Jan. 9, 1951 F. B. YINGLING 2,537,502

ROTARY AIR COMPRESSOR

Filed Dec. 14, 1944 4 Sheets-Sheet 1

FIG. 1.

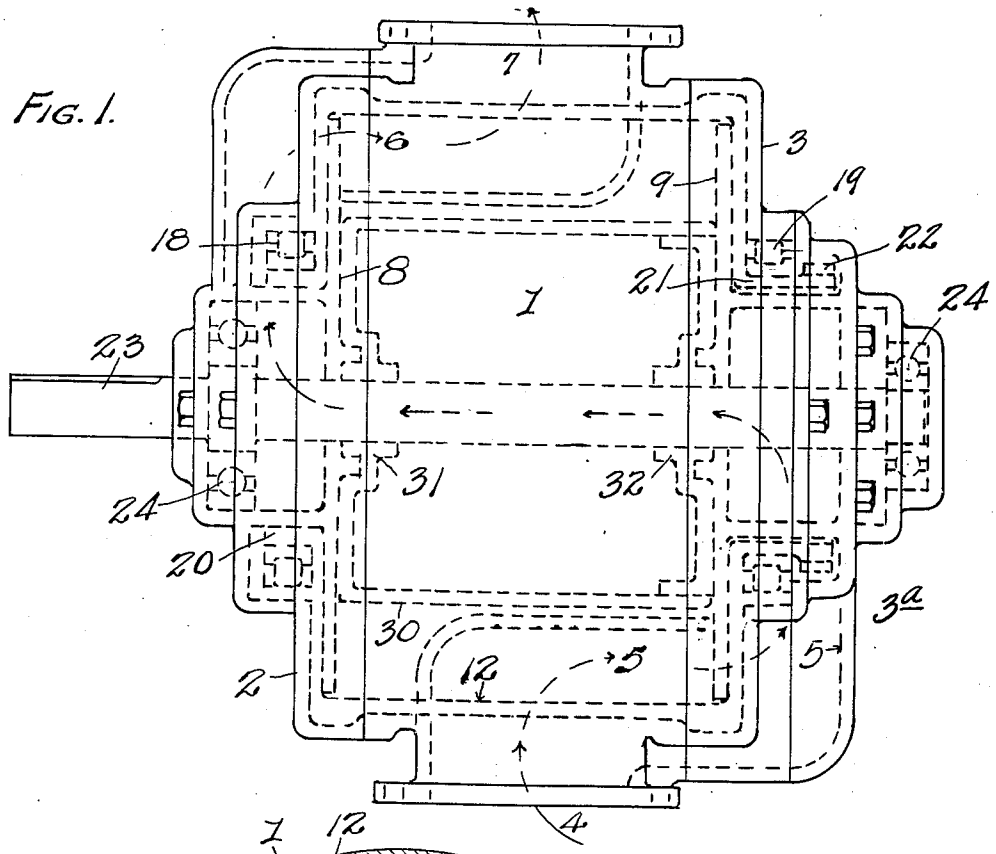
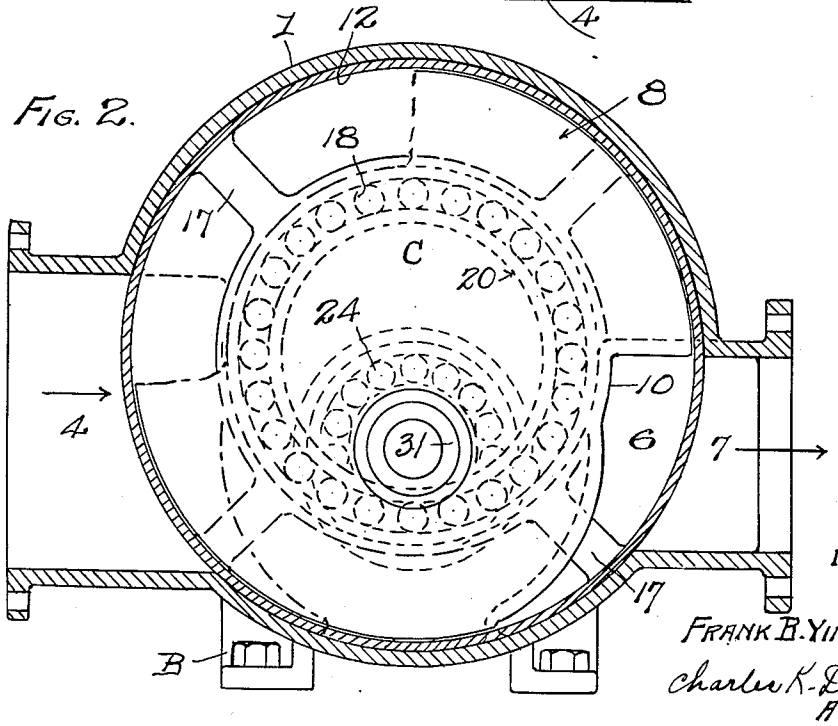


