Oct. 29, 1935. S. R. SEILLIERE 2,019,023

FLUID PUMPING APPARATUS

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Fig. 1

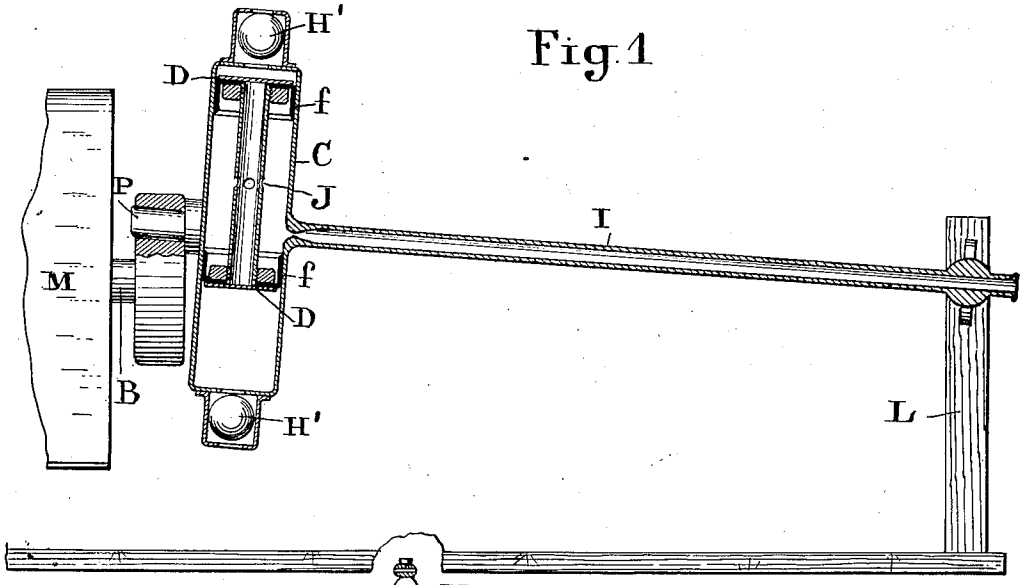
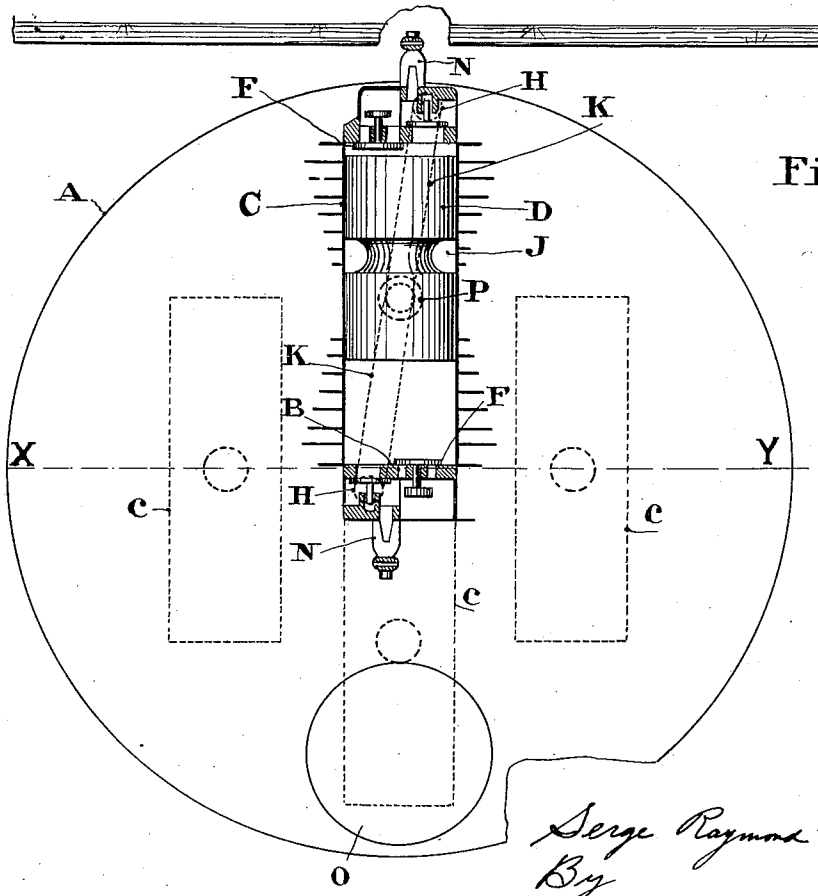


