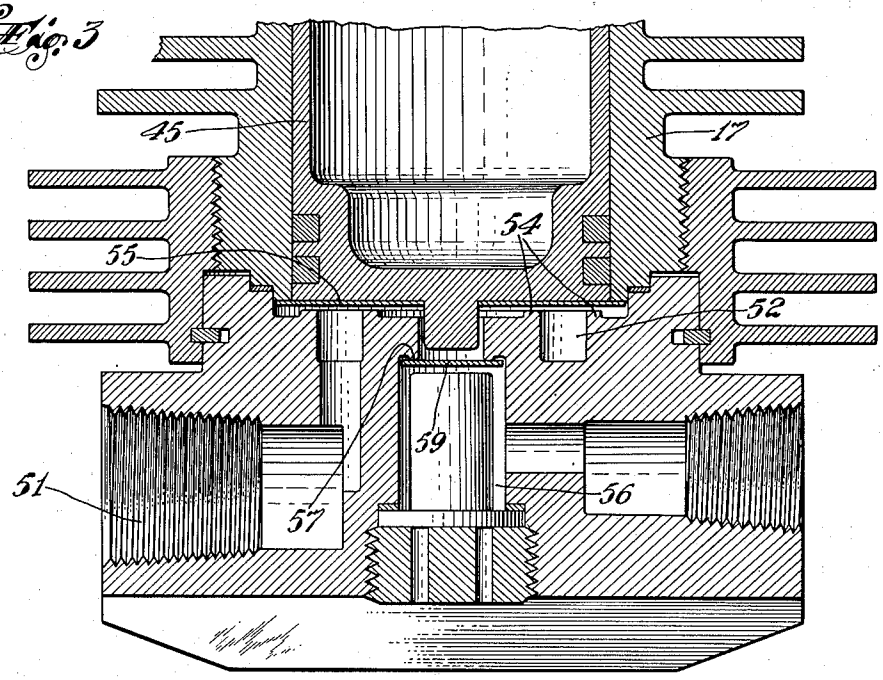
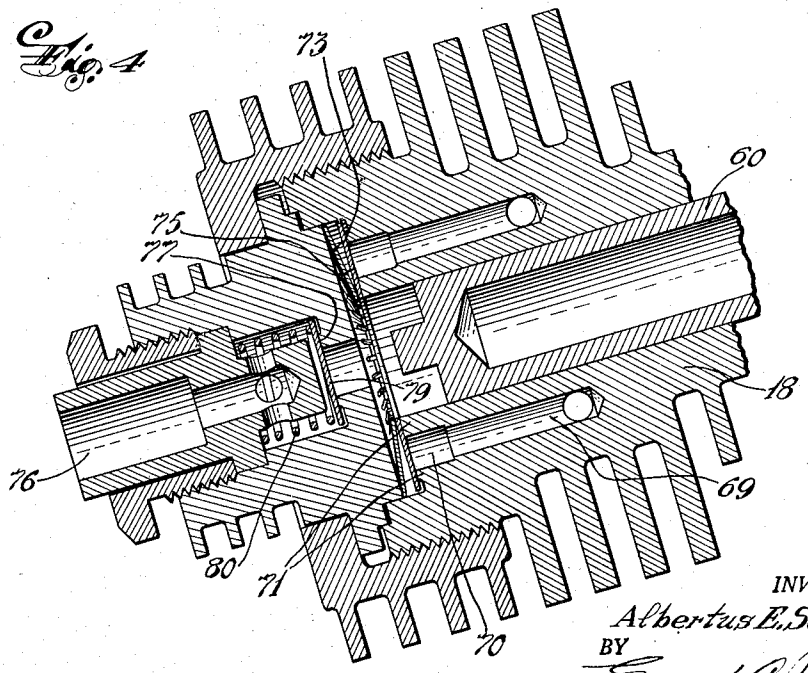