FIG. 2.



INVENTOR.

FRANK B. YINGLING

Charles K. Davies

Atty.

Jan. 9, 1951 F. B. YINGLING 2,537,502

ROTARY AIR COMPRESSOR

Filed Dec. 14, 1944 4 Sheets-Sheet 2

FIG. 3.

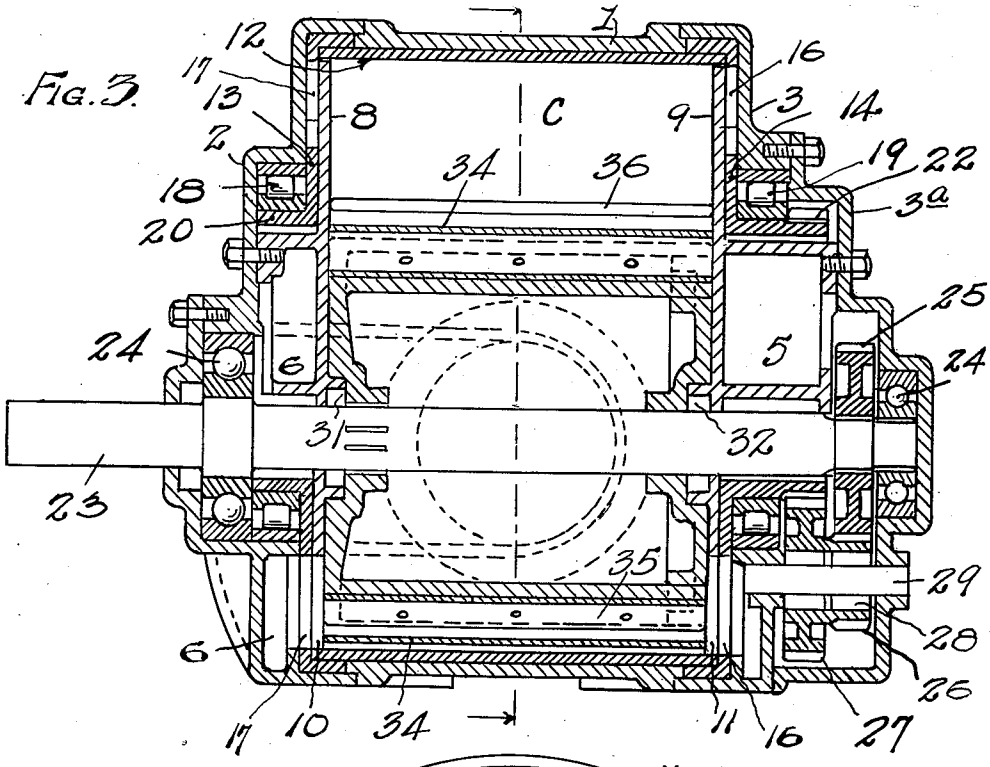
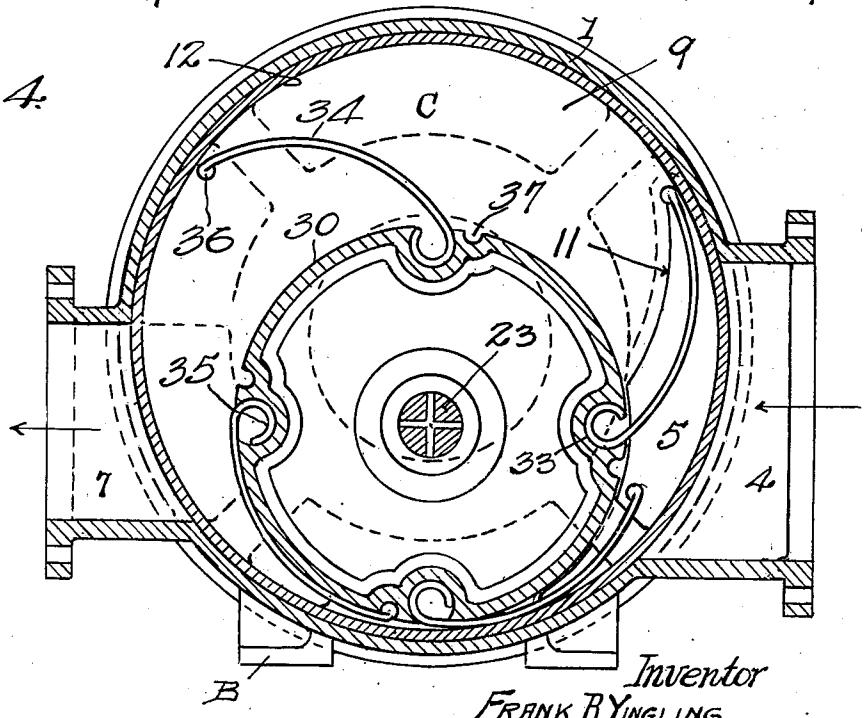


