The particular object of the invention is to provide a motor which is capable of operation by steam or compressed air, which is powerful, compact, simple and cheap of construction, efficient and easily repaired.

With these and other objects in view the invention consists in the novel construction, arrangement and combination of parts as hereinafter described and claimed.

In the accompanying drawings Figure 1 is a longitudinal section through a motor embodying my invention, on the line 1—1, Fig. 5; Fig. 2 is a similar section taken at right angles to the section of Fig. 1, on line 2—2, Fig. 5, but with the piston removed; Fig. 3 is a side view of the rear head and piston; Fig. 4 is a longitudinal section through the cylinders and guide ring on line 4—4, Fig. 5: Fig. 5 is a transverse section on the line 5—5 of Fig. 2; Fig. 6 is a transverse section on the line 6—6 of Fig. 1; Fig. 7 is a view looking at the rear end of the motor; Fig. 8 is a view of the rear end of the motor with the rear head and the piston removed; Fig. 9 is a longitudinal section of a modified construction of the rear head for use in the bore 10, and Fig. 10 is a transverse section taken on the line 0—0 of Fig. 9; and Fig. 11 is a longitudinal section of still another modification.

In the drawing 1 designates a first or high pressure cylinder, externally smooth and cylindrical, formed with an eccentric bore or piston chamber 2, with longitudinal and cross admission ports 3 and 4 respectively formed in its walls, with longitudinal and cross exhaust ports 5 and 6 respectively formed in its walls, with a circumferential receiver space 7 formed in end wall 48 and a longitudinal exhaust port 8 formed in end wall 46 at an angular distance from port 5 communicating from space 7 to the front face of cylinder 1.

9 is a second or low pressure cylinder of same diameter as 1 but much longer and is externally smooth and cylindrical and formed with an eccentric bore 10, with longitudinal and cross admission ports 11 and 12 respectively formed in its walls, and with longitudinal and cross exhaust ports 13 and 14 respectively formed in its walls. Cylinder 9 is secured to the front end of cylinder 1 externally concentric therewith but with the direction of eccentricity of bore 10 making an angle of 180 degrees with the direction of eccentricity of bore 2 and with admission port 11 registering with exhaust port 8 from cylinder chamber 2 to receive motive fluid therefrom.

15 is an admission head secured concentrically to the rear end of cylinder 1 closing the bore thereof and formed with a front cylindrical port 16, an enlarged portion or flange 17, an open arched port 18, a tubular hub 19 with a cylindrical receiving chamber threaded for attaching a motive fluid supply pipe, a perforated disk shaped strainer 21 extending across the bore of hub 19 and resting on an internal shoulder 22 therein. Head 15 is formed with a branched or arched admission port 23 formed in the arch portion 18 and communicating from the bore of hub 19 to a circumferential receiving space 24 formed in the cylindrical portion and a longitudinal delivery port 25 communicating from space 24 to the front face. Head 15 has port 25 registering with port 3 of cylinder 1 to deliver motive fluid thereeto.

26 is a rotary piston with reduced front and rear journal portions 27 and 28 respectively forming shoulders 29 and 30 respectively and a rear end collar 31 forming shoulder 32 with journal portion 28. A rear split bush 33 seated in head 15 and a front bush 34 seated in cylinder 9 rotatably supports piston 26 in contact with the curved walls of cylinders 1 and 9 between cross ports 4 and 6 of cylinder 1 and between cross ports 12 and 14 of cylinder 9. Piston 26 is formed with a longitudinal diametral slot 35 for the greater part of its length from its center nearly to shoulders 28 and 29. A blade or abutment 36 is carried loosely in the rear portion of slot 35 and during the revolution of the piston 26 slides therein and contacts at both ends and both edges with the walls of the cylinder space 2 of cylinder 1. A blade 37 is carried loosely
in the forward portion of slot 35 and similarly slides therein while contacting in like manner with the walls of space 10 of cylinder 9. A spacing block 38 fills slot 35 between blades 36 and 37. The rear face of bush 33 and the shoulder 32 of piston 26 form opposed thrust surfaces. A pocket or recess 39 is formed in these thrust surfaces and connected by a cross passage 40, an annular passage 41 and a longitudinal passage 42 with the receiving space 24. Passages 40, 41 and 42 thus form a continuous passage for admitting motive fluid at working pressure from receiving space 24 to pocket 39 under shoulder 32 of piston 26. Journal portion 28 forms a rotatable bearing with and is of smaller diameter than the bore of bush 33 thereby leaving a thin annular passage between journal portion 28 and bush 33 communicating from groove 41 to pocket 39 parallel and additional to groove 42. A flat faced axial projection 43 is formed on the inner surface of the outer portion 25 of the arch 18 of head 15 forming opposing thrust surfaces with the rear end of piston 26. A pocket or recess 44 is formed in said opposing surfaces. A passage 45 communicates from admission port 23 to pocket 44 to admit motive fluid at working pressure thereto.