Fig. 4



INVENTOR.
Albertus E. Schmidlin
BY
Ernest A. Beveridge
ATTORNEY

Aug. 7, 1951 A. E. SCHMIDLIN 2,562,954

COMPRESSOR

Filed Feb. 26, 1947 4 Sheets-Sheet 4

Fig. 6

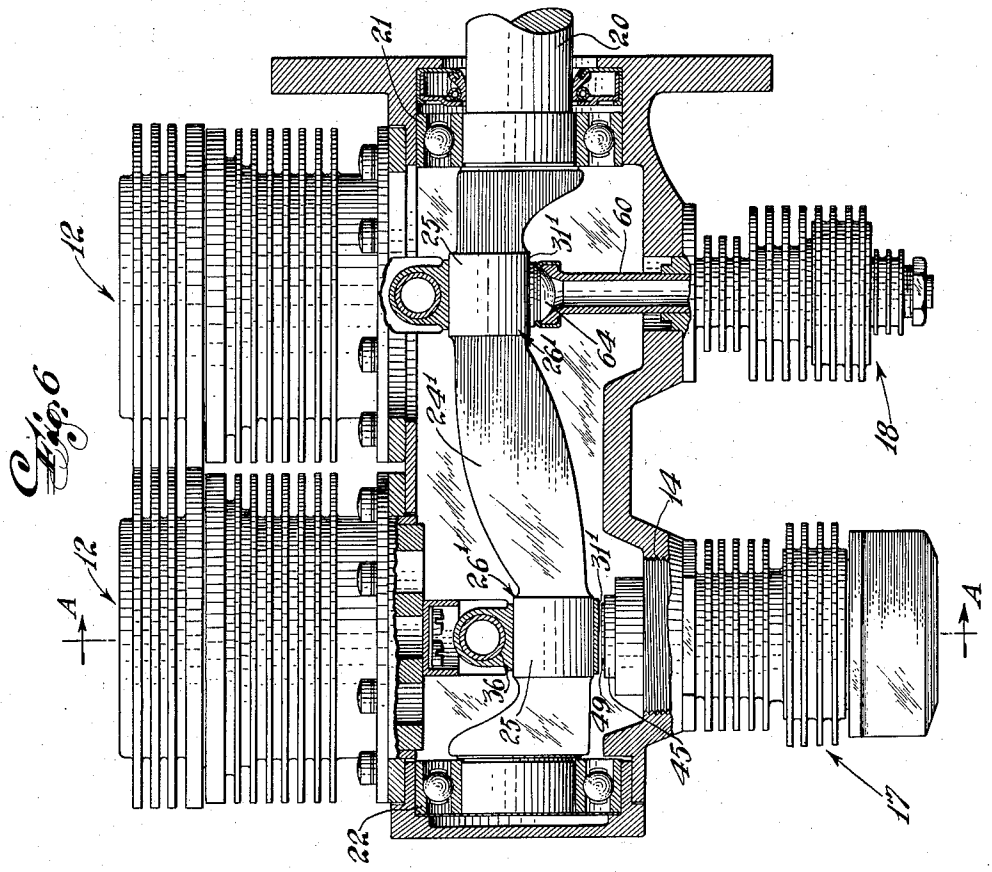
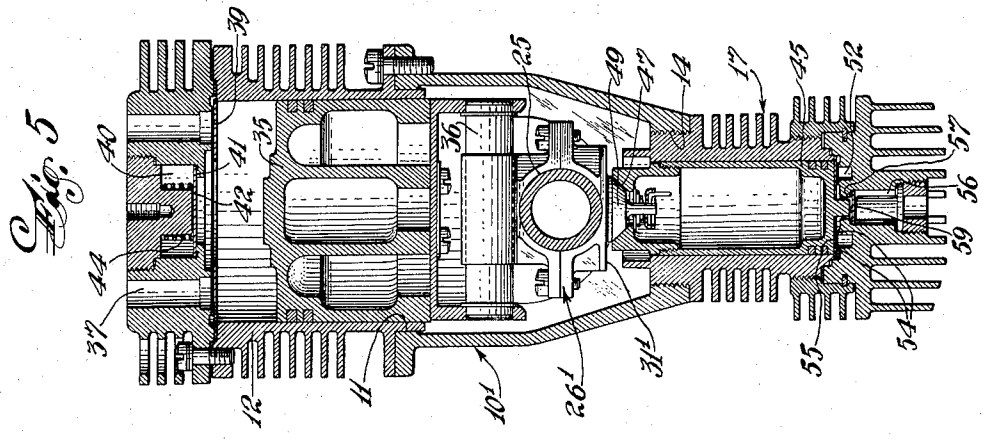


Fig. 5



INVENTOR.
Albertus E. Schmidlin
BY
Ernest A. Joerren
ATTORNEY

Patented Aug. 7, 1951

2,562,954

UNITED STATES PATENT OFFICE

2,562,954

COMPRESSOR

Albertus E. Schmidlin, Caldwell, N. J., assignor to Specialties Development Corporation, Belleville, N. J., a corporation of New Jersey

Application February 26, 1947, Serial No. 730,971

18 Claims. (Cl. 230—187)

1

The present invention relates to compressors, and more particularly to air compressors and the like of the multi-stage type.