FIG. 4.



Inventor
FRANK B. YINGLING
By Charles K. Davies Atty

Jan. 9, 1951 F. B. YINGLING 2,537,502

ROTARY AIR COMPRESSOR

Filed Dec. 14, 1944 4 Sheets-Sheet 3

FIG. 5.

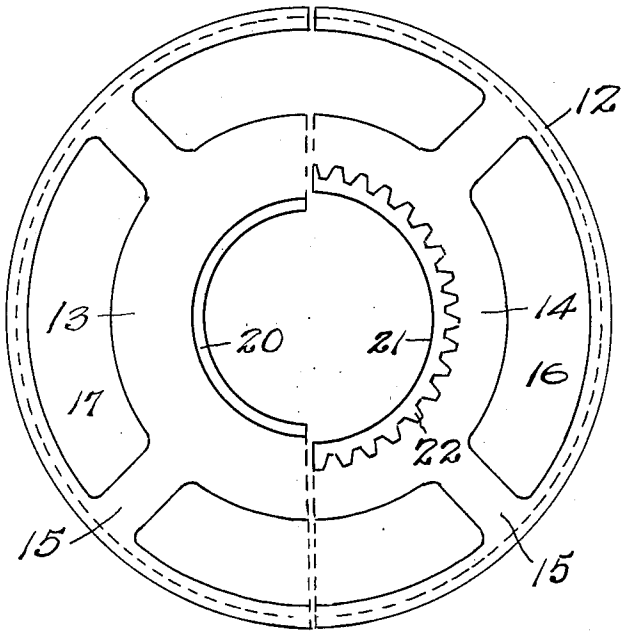
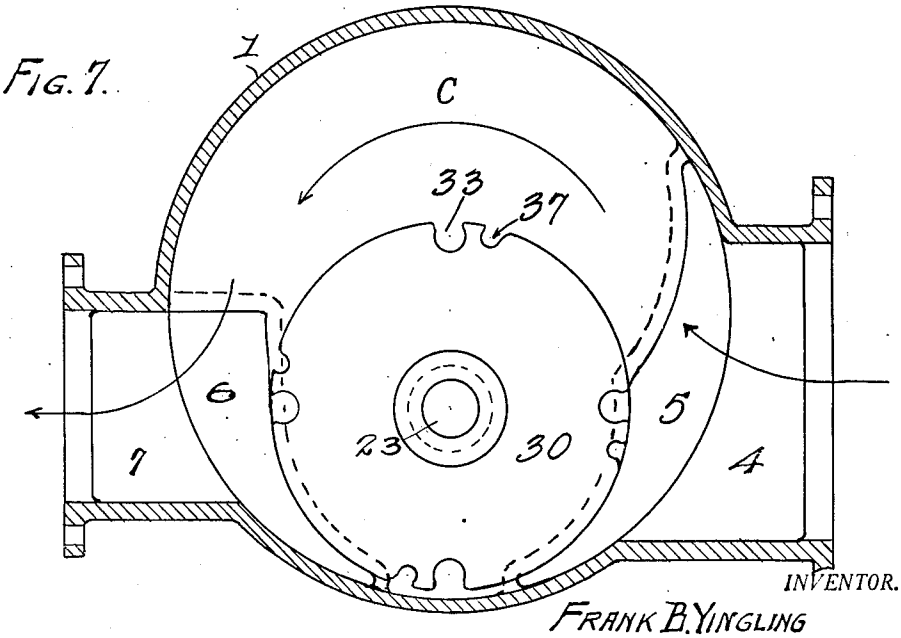