A transverse wall 46 is formed in cylinder 1 between cylinder spaces 2 and 10 forming the front and rear end walls respectively 35 of said cylinder spaces. Piston 26 passes through wall 46 forming a fluid tight joint therewith and to reduce the friction and leakage of said joint the joint is interrupted by one or more annular grooves 47. Bush 33 is formed with a flange 48 which is countersunk flush into the front face of head 15 and extends radially underneath the end face of cylinder 1 which thereby holds bush 33 axially into place. An internal flange 49 is formed in cylinder 9 to support bush 34 axially and keep it from being blown out. Cylinder 9 is formed with an external shoulder 50 to receive a shoe ring 51 with an internal shoulder 52. Long bolts 53 pass through cylinder 9, cylinder 1 and head 15 to hold them axially together with head 54 bearing on front face of cylinder 9 overlying shoulder 52 of shoe ring 51 and with nut 55 at the other end bearing on the rear face of head 15. Bolt 53 is circumferentially grooved or reduced in section for a portion 56 of its length inside annular receiving space 7 to allow greater area for the passage of motive fluid.

Fig. 9 shows the head 15 of slightly different form, with a less pronounced arch portion 15, and having a hose connector 64 provided with a spherical flanged end portion which is engaged by a correspondingly shaped face on a collar 65 threaded into the head. In this modification, the thrust collar on the end of the piston journal is omitted and said journal is sealed in a projection 66 whose outer end seats against a bridge 67 in the hose connector.

In order to hold the piston when adjusting tools, the collar 31 is provided with a diametrical hole 57 (Figs. 1 and 3) or the piston 26 is formed with flat seats 58 (Figs. 9 and 10) for receiving a wrench or like tool.

Piston 26 is formed with a threaded projection 59 for attachment to a tool.

Head and cylinders are set together with counterbored joints 60 and 61.

While I have described a combination of only two cylinders with a piston having only one slot it is evident that my invention applies to any number of cylinders set at any circumferential angles to each other with a piston of any number of slots at any angles.

While I have described a definite division of the structure into heads and cylinders it is evident that my invention applies to a construction in which two or more parts shown and described as separate are formed integral with each other and to a construction in which any part shown and described is separated into two or more pieces. The division of the structure is practically determined by the choice of the materials of which it is to be constructed. Fig. 11 shows this construction of cylinder in which a single piston chamber and piston blade is used. In this case there are three cylinder sections 65, 69 and 70, the first and last forming the heads also, said sections being set together by counterbored joints as described. This view also shows a hose connector 64 with a spherical flanged end portion which is engaged by a threaded collar 65. A bridge 67 in said hose connector bears against the head of a screw 71 threaded into the projection in which the piston journal is seated. The strainer 21 is located in the chamber of the collar or cap 65. In this case the rear bushing 35 is provided with internal and external circumferential grooves 74 and 75 connected by radial ports 76 and the front bearing is also provided with groove 76 which connects by port 77 to the inlet port 25.

While I have described a simple fluid tight joint between cylinder 1 and piston 26 it is evident that my invention also applies to a construction in which the usual floating packing rings are used.

While I have described an arrangement of the ports by which the cylinders are compounded and one receives the motive fluid discharged by the other, it is evident that my invention applies also to an arrangement of ports by which two or more cylinders receive motive fluid directly from the same receiving space or divide the supply of mo-
The operation is as follows. Motive fluid enters chamber 20 in hub 19 and through strainer 21, port 22, circumferential space 24 and admission ports 25, 3 and 4 into cylinder space 2 rotating the piston and escaping at reduced pressure through ports 6 and 5 into receiver space 7 where the fluctuating pressure is partially equalized and the motive fluid then passes around and escapes through ports 8, 11 and 12 into cylinder space 10 exerting driving effort to rotate the piston and escaping through ports 14 and 13 to outside the motor. The cylinder spaces are proportioned in their dimensions and angular setting to partly balance the lateral pressure of the piston on the bearings. Motive fluid entering pocket 39 through passages 40, 41, 42, and around journal portion 28 from space 24 lifts shoulder 32 slightly from bush 33 while an opposing pressure from pocket 44 results that the piston is axially floated between two fluid cushions.