An object of the present invention is to provide an improved compressor of the foregoing type.

Another object is to provide a compressor of the foregoing type which is simple in construction and is economical to manufacture.

Another object is to provide a compressor which is compact, light in weight, and is constructed of a minimum number of parts which are readily assembled.

A further object is to eliminate the use of positive connections between the drive means and the pistons of certain stages of the compressor.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

In the drawings:

Figure 1 is a longitudinal sectional view of a multi-stage compressor illustrating an embodiment of the invention.

Figure 2 is a side view of the compressor shown in Figure 1, partly in elevation and partly in section.

Figure 3 is an enlarged fragmentary sectional view illustrating the intake and exhaust valves of the cylinder of one stage.

Figure 4 is an enlarged fragmentary sectional view illustrating the intake and exhaust valves of the cylinder of another stage.

Figure 5 is a longitudinal sectional view illustrating another embodiment of the invention.

Figure 6 is a side elevational view, partly in section, illustrating still another embodiment of the invention.

Referring to Figures 1 and 2 of the drawings, there is shown a compressor of the multi-stage radial type for compressing air or other gas from about atmospheric pressure to pressures as high as about 3,000 pounds per square inch. The compressor shown in Figure 1 comprises a crankcase or housing 10 having a top opening 11 for a first or primary stage cylinder 12, and having a bottom opening 14 and side openings 15 and 16 for subsequent stage cylinders 17, 18 and 19, respectively. More particularly, the cylinders 17, 18 and 19 are associated with the second, third and fourth stages of compression, respectively. The side openings 15 and 16 are so formed that the cylinders 18 and 19 are inclined

2

upwardly and inwardly. The cylinders 12, 17, 18 and 19 have their longitudinal centers located in the same vertical plane and are spaced circumferentially about the center of the housing.

A drive shaft 20 extends through the housing 10 from which the cylinders radiate and is supported by bearings 21 and 22 (Figure 2). Between the bearings, the shaft is provided with an eccentric in the form of a crank 24 having a middle portion 25 rotatably journalled in a cam member 26 which is of generally keystone shape (Figure 1) and which is adapted to be moved in a circular path by the crank. Adjacent the middle portion 25, suitable counterweights 27 and 28 are secured to the crank 24.

The cam member 26 has a bearing bore 30 (Figure 2) extending horizontally through the upper portion and has a horizontal cam surface or face 31 at the bottom thereof. At opposite sides of the cam member, upwardly and outwardly inclined cam surfaces or faces 33 and 34 (Figure 1) are provided. The cam faces 31, 33 and 34 operate the pistons associated with the second, third and fourth stages of compression, respectively, as will be described hereinafter.

The first stage cylinder 12 has a piston 35 slidably mounted therein. A wrist pin 36 is supported by the lower end of the piston and extends through the bore 30 to slidably mount the cam member thereon and to operatively connect the cam member and the piston, whereby circular motion of the cam member imparts reciprocating motion to the piston.

The cylinder 12 has inlet ports 37 (Figures 1 and 2) communicating with the atmosphere which are closed by a flexible metallic ring 39 during the compression stroke, and has an outlet port 40 (Figure 2) provided with a seat 41 on which a disc 42 is seated by a spring 44 during the intake stroke.

The second stage cylinder 17 has a piston 45 slidably mounted therein which has a conical seat 46 at its upper end (Figure 1) for receiving the spherical surface 47 of a cam follower 49 provided with a flat upper surface 50 for engaging the bottom cam face 31. The cam follower is self-aligning and serves to effect reciprocation of the piston 45 upon movement of the cam member in a circular path.