FIG. 6.

FIG. 7.



INVENTOR.
FRANK B. YINGLING
BY
Charles K. Davies
Atty.

Jan. 9, 1951 F. B. YINGLING 2,537,502

ROTARY AIR COMPRESSOR

Filed Dec. 14, 1944 4 Sheets-Sheet 4

FIG. 8.

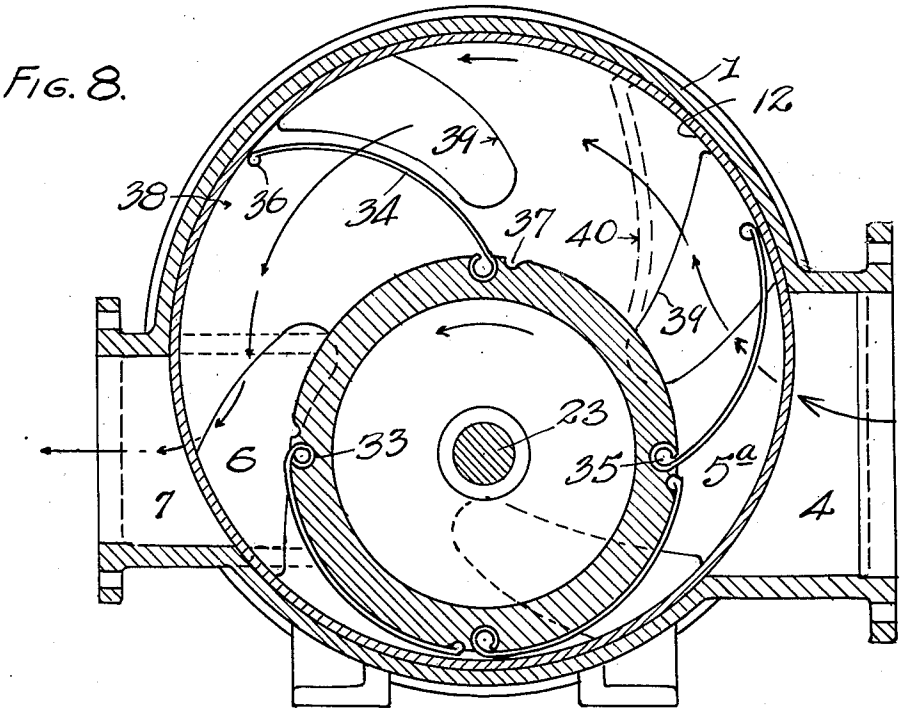
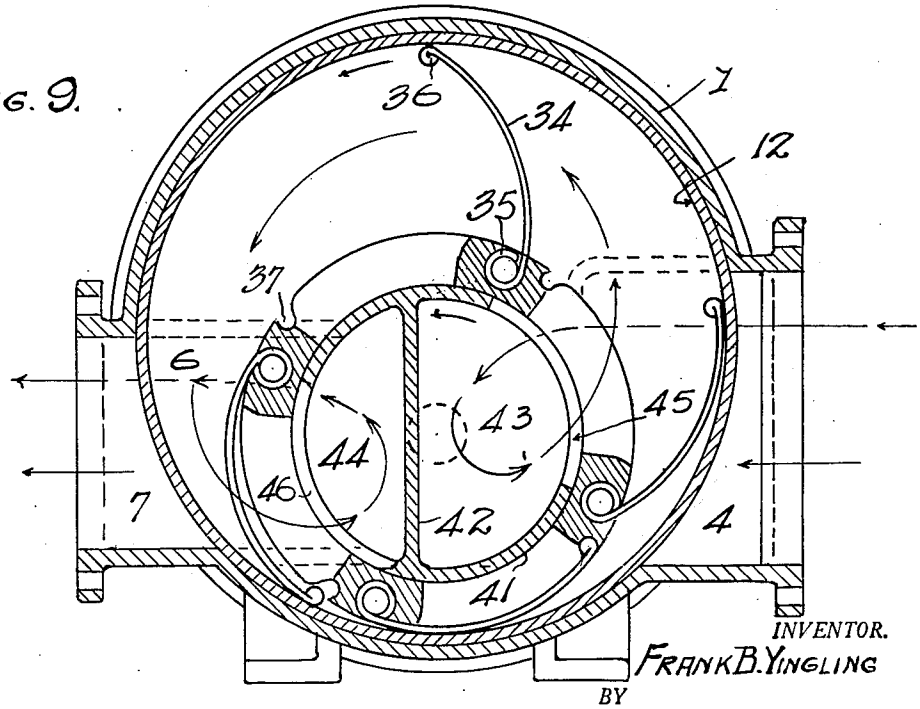


