No. 819,674. PATENTED MAY 1, 1906.

F. J. ROCHOW.

ROTARY PUMP, COMPRESSOR, MOTOR, ENGINE, AND LIKE MACHINERY.

APPLICATION FILED OCT. 12, 1903.

2 SHEETS—SHEET 1.

Fig. 1

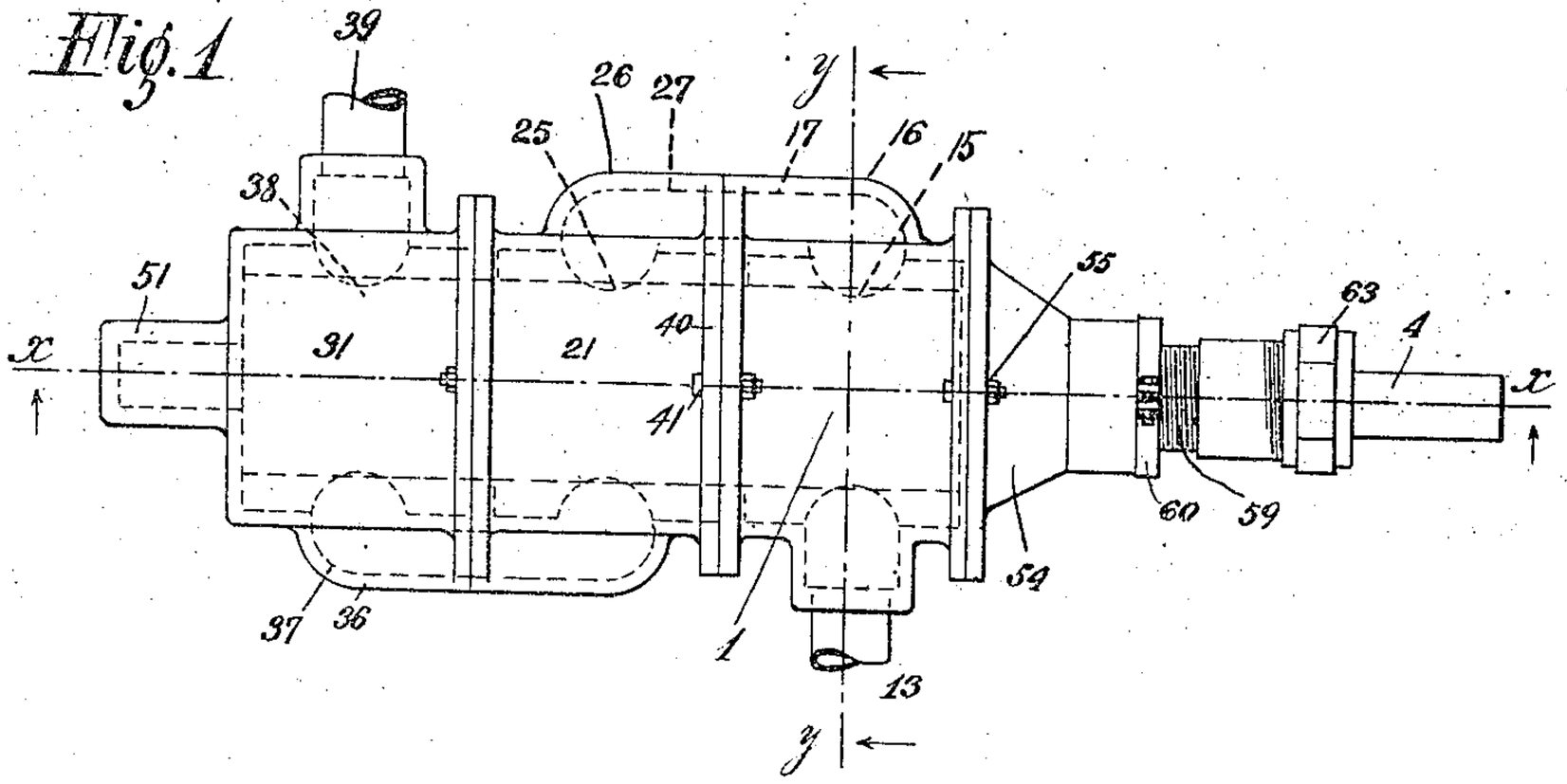

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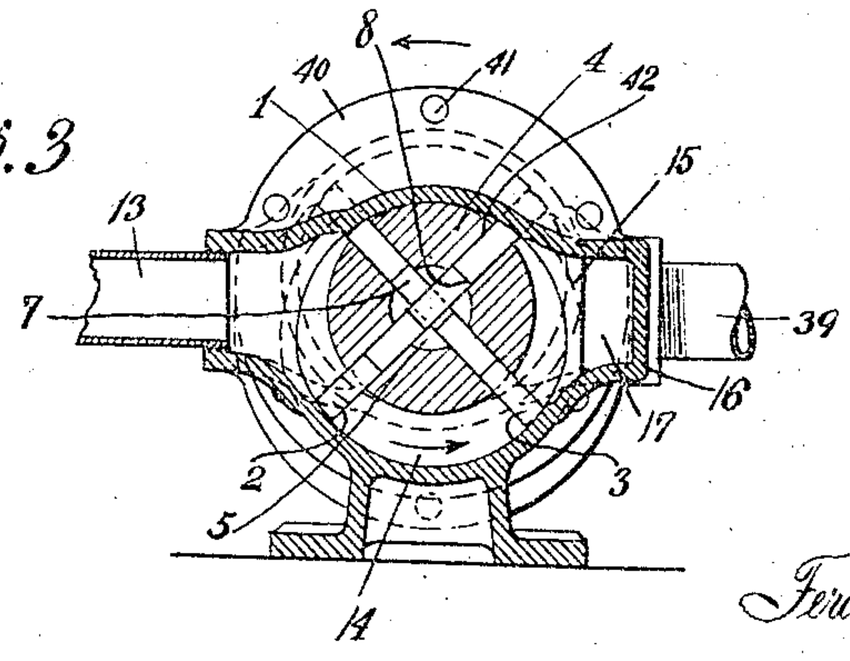
Fig. 2