The cylinder 17 also has an inlet port 51 (Figure 2) and an annular groove 52 (Figure 3) provided with seat portions 54 over which a movable annular member 55 is positioned. The cylinder 17 also has an outlet port 56 provided

with a seat 57 over which a movable disc 59 is positioned.

The third and fourth stage cylinders 18 and 19 are substantially identical in construction, except that the latter has a smaller bore. Both cylinders have a piston 60 (Figure 1) slidably mounted therein which has a head 61 provided with a conical seat or recess 62 adapted to receive a cam follower 64 provided with a spherical surface 65 to render the cam follower self-aligning. The cam followers 64 each have a flat inwardly facing surface 66 for respectively engaging the cam faces 33 and 34 of the cam member 26. The cam followers are retained adjacent their seats by a ring member or collar 67.

As illustrated in Figure 4, both of the cylinders 18 and 19 have inlet ports 69 and an annular groove 70 provided with seat portions 71 over which a movable annular member 75 is seated by a spring 73, and both cylinders have an outlet port 76 provided with a seat 77 on which a disc 79 is retained by a spring 80.

While not shown herein, it will be understood that the outlet ports of the first, second and third stage cylinders are connected by a conduit to the inlet ports of the second, third and fourth stage cylinders, respectively. Likewise, means for cooling the compressed air or gas may be provided in the conduits connecting the stages of compression.

Another feature of the present invention resides in the manner in which the wrist pin and the cam faces 31, 33 and 34 are lubricated. As shown in Fig. 2, lubricant is introduced into the space 81 at the left side of the housing by means of a conduit 82 and enters a passage 84 of the crankshaft (Figures 1 and 2) extending to the middle portion 25. A passage is provided between the interior and the exterior of the tubular middle portion 25 to provide for the flow of lubricant to a bore 86 in the cam member or keystone 26 through which the middle portion 25 extends.

Suitable passages 87 extend through the keystone from the bore to the cam surfaces 31, 33 and 34, whereby, when maximum forces are exerted adjacent a portion of the keystone bore at which the passage 87 terminates, the lubricating film between the keystone bore and the portion 25 is forced through this passage 87 and is deposited between the cam surface and a cam follower. In this manner, sufficient lubricant is provided to eliminate slight friction between the cam surfaces 31, 33 and 34 and their respective cam followers.

Lubricant is similarly directed to a bore 89 of the keystone (Figure 2), through which the wrist pin 36 extends, by way of one or more passages 90 leading from the wrist pin bore to a point adjacent the passage 85.

The bearing 22 is sealed off from lubricant space 81 by a beryllium copper annular disc 83 against which the inner rotating bearing race bears. Only a small amount of lubricant can pass through the space between the disc and the inner bearing race whereby practically the entire amount of lubricant supplied is conducted to the bore or passage 84 of the tubular crank portion 25.

In operation, assuming that the cam member 26 moves through a circular path in a clockwise direction, as viewed in Figure 1, compression takes place in the first, fourth, second and third stage cylinders successively in the order named during one cycle of rotation.

As the cam member 26 moves the first stage piston 35 towards its lowermost position, the ring 39 is sucked downwardly to uncover the inlet ports 37 whereby air enters the cylinder 12. Upon upward movement of the piston, compression takes place and the ring 39 closes the inlet ports 37, and the compressed air causes the disc 42 to unseat in opposition to the spring 44, and leaves the cylinder by way of the outlet port 40.

The compressed air flows to the inlet port 51 of the second stage cylinder and, during the upward stroke of the cam member 26, unseats the annular member 55, enters the cylinder, and causes the piston 45 to move upwardly and follow the cam member. Upon downward movement of the cam member, the cam surface 31 bears against the cam follower 49 causing the piston 45 to move downwardly whereupon compression takes place. The air compressed in the cylinder has a pressure greater than the pressure of the air at the inlet port whereby the annular member 55 is held against its seat portions 54 to seal off the inlet port. The compressed air causes the disc 59 to unseat and leaves the cylinder by way of the outlet port 56.

The compressed air then flows to the third stage cylinder and, during movement of the cam member towards the right, unseats the ring member 75, enters the cylinder and causes the piston 60 to move towards the right and follow the cam member.