What I claim is:
1. In a rotary motor, the combination of a cylinder, a head, and a diametrically slotted piston, said cylinder being externally circular, and formed with an eccentric bore, said head being concentrically secured to said cylinder and formed with a hollow arch over the center thereof, said head terminating in a concentric hollow hub threaded to receive a supply pipe and said piston having an end extension under said arch formed to engage a wrench.
2. In a rotary motor, the combination with a cylinder, of a diametrically slotted piston, a concentric cylinder head composed of two cylindrical concentric end portions united by a plurality of smaller portions formed with a passage for motive fluid, a collar on the end of the piston forming a thrust bearing with one of the cylindrical end portions, and tension rods connecting said cylinder with said head.
3. In a rotary motor, the combination with a cylinder, of a diametrically slotted piston, and a concentric head composed of two concentric cylindrical end portions united by a plurality of smaller portions, said piston having a flanged end portion axially between said cylindrical end portions of said head and formed to engage a wrench.
4. In a rotary motor, the combination of an externally smooth cylinder, a slotted piston concentrically mounted therein, a concentric hollow hub arranged to receive a supply pipe with a central open space between said cylinder and said hub, and a plurality of longitudinal members uniting said cylinder and said hub, one of said longitudinal members being formed with a passage for the motive fluid, said piston having one end extending axially into said open space.
5. In a rotary motor, the combination of a slotted piston and a cylinder having a head formed with a concentric hollow hub arranged to receive a concentric supply pipe, said hub being supported on a plurality of axial portions leaving an open central space between said hub and said cylinder proper, said piston extending axially into said central space and being formed there to engage a wrench.
6. In a rotary motor, a diametrically slotted piston, a cylinder and a head formed with an arch, the end of said piston thrusting against the inner surface of said arch said arch comprising two longitudinal members united in a central hub.
7. In a rotary motor, a slotted piston, a cylinder and a head formed with an arch, the end of said piston thrusting and rotating against a fluid cushion formed in a pocket in the surface of said arch and supplied with motive fluid under pressure.
8. In a rotary motor, a slotted piston, a cylinder and a head formed with an arch, the end of said piston thrusting and rotating against a fluid cushion formed in a pocket in the surface of said arch, said fluid cushion being maintained by continuously admitting motive fluid under pressure into said pocket.
9. In a rotary machine, an externally smooth cylindrical cylinder having an eccentric bore, a piston mounted in said cylinder concentric with the external form of said cylinder and eccentric with the bore thereof and having a diametric slot, a plurality of blades each loosely mounted to slide freely in said slot of said piston and projecting at both ends into contact with the cylinder walls, and a spacing block filling the slot of said piston between said blades and free to slide axially in said slot relative to said piston to accommodate itself to axial wear and movement of the piston and radially retained therein by a transverse wall formed in said cylinder.
10. In a rotary motor, a piston having a longitudinal diametric slot, a plurality of 11 blades each extending through said piston, arranged to slide in different longitudinal portions of said slot, a spacing block passing through said piston and filling a portion of said slot between said blades, and a cylinder having a transverse partition wall separating said blades and loosely fitting around said piston and retaining said block in said slot.
11. In a rotary motor, a piston having a long diametric slot, a plurality of short blad es in said slot and a spacing block filling said slot between said blades, said block being free to float longitudinally with said blades in said slot.
12. In a rotary motor, a slotted piston and a plurality of cylinders formed with longitudinal ports communicating at different angular positions with a circumferential receiver space, said piston being rotatably mounted eccentric to the bores of said cylinders and contacting with the walls of said bores along longitudinal lines, and two or more blades mounted in a single slot of the piston and separated by a spacing block free to move axially relative to the piston.

13. In a rotary motor, a piston formed with a diametric slot, a plurality of blades each extending through said slot, a floating space block separating said blades, and a plurality of cylinder bores eccentric at different angles from said piston, said blades being parallel with each other and said cylinder bores being eccentric at different angles.

14. In a rotary motor, a slotted piston, a plurality of blades located in the slot of said piston, a spacing block loosely mounted in said slot and spacing said blades apart longitudinally, a plurality of cylinders whose bores are eccentric to each other and communicate with a common circumferential receiver space, long bolts connecting said cylinders, and a stationary transverse division wall fitting around said piston between the two blades in the slot of said piston.

15. In a rotary motor, a cylinder having two eccentric cylinder chambers placed at different angular positions, and a circumferential receiver space between said eccentric cylinder chambers, a cylinder head, axial bolts passing through said receiver space, and a rotary piston provided with two blades, one in each cylinder chamber, both blades being mounted in the same slot.

16. In a rotary motor, a cylinder having a receiver space between two eccentric cylinder chambers, a cylinder head and longitudinal bolts connecting said cylinder and said head, said bolts passing through said receiver space and being reduced in cross section therein.

17. In a rotary motor, a plurality of cylinder bores eccentric to each other around a common axis and having a transverse stationary wall between them, a rotary piston common to said bores and passing through said wall, said wall being circumferentially grooved on the inner surface adjacent to said piston, and blades carried in a single continuous slot in said piston, one blade in each chamber.

In testimony whereof, I have hereunto set my hand.

PHILIP J. DARLINGTON.

Witnesses:
C. D. BISHOP,
HAROLD F. RYDER.