Fig. 2



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Fig. 3

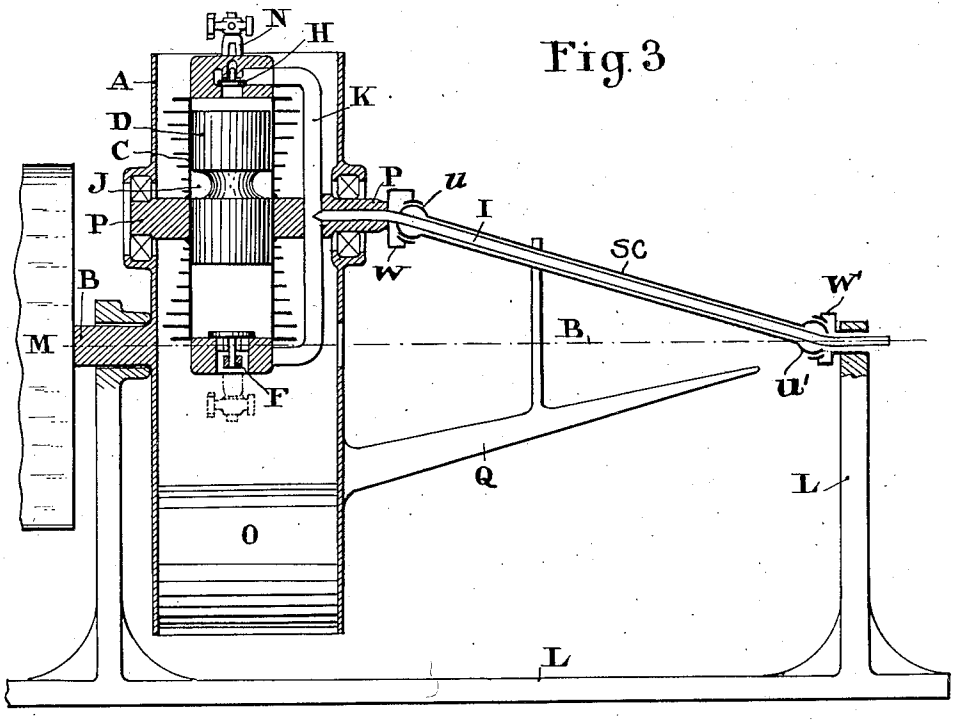


Fig. 6.