FIG. 9.



INVENTOR.
FRANK B. YINGLING
BY
Charles K. Davies
Atty.

Patented Jan. 9, 1951 2,537,502

UNITED STATES PATENT OFFICE

2,537,502

ROTARY AIR COMPRESSOR

Frank B. Yingling, Hamilton, Ohio

Application December 14, 1944, Serial No. 568,106

4 Claims. (Cl. 230—154)

1

This invention relates to an improved rotary air compressor of the type utilizing a ported rotary cylinder containing an offset or eccentrically arranged rotor, which together form a crescent shaped compression chamber, with multiple vanes pivotally mounted on the exterior of the rotor and rotatable therewith in the chamber for compressing air. In each cycle of the compressor the vanes are extended from the rotor to create suction, and retracted or folded toward and upon the rotor for compressing air, or other fluid; and co-acting operating means are employed for simultaneously rotating the ported cylinder and the rotor with its vanes, at desired speeds.

While the compressor here illustrated is particularly designed and primarily adapted for supplying air or gas under pressure, it will be understood that the invention may also be embodied in vacuum pumps, or compressors for other uses where a smooth flow of currents without substantial pulsations, is desired.

For insuring a smooth flowing air stream with maximum capacity, the compressor is capable of operating at high speeds, with a minimum amount of friction and consequent wear on the operating parts, and yet without leakage, due to the close and compact arrangement of the operating parts of the compressor.

The improvements in the compressor consist essentially in the use with an exterior fixed housing having an interior stator and provided with lateral intake and delivery ports communicating with complementary, spaced, intake and delivery compartments of the housing, and an interior rotary cylinder containing an offset and eccentric rotor forming a crescent-shaped compression chamber within the stator and intermediate the spaced compartments. And in the use of automatically extended and positively folded vanes carried by the rotor, for transferring and compressing air from the inlet compartment through the compression chamber to and through the outlet compartment of the housing. And, further, the invention consists in certain novel combinations and arrangements of parts for accomplishing the above mentioned functions, as will be set forth and claimed.