Upon movement of the cam member towards the left, the cam surface 33 bears against the cam follower 64 causing the piston to move towards the left whereupon compression takes place. The pressure of the air thus compressed is greater than the pressure of the air at the inlet port 69 whereby the ring member 75 is seated to seal off the inlet port. The compressed air causes the disc 79 to unseat in opposition to its spring 80 and leaves the cylinder by way of the outlet port 76.

The compressed air then flows to the fourth stage cylinder where a fourth stage compression is effected by the same operation of parts just described in connection with the third stage of compression. The air leaving the fourth stage cylinder is collected in a receiver or is conducted to its point of use.

In Figure 5, a modified compressor is shown which in a sense is a radial type compressor except that the body or housing 10' is provided only with openings 11 and 14 at the top and bottom, respectively, for receiving a primary stage cylinder 12 and a secondary stage cylinder 11, respectively. The construction of the compressor is similar to that shown in Figures 1, 2 and 3, except for the cam member 26' which is in the form of a yoke having a cam face or surface 31' at the underside thereof for effecting movement of the secondary stage piston 45.

In Figure 6, a further modified compressor is shown which comprises a pair of in line primary stage cylinders 12 and a pair of in line subsequent stage cylinders 17 and 18 opposite the pair of cylinders 12. A crankshaft 24' extends between the first and second mentioned pairs of cylinders and carries a pair of cam members 26', each having a cam surface 31' at the underside thereof, each engaging a cam follower of the pistons 45 and 60. The cylinders 12 and 17 and the parts therein when viewed along the line A—A appear as in Figure 5. The cylinder 18, its piston and valving correspond to similarly numbered parts illustrated in Figures 1 and 4. In this arrangement, the outlets of the cylinders 12 are in fluid

flow communication with the inlet of the cylinder 17, and the outlet of the cylinder 17 is in fluid flow communication with the inlet of the cylinder 18. It will be understood that first, second, third and fourth stage cylinders could be employed in any desired arrangement in pairs as shown in Figure 6.

From the foregoing description, it will be seen that the present invention provides a multi-stage compressor which is extremely simple in design and comprises a minimum number of parts. By eliminating positive connections between the second, third and fourth stage pistons and the drive, high speed operation is facilitated. Also, the parts need not be as strong as in the case of rigid drive connections. The cam followers are self-aligning and ride on the cam faces, which are lubricated, with minimum friction and eliminate bending strains on the pistons whereby the motion of the cam member imparts only an end thrust to the pistons during the compression stroke. The compressor is light in weight, but yet is rugged in construction, and can readily withstand any rough usage to which it may normally be subjected.

As various changes may be made in the form, construction and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in any limiting sense.

It is also to be understood that the following claims are intended to cover all the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim:

1. In a multi-stage compressor, the combination of a drive shaft, a primary stage cylinder having an inlet and an outlet, a subsequent stage cylinder having an inlet adapted for fluid flow communication with the outlet of said primary stage cylinder and having an outlet, said cylinders being radially disposed with respect to said shaft and spaced circumferentially with respect to each other, an eccentric connected to said shaft, a cam member mounted on said eccentric for movement in a circular path, a piston for said primary stage cylinder connected to said cam member for reciprocating movement thereby, and a piston for said subsequent stage cylinder having follower means adapted to be engaged by said cam member to effect movement thereof.

2. In a multi-stage compressor, the combination of a drive shaft, a primary stage cylinder having an inlet and an outlet, a secondary stage cylinder having an inlet adapted for fluid flow communication with the outlet of said primary stage cylinder and having an outlet, said cylinders being radially disposed with respect to said shaft and opposite each other, an eccentric connected to said shaft, a cam member mounted on said eccentric for movement in a circular path, a piston for said primary stage cylinder connected to said cam member for reciprocating movement thereby, and a piston for said secondary stage cylinder having follower means adapted to be engaged by said cam member to effect movement thereof.

3. In a radial multi-stage compressor, the combination of a drive shaft, a primary stage cylinder having an inlet and an outlet, a secondary stage cylinder having an inlet adapted for

fluid flow communication with the outlet of said primary stage cylinder and having an outlet, said cylinders being radially disposed with respect to said shaft and spaced circumferentially with respect to each other, an eccentric connected to said shaft, a cam member mounted on said eccentric for movement in a circular path and having a cam surface, a piston for said primary stage cylinder connected to said cam member to impart reciprocating movement thereto, and a piston for said secondary stage cylinder having a follower means adapted to be engaged by said cam surface of said cam member to effect reciprocation thereof.