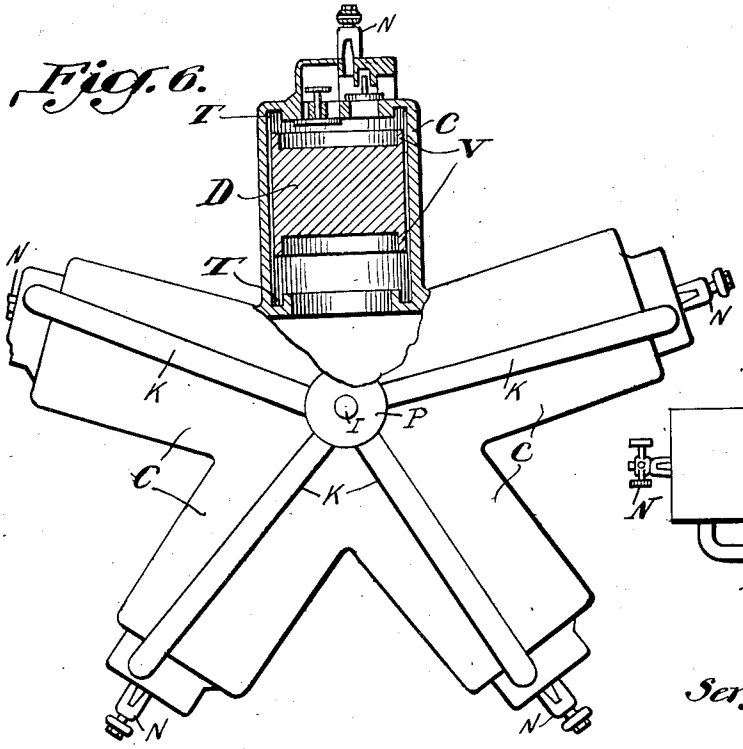
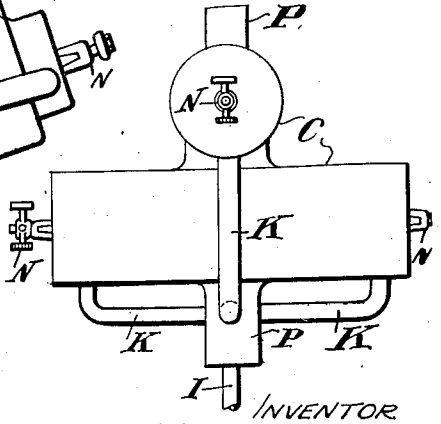


Fig. 5.



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Fig. 8.

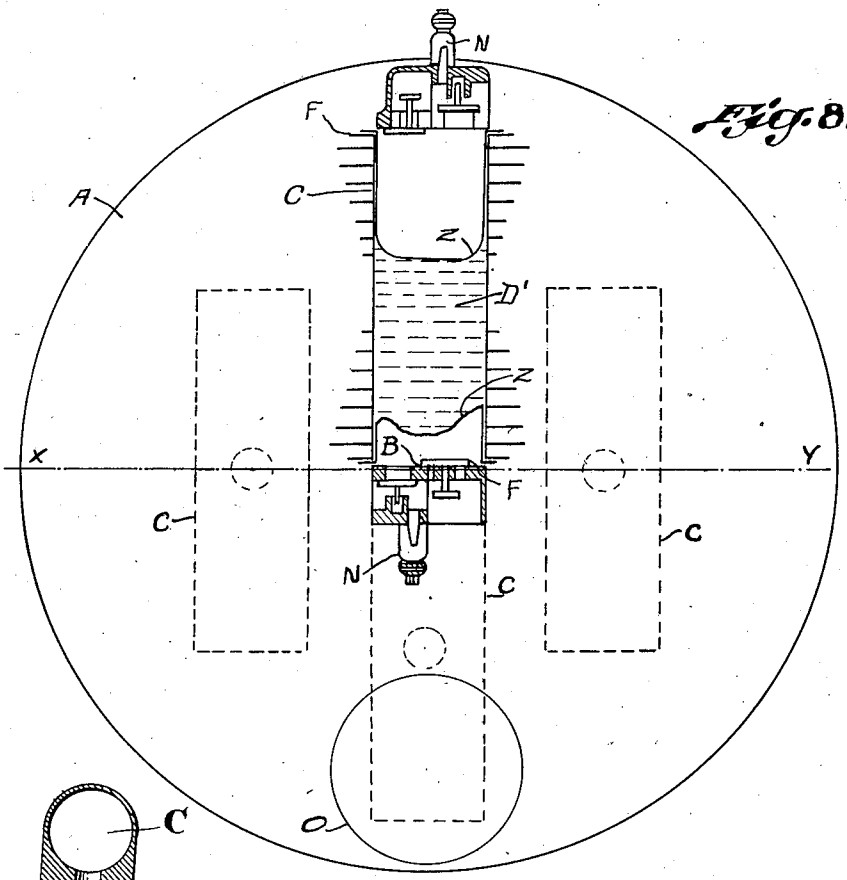


Fig. 7.