In the accompanying drawings I have illustrated one complete example of the physical embodiment of the preferred form of my invention wherein the parts are combined and arranged according to one mode I have devised for the practical application of the principles of my invention. Changes and alterations may be made in these exemplifying drawings, as indicated for

2

instance in the two accompanying modifications, within the scope of my claims, without departing from the principles of the invention.

Figure 1 is a top plan view of an air compressor constructed according to my invention, showing by dotted lines the relation of the interior working parts of the compressor, together with the ports, compartments and chamber, through which the air passes from the vacuum side to the delivery side of the compressor.

Figure 2 is a transverse, vertical, sectional view through the compressor, as at line 2—2 of Fig. 1, showing a portion of the compression chamber and the complementary intake port and inlet compartment, and a broken portion of the rotary cylinder with one of its supporting roller bearings shown in dotted lines.

Figure 3 is a vertical central sectional view of the compressor as at line 3—3 of Fig. 1.

Figure 4 is a transverse sectional view at line 4—4 of Fig. 1 showing the lateral air intake port and inlet compartment to the compression chamber, together with the differential lateral delivery port.

Figures 5 and 6 form a composite view, and illustrate the construction, by half-sections, of the opposite ends of the rotary cylinder.

Figure 7 is a diagrammatic illustration, showing by arrows the flow of air through the lateral intake port and inlet compartment to the compression chamber, and the flow of compressed air from the compression chamber through the differential outlet compartment and delivery port, of the compressor.

Figure 8 is a view similar to Fig. 4 with a modified arrangement of the ports between the inlet compartment and the compression chamber.

Figure 9 is a view similar to Fig. 8 with a further modified form of rotor, and arrangement of the ports.

In the form of the invention illustrated in Figures 1 through 6, an exterior cylindrical housing 1 is employed and provided with fixed end-plates 2, 3, and 3a, which plates are fashioned in desired form and shape, and rigidly bolted to the housing to accommodate the interior working parts of the compressor; and suitable brackets, as B, provide a supporting base for the appliance.

For a clear understanding of the flow of air through the compressor, in the diagram of Figure 7, the arrows indicate that air enters the compressor through lateral intake port 4, passes through an inlet compartment 5 formed within the end-plate 2, thence through the crescent-shaped compression chamber C and into the out-

let compartment 6 within the end-plate 3a, and the compressed air flows outwardly through the lateral delivery port 7 of the housing.

Within the cylindrical housing of the compressor is mounted a stator, including two spaced, rigid, frames or structures, one bolted to each of the end-plates 2 and 3, and each of the spaced frames includes a circular disk, as 8 and 9, which disks form the opposite end walls or stator walls of the interior crescent-shaped compression chamber C of the compressor. As best seen in Figures 1 and 3, these stator walls or plates are inwardly spaced from the complementary end-plates of the housing; and at their lowermost portions the periphery of each stator wall is cut out to form an open outlet port, as 10, and an inlet port as 11.

Concentrically with the interior of the cylindrical housing is mounted a rotary cylinder, the bore or annular wall 12 of which forms the outer circular portion of the crescent-shaped compression chamber C, and the respective end-walls 13 and 14 of this cylinder are located in the spaces between the end-plate 2 and stator disk 8, and between the end-plate 3 and complementary stator wall 9.

As best seen in Figures 3, 5, and 6, each end wall of the cylinder, adjoining its outer periphery, is cut out, leaving a number of spaced, radial arms 15, and between the adjoining arms of the end-walls are formed segmental ports 16 at the inlet end of the cylinder, and dual ports 17 at the outlet or discharge end of the cylinder.

In Fig. 3 it will be seen that ports 16 register with stationary ports 11 of the stator wall 9 to establish communication between the inlet compartment 5 and the crescent-shaped compression chamber C; and the rotating ports 17 register with stationary ports 10 of the stator wall 9 to afford communication between the chamber C and the outlet compartment or compressed air compartment 6 of the housing.