4. In a radial multi-stage compressor, the combination of a drive shaft, a primary stage cylinder having an inlet and an outlet, a secondary stage cylinder having an inlet adapted for fluid flow communication with the outlet of said primary stage cylinder and having an outlet, said cylinders being radially disposed with respect to said shaft and spaced circumferentially with respect to each other, an eccentric connected to said shaft, a cam member mounted on said eccentric for movement in a circular path and having a cam surface, a piston for said primary stage cylinder connected to said cam member to impart reciprocating movement thereto, and a piston for said secondary stage cylinder having self-aligning follower means adapted to be engaged by said cam surface of said cam member to effect reciprocation of said last mentioned piston.

5. In a radial multi-stage compressor, the combination of a drive shaft, a primary stage cylinder having an inlet and an outlet, a secondary stage cylinder having an inlet adapted for fluid flow communication with the outlet of said primary stage cylinder and having an outlet, said cylinders being radially disposed with respect to said shaft and spaced circumferentially with respect to each other, an eccentric connected to said shaft, a cam member on said eccentric, a piston for said primary stage cylinder, a wrist pin on said piston for slidably mounting said cam member, and a piston for said secondary stage cylinder having follower means adapted to be engaged by said cam member to effect reciprocation thereof.

6. In a radial multi-stage compressor, the combination of a drive shaft, a primary stage cylinder and a plurality of subsequent stage cylinders each having an inlet and an outlet, the inlet of one of said subsequent stage cylinders being adapted for connection in fluid flow communication with the outlet of said primary stage cylinder and the inlet of said other subsequent stage cylinder being in fluid flow communication with the outlet of another subsequent stage cylinder, said cylinders being radially disposed with respect to said shaft and spaced circumferentially with respect to each other, an eccentric connected to said shaft, a cam member mounted on said eccentric for movement in a circular path, a piston for said primary stage cylinder connected to said cam member to impart reciprocating movement thereto, and a piston for each of said subsequent stage cylinders having follower means adapted to be engaged by said cam member to effect reciprocation thereof.

7. In a radial multi-stage compressor, the combination of a drive shaft, a primary stage cylinder having an inlet and an outlet, a plurality of subsequent stage cylinders each having an inlet and an outlet, the inlet of one of said subsequent stage cylinders being adapted for connection in fluid flow communication with the outlet of said primary stage cylinder and the inlet of said other

subsequent stage cylinder being in fluid flow communication with the outlet of another subsequent stage cylinder, said cylinders being radially disposed with respect to said shaft and spaced circumferentially with respect to each other, an eccentric connected to said shaft, a cam member mounted on said eccentric for movement in a circular path, a piston for said primary stage cylinder connected to said cam member to impart reciprocating movement thereto, and a piston for each of said subsequent stage cylinders having self-aligning follower means adapted to be engaged by said cam member to effect reciprocation thereof.

8. In a radial multi-stage compressor, the combination of a drive shaft, a first stage cylinder, a second stage cylinder opposite said first stage cylinder, a third stage cylinder between said first and second stage cylinders, a fourth stage cylinder substantially opposite said third stage cylinder, said cylinders each having an inlet and an outlet, the inlet of each succeeding stage cylinder being adapted for connection in fluid flow communication with the outlet of its preceding stage cylinder, an eccentric connected to said shaft, a cam member mounted on said eccentric, a piston for said first stage cylinder connected to said cam member to impart reciprocating movement thereto, and pistons for said second, third and fourth stage cylinders, respectively, having follower means adapted to be engaged by said cam member to effect reciprocation thereof.

9. In a radial multi-stage compressor, the combination of a drive shaft, a first stage cylinder, a second stage cylinder opposite said first stage cylinder, a third stage cylinder between said first and second stage cylinders, a fourth stage cylinder substantially opposite said third stage cylinder, said cylinders each having an inlet and an outlet, the inlet of each succeeding stage cylinder being adapted for connection in fluid flow communication with the outlet of its preceding stage cylinder, an eccentric connected to said shaft, a cam member mounted on said eccentric, and having three cam surfaces thereon, a piston for said first stage cylinder connected to said cam member to impart reciprocating movement thereto, and pistons for said second, third and fourth stage cylinders, respectively, each having self-aligning follower means adapted to be engaged by a cam surface of said cam member to effect reciprocation of said last mentioned pistons.