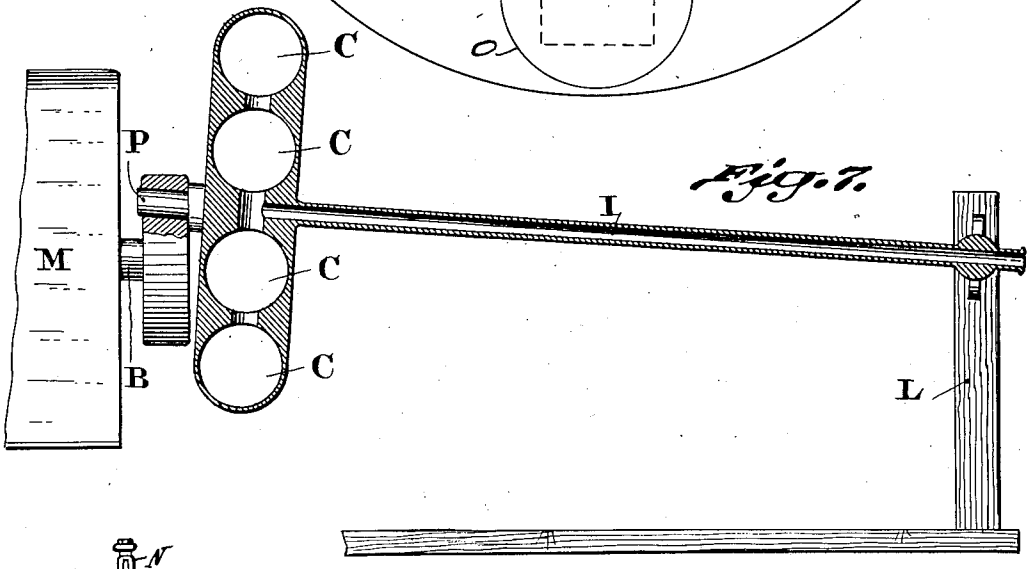
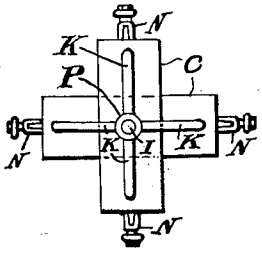


Fig. 4.



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2,019,023

UNITED STATES PATENT OFFICE

2,019,023

FLUID PUMPING APPARATUS

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Application January 22, 1932, Serial No. 588,189
In France January 25, 1931

19 Claims. (Cl. 230—174)

The present invention relates to a form of compressor or exhauster which may be employed conveniently for the pumping of fluids, particularly atmospheric air or other gases.

It is an object of the present invention to provide an improved fluid pumping apparatus employing a cylinder or cylinders containing pistons free from mechanical connection with external actuating means.

Another object is to provide a pump deriving its energy from centrifugal forces.

Further objects of the invention will be apparent from the following description of apparatus constructed in accordance therewith.

In general the apparatus comprises essentially one or more cylinders rotatably mounted on an axis, this axis being given an eccentric movement, means being provided for maintaining the cylinders parallel to a fixed direction meanwhile. Many arrangements of cylinders may be used, their longitudinal axes being either crossed, arranged in star formation, or parallel to one another, but preferably made in a single block and arranged symmetrically.

In each cylinder is a piston of considerable mass which, under action of the centrifugal forces arising from the eccentric movement of the cylinder structure, is flung from end to end of its cylinder.

The motion being rotary, the directions of the forces acting upon the piston or pistons change at each half revolution and consequently one movement is used for drawing-in the fluid, the other for compressing it. The valves controlling this action may also be governed by centrifugal force.