The rotary cylinder is journaled in spaced roller bearings 18 and 19, the former mounted on an exterior annular bearing flange 20 projecting outwardly from the end-wall 13 of the cylinder, and the latter bearing mounted on an exterior annular flange 21 projecting outwardly from the opposite end-wall 14 of the cylinder. The flange 21 terminates as shown, in an external gear ring 22 located within and enclosed by the hollow end-plate 3a of the housing.

This gear ring 22 forms the driven member of an operating train of gears for the cylinder, to which power is transmitted from an offset or eccentrically located drive shaft 23 journaled in spaced ball-bearings 24, 24, arranged at opposite ends of the housing and enclosed within its end plates.

From a drive gear 25, which is keyed to the shaft 23, the gear ring 22 is driven through the operating train including a small pinion 26 and an integral stepped up gear 27, which are journaled as a unit on bearings 28 mounted on the shaft 29 disposed parallel with the drive shaft 23 and mounted in seats of the plates 3 and 3a at one end of the housing. The train of operating gears is timed with a suitable ratio between the rotary clinder and the drive shaft, and with relation to the rotor 30 that rotates with the shaft.

The eccentrically arranged rotor is offset from the longitudinal axis of the drive shaft and this cylindrical rotor, together with the enclosing cylinder form the crescent shaped compression chamber C of the appliance. The rotor is rigidly mounted on the shaft 23 with complementary packed bearing bushings 31, and 32 of the stator walls 8 and 9 and tubular bosses on the end-heads of the rotor. The rotary cylinder and the smaller, offset rotor, are thus simultaneously rotated, indirectly and directly, from the drive shaft, in the same direction, and at desired speed.

At four diametrically arranged points of the rotor 30 are fashioned exterior longitudinally extending peripheral grooves 33, which are open at their opposite ends through the heads of the closed cylindrical rotor, and four curved vanes 34, of thin flexible steel are pivoted or journaled to oscillate in these grooves through the instrumentality of integral tubular longitudinally extending pivot-heads 35. The free ends 36 of the vanes are designed to ride in close contact with and along the interior cylindrical face or bore of the rotary cylinder 12, and thus seal the vacuum sides of the vanes from the front or pressure sides of the vanes as they travel through the crescent shaped compression chamber. As indicated by the various positions of the vanes in Figure 4 they are designed to swing outwardly from the rotor on the pivot heads 35 as centers, and to be retracted or folded inwardly upon the annular exterior surface of the rotor with the sealing edges or ends 36 adapted, when the vane is folded, to seat in longitudinally extending surface sockets or grooves 37 of the rotor.

In operation, the simultaneous rotation of the cylinder and the enclosed offset rotor with its self-adjusting, thin, flexible and resilient blades or vanes, causes the initially opening vanes to sweep upwardly and outwardly from the supporting rotor along the gradually increasing and communicating ports 11 of the stator wall 9 and the cylinder ports 16. This movement of the vanes induces an airstream from the large intake port 4, through the inlet compartment 5, and into the intake end of the crescent shaped compression chamber C. At their front or pressure sides, the wide swinging vanes sweep the trapped air forward through the chamber, while a vacuum condition is created at the rear sides of the vanes. This continuous vacuum condition being created at the rear of the multiple vanes insures the induction and supply of a constant and uniform air stream to the compression chamber.

The advancing vanes slide in close frictional contact with the spaced stator walls, and the front edges of the curved vanes ride in frictional engagement with the bore of the cylinder, thus sealing the trapped air in successive pockets against leakage, or back pressure, within the compression chamber.

As the moving vanes advance through the upper, largest area of the crescent-shaped compression chamber the trapped air in the successive air-tight pockets is then forced into the decreasing space toward the outlet side of the compression chamber, thus causing a reduction in the volume of air, and compressing the successive charges as they flow into the outlet compartment 6.

During the descent of the moving vanes through the decreasing area of the outlet side of the compression chamber, and as they pass across the port 10 of the stator 8, the vanes are positively folded, by sliding contact with the inner bore of the cylinder, toward inactive position. In this inactive position the vanes pass through, and close, the short arc between the bottom of the rotor and the inner face of the cylinder bore, thus separating the two sides of the compression

chamber and preventing back pressure of air from the outlet side toward the intake side of the compressor.