10. In a radial multi-stage compressor, the combination of a drive shaft, a first stage cylinder, a second stage cylinder opposite said first stage cylinder, a third stage cylinder intermediate said first and second stage cylinder, a fourth stage cylinder substantially opposite said third stage cylinder, said cylinders each having an inlet and an outlet, the inlet of each succeeding stage cylinder being adapted for connection in fluid flow communication with the outlet of its preceding stage cylinder, an eccentric connected to said shaft, a keystone member mounted on said eccentric having lower cam face and a pair of opposite inclined side cam faces, a piston for said first stage cylinder connected to said keystone member to impart reciprocating movement thereto, and pistons for said second, third, and fourth stage cylinders, respectively, having follower means adapted to be engaged by said lower cam face and said side cam faces, respectively, to effect reciprocation of said last mentioned pistons.

11. In a radial multi-stage compressor, the combination of a drive shaft, a first stage cylinder, a second stage cylinder opposite said first stage cylinder, a third stage cylinder intermediate said first and second stage cylinder, a fourth stage cylinder substantially opposite said third stage cylinder, said cylinders each having an inlet and an outlet, the inlet of each succeeding stage cylinder being adapted for connection in fluid flow communication with the outlet of its preceding stage cylinder, an eccentric connected to said shaft, a keystone member mounted on said eccentric having lower cam face and a pair of opposite inclined side cam faces, a piston for said first stage cylinder connected to said keystone member to impart reciprocating movement thereto, and pistons for said second, third and fourth stage cylinders, respectively, each having self-aligning means adapted to be engaged by said lower cam face and said side cam faces, respectively, to effect reciprocation of said last mentioned pistons.

12. In a radial multi-stage compressor, the combination of a drive shaft, a first stage cylinder, a second stage cylinder opposite said first stage cylinder, a third stage cylinder intermediate said first and second stage cylinders, a fourth stage cylinder substantially opposite said third stage cylinder, said cylinders each having an inlet and an outlet, the inlet of each succeeding stage cylinder being adapted for connection in fluid flow communication with the outlet of its preceding stage cylinder, an eccentric connected to said shaft, a keystone member on said eccentric having lower cam face and a pair of opposite inclined side cam faces, a piston for said first stage cylinder, a wrist pin on said piston for slidably mounting said keystone member, and pistons for said second, third and fourth stage cylinders, respectively, having follower means adapted to be engaged by said lower cam face and said side cam faces, respectively, to effect reciprocation of said last mentioned pistons.

13. In a multi-stage compressor, the combination of a pair of laterally disposed cylinders, a second pair of laterally disposed cylinders opposite said first pair of cylinders, said cylinders each having an inlet and an outlet, the outlets of said first pair of cylinders being adapted for connection in fluid flow communication with the inlet of one of said second pair of cylinders and said aforementioned cylinder having its outlet adapted for connection in fluid flow communication with the inlet of the other cylinder of said second pair of cylinders, a piston for each of said cylinders, a double throw crankshaft intermediate said pairs of cylinders having a pair of eccentrically disposed circular portions, and a cam member for each of said portions having a bearing through which said portion extends and each having a cam surface, the pistons of said first pair of cylinders each being connected to one of said cam members and the pistons of said second pair of cylinders having follower means adapted to be engaged by said cam surface of one of said cam members to effect movement thereof.

14. In a multi-stage compressor, the combination of a plurality of in-line primary stage cylinders, a plurality of in-line subsequent stage cylinders each opposite one of said primary stage cylinders, said cylinders each having an inlet and an outlet, the outlets of said primary stage cylinders being adapted for connection in fluid flow communication with the inlet of one of said subsequent stage cylinders and said aforementioned cylinder having its outlet adapted for connection in fluid flow communication with the inlet of said other subsequent stage cylinder, a piston for each

of said cylinders, a double throw crankshaft intermediate said primary stage cylinders and said subsequent stage cylinders having a pair of eccentrically disposed circular portions, and a cam member for each of said portions having a bearing through which said portion extends and each having a cam surface, the pistons of said primary stage cylinders each being connected to one of said cam members and the pistons of said subsequent stage cylinders each having follower means adapted to be engaged by said cam surface of one of said cam members to effect movement thereof.