The fluid conducting ports of the cylinder or cylinders may be connected to a storage chamber through a flexible tube.

In the drawings Fig. 1 shows an elevational, sectional view of one form of compressor according to the invention.

Fig. 2 shows a plan view of another form of the apparatus also in section.

Fig. 3 shows a sectional elevation of the apparatus shown in Fig. 2.

Fig. 4 shows diagrammatically an elevation of a crossed arrangement of two cylinders.

Fig. 5 shows a plan view of the arrangement shown in Fig. 4.

Fig. 6 shows diagrammatically in elevation and partly in section a group of five cylinders in star formation.

Fig. 7 shows an elevational sectional view of a compressor employing a group of four cylinders arranged in a single block with their axes parallel.

Fig. 8 shows a plan view of a machine constructed in a manner similar to that shown in Fig. 2 but wherein the rigid piston is replaced by a liquid mass acting on flexible pockets.

Referring first to the arrangement shown in Figs. 2 and 3, the compressor comprises a casing A rotatably mounted upon the shaft B driven by the motor M, in which is mounted on the axle P a cylinder C containing the centrifugally operated piston D. Communication between the interior of the cylinder and the outside air or other gas to be compressed is obtained through valves F, while the compressed gas is supplied by valves H through the tubes K and pipe I which passes through the axle upon which the cylinder C is mounted, to a suitable storage chamber.

The pipe I leads to a point L at which it is supported on the axis of rotation of the casing A. This pipe is made flexible, and is supported intermediately by a supporting member Q which serves also to counterpoise the mass of this pipe, fixed to the casing A. A steel casing SC may be provided for the protection of this tube, this casing being mounted on Cardan joints at each end. These Cardan joints comprise ball members U and U' which are adapted to turn in cup members W, W'. The cup W is carried by the cylinder C while the cup W' is rigidly mounted in the support L.

The weight of the cylinder and its associated parts is counterpoised by the mass O held between the plates of the casing A diametrically opposite to the axle P.

In operation, on rotation of the casing A, the cylinder is maintained parallel to a given line so that the centrifugal force due to rotation of the whole, acts upon the piston D to force it in opposite directions during opposite half-cycles of rotation. Thus, during movement of the cylinder from position X, through the position in which it is drawn, to the position Y, the piston is forced towards the end shown uppermost in Fig. 2, while during the other half cycle it is forced in the opposite direction.

Thus it will be seen that in the first half-cycle mentioned, the upper valve H must be opened for the supply of compressed gas through the tube K, and pipe I, to the storage chamber, and the lower valve F also, for a fresh supply of gas to the lower part of the cylinder. The upper valve F and lower valve H are meanwhile closed. During the other half-cycle the reverse is of course the case.

The valves F and H may be actuated by centrifugal forces. In the apparatus illustrated, the

forces acting upon the valve members are always in the same direction as the movement of the piston relative to the cylinder. By inspection it will be observed that the valves are, therefore, automatically operated in the correct manner.

Centrifugal purifiers or dust collectors N may be provided in the space above the valves H, in which denser impurities in the compressed gas collect instead of being carried through the tubes K. The groove or chamber J may also be provided which serves as a reservoir for lubricant.

In the arrangement shown in Fig. 1, the cylinder is shown connected directly with the supply tube I' which in this case is made rigid and lies in the axis of rotation P. The axis P and therefore the rigid tube I' is inclined towards the axis B. The remote end of the tube I' is mounted at L in a swivel joint comprising a ball member S which turns in a cup provided in the supporting member L and which allows a bodily movement of the cylinder. On rotation of the shaft B movement of the cylinder is obtained in like manner to the first arrangement. In this case, however, the solid piston is replaced by a pair of opposed cup washers *f* suitably connected to make a piston-like arrangement of considerable mass. These cup washers *f* act in place of the valve F, the valves H' being conveniently ball valves.

Another arrangement of cylinders is shown in Figs. 4 and 5, which show respectively a plan view and elevation of an arrangement of a pair of cylinders at right angles to one another.