As thus constructed the compressor is economical in manufacture, durable, and the operating parts which are compactly arranged and simplified in construction, are not likely to become deranged in operation; and further, the co-acting parts are effective in the performance of their functions.

While I have shown the rotor equipped with four swinging vanes of proper size to clear each other and permit automatic and maximum opening movement, and to retract or fold under pressure from the rotating cylinder against their free edges; it will be understood that the number of vanes may be varied to suit different requirements in construction and operation, as well as in the different uses for which the compressor is designed.

Other changes and alterations in the construction and operation of the compressor are contemplated, as for instance in Figure 8 where the stator wall is omitted for simplicity of construction. Here the end wall 38 of the cylinder 12 is fashioned with ports 39 disposed in an annular series and extending from a point adjacent the central part of the cylinder to its outer periphery, and the inlet compartment 5a is enlarged accordingly, and bounded by a partition 40 shown in dotted lines. Like the previously mentioned ports 16 and 17 of the rotary cylinder, the ports 39 are successively opened as they move up past the inlet compartment 5a; closed as they pass between the pairs of adjoining stator walls and end-walls of the housing; and are again opened as they descend past the outlet compartment 6.

In Figure 9 a modified form of rotor 41 is illustrated having a center air inlet and compressed air outlet and fashioned with an offset partition 42 which forms a large capacity intake chamber 43, and a smaller area outlet chamber 44, each having a circumferential port as 45 and 46.

In both Figures 8 and 9 the arrows indicate the movement of a stream of air from the intake port 4 at one side of the housing 1 to the delivery port 7 at the opposite side of the housing.

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

1. In an air compressor, the combination with a fixed housing having spaced intake and outlet compartments, a ported cylinder rotatably mounted in the housing and forming an intermediate compression chamber, a gear ring rigid with the cylinder, a drive shaft extending through the cylinder, spaced eccentric bearings in the housing for said shaft and a drive gear on the shaft, a rotor rigid with the shaft, movable impellers mounted on the rotor, and operating gears between the drive gear and gear ring.

2. In an air compressor of the rotary, oscillating vane type, the combination with a housing having an intake port and a laterally spaced reduced outlet port, of a concentric cylinder mounted within the housing and having end ports for communication with said intake and outlet ports, a rotary impeller mounted within the cylinder to form a compression chamber, an eccentric operating shaft journaled in the housing extending through the cylinder and rigid with the impeller, and a train of gears operatively connecting said shaft with the cylinder.

3. In an air compressor of the rotary, oscillating vane type, the combination with a housing having laterally spaced inlet and outlet ports, a concentric cylinder mounted in the housing and forming a compression chamber, said cylinder having end ports for communication with said intake and outlet ports, an eccentrically arranged drive shaft journaled in bearings of the housing, an impeller located in the cylinder and rigid with the shaft, and a train of operating gears within the housing connecting the shaft and cylinder.

4. In an air compressor of the rotary, oscillating vane type, the combination with a fixed housing having laterally spaced inlet and outlet ports, and a cylinder rotatable in the housing and forming a compression chamber, said cylinder having end ports, for co-action with said intake and outlet ports, of a drive shaft journaled in the housing and eccentrically arranged bearings for said shaft, a cylindrical impeller rigid with the shaft and located in the ported cylinder, a longitudinal partition within the impeller forming intake and outlet chambers open to the compression chamber, and a train of gears within the housing operatively connecting said shaft and ported cylinder.

FRANK B. YINGLING.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,000,316	Alexander	Aug. 8, 1911
1,010,388	Kirby	Nov. 28, 1911
1,146,545	Aurand	July 13, 1915
1,197,579	Jackson	Sept. 5, 1916
1,253,460	Bodge	Jan. 15, 1918
1,291,520	Hoere	Jan. 14, 1919
1,364,246	Carey	Jan. 4, 1921
1,842,829	Gregg	Jan. 26, 1932
1,886,206	Mandler	Nov. 1, 1932