15. In a radial multi-stage compressor, the combination of a drive shaft, a first stage cylinder, a second stage cylinder diametrically opposite said first stage cylinder, the longitudinal axes of said first and second stage cylinders being in alignment, a third stage cylinder between said first and second stage cylinders, a fourth stage cylinder substantially opposite said third stage cylinder, the longitudinal axes of said third and fourth stage cylinders being inclined with respect to a plane perpendicular to the axes of said first and second stage cylinders, said cylinders each having an inlet and an outlet, the inlet of each succeeding stage cylinder being adapted for connection in fluid flow communication with the outlet of its preceding stage cylinder, valving for the inlets and outlets of said cylinders, an eccentric connected to said shaft, a cam member mounted on said eccentric having three cam surfaces thereon, one of said cam surfaces being perpendicular to the longitudinal axis of said second stage cylindler and each of the other two cam surfaces being perpendicular to the longitudinal axes of said third and fourth stage cylinders, respectively, a piston for said first stage cylinder connected to said cam member to impart reciprocating movement thereto, and pistons for said second, third and fourth stage cylinders, respectively, each having follower means slidably engaged by the respective cam surfaces of said cam member.

16. In a multi-stage compressor, the combination of a drive shaft, a primary stage cylinder having an inlet and an outlet, a subsequent stage cylinder having an inlet adapted for connection in fluid flow communication with the outlet of said primary stage cylinder and having an outlet, valving for the inlets and outlets of said cylinders, said cylinders being positioned with the longitudinal axes thereof extending substantially radially with respect to said shaft and being spaced circumferentially about said shaft with respect to each other, an eccentric connected to said shaft, a cam member mounted on said eccentric for movement in a circular path, a piston for said primary stage cylinder connected to said cam member for positive reciprocating movement thereby, a piston for said subsequent stage cylinder structurally independent of said primary stage piston and said cam member, and follower means slidably engaged by said cam member during its movement in its circular path to effect positive movement of said subsequent stage piston only during its compression stroke, said follower means being maintained in sliding engagement with said cam member while the return stroke of said subsequent stage piston is effected by the pressure of compressed medium in said subsequent stage cylinder.

17. A compressor according to claim 1, wherein said cam member has a bore extending therethrough, a surface which engages said follower means, and a passage between said bore and said surfaces; wherein said eccentric includes crankshaft means having a tubular portion extending through said bore to mount said cam member on said eccentric and said tubular member is provided with a passage between the interior and the exterior thereof; and wherein means are provided for supplying lubricant to the interior of said tubular portion, whereby lubricant is conducted by said passage of said tubular portion and said passage of said cam member to said cam surface.

18. A compressor according to claim 6, wherein said cam member has a bore extending therethrough, a plurality of surfaces corresponding in number to the number of subsequent stage cylinders each of which surfaces engages one of said follower means, and a passage between said bore and each of said surfaces; wherein said eccentric includes crankshaft means having a tubular portion extending through said bore to mount said cam member on said eccentric and said tubular member is provided with a passage between the interior and the exterior thereof; and wherein means are provided for supplying lubricant to the interior of said tubular portion, whereby lubricant is conducted by said passages of said tubular portion and said cam member to said cam surfaces.

ALBERTUS E. SCHMIDLIN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
734,595	Olin	July 28, 1903
761,598	McCall	May 31, 1904
1,479,856	Humason et al.	Jan. 8, 1924
1,914,141	Lundin	June 13, 1933
1,964,245	Benedek et al.	June 26, 1934
2,027,076	Volliman	Jan. 7, 1936
2,176,300	Fette	Oct. 17, 1939
2,178,662	Hanson	Nov. 7, 1939
2,236,853	Herzmark	Apr. 1, 1941
2,417,197	Hewitt et al.	Mar. 11, 1947

FOREIGN PATENTS

Number	Country	Date
90,986	Sweden	Oct. 7, 1937
387,409	Great Britain	Feb. 9, 1933
482,745	Great Britain	Apr. 4, 1938
492,463	Great Britain	Sept. 21, 1938