In Fig. 6 a group of cylinders is shown in star formation each point of the star having an independent piston. In this arrangement it is preferable to provide the pistons at each end with projecting rings V adapted to enter the recesses T and damp the action of the pistons at the end of each stroke.

In the arrangements of cylinders above described with reference to Figs. 4, 5 and 6 it is to be understood of course that in each of the cylinders comprised in each arrangement, a piston and valve arrangements are provided according either to the arrangement shown in Fig. 1 or to that shown in Figs. 2 and 3. Thus in the construction shown in Figs. 4 and 5 inlet valves with dust collectors N are provided at the extremities of the cylinders, and pipes K are provided communicating with each end of each cylinder for the supply of the compressed gas to a supply pipe I at the pivot P. In Fig. 6, the piston D is shown to be of the solid type. Inlet valves F, and outlet valves H for the compressed gas are in this case provided enabling the supply of gas to and from the outer ends of the five cylinders and such valves (not shown) are also provided communicating with the central common chamber. In this embodiment pipes K may be provided affording communication between the outer extremities of the five cylinders and the central chamber, for the supply of the compressed gas from the outer extremities of the cylinders to the central chamber and thus to an outlet pipe I.

In Fig. 7 a group of four cylinders is shown mounted in an arrangement similar to that shown in Fig. 1. The cylinders are in this case parallel and at right angles to the axis P.

In the above described constructions it will be apparent that the compression obtained is dependent upon the distance of the axis P from the axis of rotation B. It is dependent also upon the speed of rotation of the casing A. In order that the safe output of the motor M may not be exceeded when higher compression is required, a constriction R may be provided in the compressed gas supply tube.

In Fig. 8 a construction is shown in which the piston D is replaced by a liquid mass D' which acts upon the flexible pockets Z and Z' which enclose air pressure pockets at each end of the cylinder. This construction corresponds in all other respects with the construction shown in Figs. 2 and 3.

Compressors constructed according to the invention are much simpler and more adaptable than rod actuated, piston controlled compressors, they being readily repaired and easily started. Lubrication is also facilitated.

It will be apparent of course that any one of the constructions described may be employed as an exhauster by suitable rearrangement of the valve mechanisms.

I claim:

1. Fluid pumping apparatus comprising in combination a cylinder rotatably mounted eccentrically upon a rotatable member, driving means for said rotatable member, means for retaining said cylinder axially parallel to a fixed direction in space during rotation of said rotatable member, fluid inlet and outlet means associated with said cylinder, a deformable member enclosing a fluid chamber within said cylinder, communicating with said fluid inlet and outlet means, and a liquid mass within said cylinder, exterior to said fluid chamber, displaceable within said cylinder under the action of its own mass on rotation of the rotatable member, to compress and decompress the fluid in said fluid chamber.

2. Fluid pumping apparatus comprising in combination a cylinder rotatably mounted eccentrically upon a rotatable member, driving means for said rotatable member, means for retaining said cylinder axially parallel to a fixed direction in space during rotation of said rotatable member, fluid inlet and outlet means associated with each end of said cylinder, a deformable member at each end of said cylinder enclosing fluid chambers within said cylinder at opposite ends thereof communicating with said fluid inlet and outlet means and a liquid mass between said deformable members displaceable within said cylinder under the action of its own mass on rotation of the rotatable member to compress and decompress the fluid in said fluid chamber.

3. Fluid pumping apparatus comprising in combination a cylinder rotatably mounted eccentrically upon a rotatable member, driving means for said rotatable member, means for retaining said cylinder axially parallel to a fixed direction in space during rotation of said rotatable member, intercommunicating fluid inlet and outlet means associated with each end of said cylinder, a deformable member at each end of said cylinder enclosing fluid chambers within said cylinder at opposite ends thereof communicating with said fluid inlet and outlet means and a liquid mass between said deformable members displaceable within said cylinder under the action of its own mass on rotation of the rotatable member to compress and decompress the fluid in said fluid chamber.

4. Fluid pumping apparatus comprising a cylinder having an axial bore, a piston axially movable within said bore, a rotatable member and means for driving said rotatable member, said cylinder being rotatably mounted on an axis transverse to its bore eccentrically upon said rotatable member means being provided for

maintaining said cylinder axially parallel to a fixed direction in space.

5. Fluid pumping apparatus comprising a cylinder having an axial bore, a piston closely fitting in said bore and freely movable longitudinally thereof, a rotatable member and means for driving said rotatable member, said cylinder being rotatably mounted on an axis transverse to its bore, eccentrically on said rotatable member means being provided for maintaining said cylinder axially parallel to a fixed direction in space.

6. Fluid pumping apparatus comprising a cylinder having an axial bore rotatably mounted on an axis transverse to its bore, a piston freely movable longitudinally within said bore and means for moving said axis in a circular path, while retaining the cylinder axially parallel to a fixed direction in space, whereby said piston is moved to and fro from end to end of the cylinder under the action of its own mass.

7. Fluid pumping apparatus comprising a rotatable member, driving means applied to said rotatable member, a cylinder having an axial bore, an inlet valve communicating with each end of said bore, compressed fluid outlet means associated with said bore, a piston closely fitting within said bore and movable longitudinally thereof, said cylinder being mounted on an axis transverse to its bore eccentrically on said rotatable member, and means for retaining the cylinder axially parallel to a fixed direction in space throughout the rotation of said rotatable member.

8. Fluid pumping apparatus comprising a rotatable member, driving means applied to said rotatable member, a cylinder having an axial bore, fluid inlet and compressed fluid outlet means at each end of said bore, a piston closely fitting within said bore and movable longitudinally thereof, defining a fluid compression space at each end of said cylinder, said cylinder being rotatably mounted on an axis transverse to its bore, eccentrically on said rotatable member, and means for maintaining said cylinder axially parallel to a fixed direction in space throughout rotation of said rotatable member, whereby said piston is urged towards each end of said cylinder in turn under the action of centrifugal force to compress the fluid within said fluid compression spaces alternately.

9. Fluid pumping apparatus comprising a rotable member driving means applied to said rotatable member, a cylinder having an axial bore, fluid inlet valves at each end of said bore, a piston closely fitting within said bore and longitudinally movable therein, said piston comprising opposed valve members defining fluid compression spaces at each end of said cylinder, and a compressed fluid chamber between the said valve members, and compressed fluid supply means communicating with said compressed fluid chamber, said cylinder being rotatably mounted eccentrically upon said rotatable member, means being provided for retaining said cylinder axially parallel to a fixed direction in space throughout the rotation of said rotatable member.

10. Fluid pumping apparatus comprising a cylinder having an axial bore rotatably mounted on an axis transverse to its bore, a piston freely movable longitudinally within said bore, said piston defining two fluid compression chambers one at each end of said cylinder, an inlet valve communicating with each end of said bore, means for the supply of compressed fluid from said fluid compression chambers and means for moving the transverse axis of said cylinder in a circular path while retaining the bore of the cylinder axially parallel to a fixed direction in space.

11. Fluid pumping apparatus comprising a rotatable member, driving means applied to said rotatable member, a cylinder having an axial bore, said cylinder being mounted on an axis transverse to its bore eccentrically on said rotatable member, means for retaining the cylinder axially parallel to a fixed direction in space throughout the rotation of said rotatable member, an inlet valve communicating with each end of the bore of said cylinder, a piston closely fitting within said bore and movable longitudinally thereof and means for deriving compressed fluid from the portions of said bore on either side of said piston.

12. Fluid pumping apparatus comprising a rotatable member, driving means applied to said rotatable member, a cylinder having an axial bore mounted on an axis transverse to its bore eccentrically on said rotatable member, means for retaining the cylinder axially parallel to a fixed direction in space, throughout the rotation of said rotatable member, a piston closely fitting within said bore and movable longitudinally thereof, defining a fluid compression chamber at each end of said cylinder, and an inlet valve and compressed fluid outlet means communicating with each of said compression chambers.

13. Fluid pumping apparatus comprising a rotatable member, driving means for said rotatable member, a cylinder having an axial bore mounted on an axis transverse to its bore eccentrically on said rotatable member, means for retaining said cylinder parallel to a fixed direction in space throughout the rotation of said rotatable member, a piston closely fitting within said bore and movable longitudinally thereof, confining fluid compression chamber at each end of said cylinder, fluid inlet valves and compressed fluid outlet means communicating with each of said compression chambers, said inlet valves being centrifugally operated to close their respective inlets during compression of fluid in the chamber associated therewith.

14. Fluid pumping apparatus comprising a cylinder having an axial bore and an inlet valve at each end of said bore, a piston axially movable within said bore and comprising opposed valve members for controlling the outflow of compressed fluid, a rotatable member and means for driving said rotatable member, said cylinder being mounted eccentrically on said rotatable member on an axis transverse to its bore and inclined to the axis of said rotatable member, means for maintaining said cylinder axially parallel to a fixed direction in space, throughout rotation of said rotatable member, a rigid pipe lying in the transverse axis of said cylinder, said pipe affording communication between the interior of said cylinder and compressed fluid storage apparatus, and a swivel joint supporting the remote end of said pipe at the axis of said rotatable member.

15. Fluid pumping apparatus comprising a plurality of cylinders each having an axial bore, a piston axially movable within each of said bores a rotatable member and means for driving said rotatable member, said cylinders being mounted with their bores in parallel planes and mutually inclined, on a common axis at right angles to all the said planes, eccentrically upon said rotatable member, means being provided for maintaining said cylinders with the bore of each thereof, par-

allel to a fixed direction in space throughout rotation of said rotatable member.

16. Fluid pumping apparatus comprising a plurality of cylinders each having an axial bore, a piston axially movable within each of said bores, a rotatable member and means for driving said rotatable member, said cylinders being mounted with their bores mutually inclined to one another and disposed in a common plane, rotatably on a common axis perpendicular to the plane containing the bores eccentrically upon said rotatable member, means being provided for maintaining all of said cylinders with their bores each axially parallel to a fixed direction in space throughout rotation of said rotatable member.

17. Fluid pumping apparatus comprising a plurality of cylinders each having an axial bore, a piston axially movable within each bore, a rotatable member and means for driving said rotatable member, said cylinders being mounted with their bores mutually parallel, rotatably on a common axis transverse to the common direction of said bores, eccentrically upon said rotatable member, means being provided for maintaining said cylinders axially parallel to a fixed direction in space throughout rotation of said rotatable member.

18. Fluid pumping apparatus comprising a cylinder having an axial bore, a piston axially movable within said bore a rotatable member and means for driving said rotatable member, said cylinder being rotatably mounted on an axis transverse to its bore, eccentrically upon said rotatable member, means being provided for maintaining said cylinder axially parallel to a fixed direction in space throughout rotation of said rotatable member, and a counterpoising mass mounted on said rotatable member in diametrically opposed spaced relation to said cylinder.

19. Fluid pumping apparatus comprising a rotatable member, driving means applied to said rotatable member, a cylinder having an axial bore, fluid inlet and compressed fluid outlet means at each end of said bore, a piston closely fitting within said bore and movable longitudinally thereof, defining a fluid compression space at each end of said cylinder, said cylinder being rotatably mounted on an axis transverse to its bore, eccentrically on said rotatable member, means for maintaining said cylinder axially parallel to a fixed direction in space throughout rotation of said rotatable member, and a counterpoising mass mounted on said rotatable member in diametrically opposed spaced relation to said cylinder.

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