Fig. 3



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2 SHEETS—SHEET 2.

Fig. 4

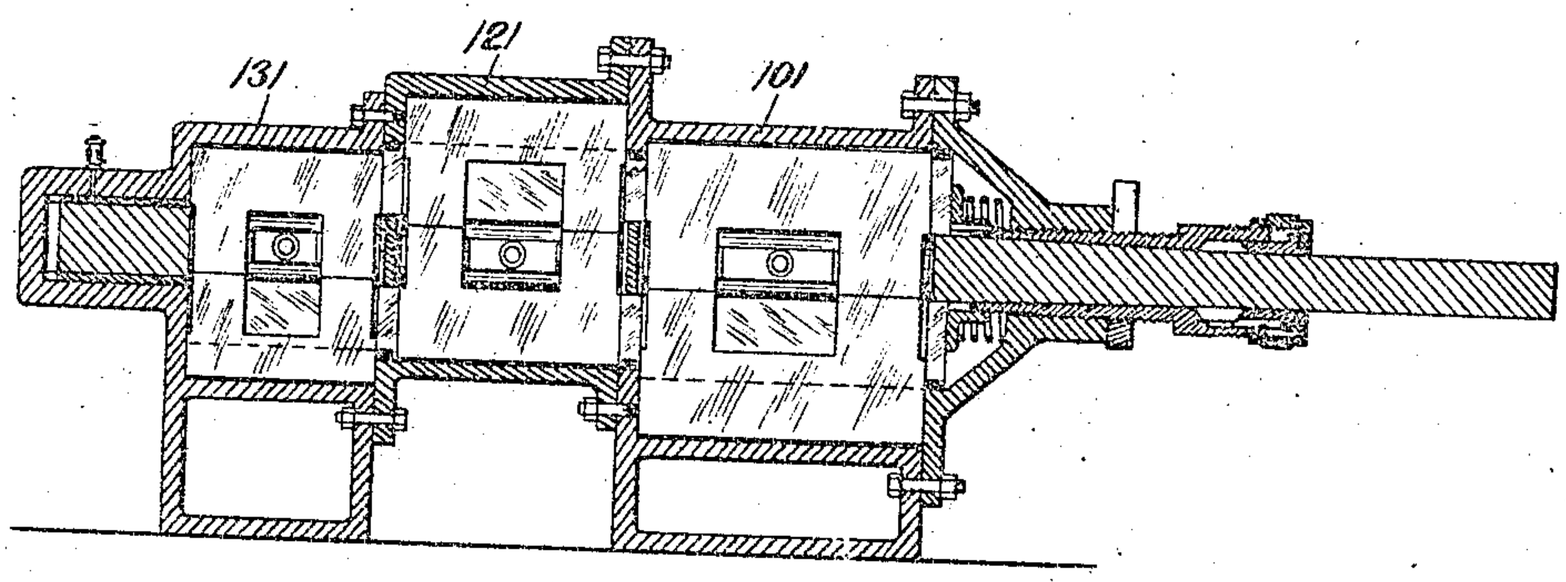


Fig. 5

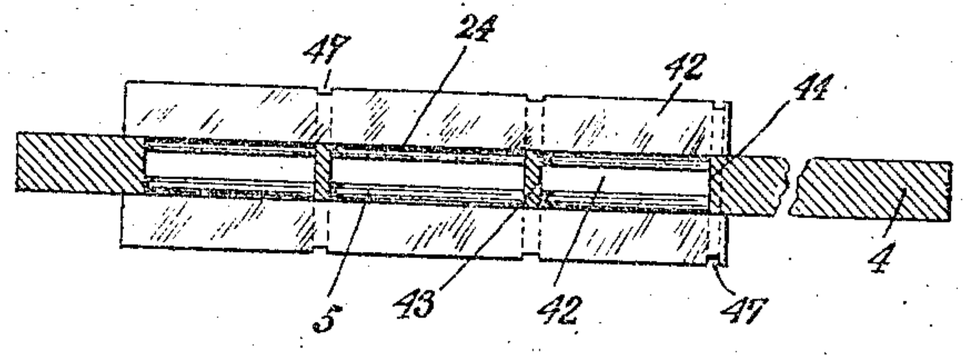
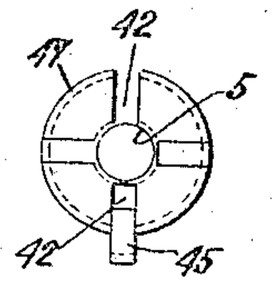


Fig. 6



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UNITED STATES PATENT OFFICE.

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ROTARY PUMP, COMPRESSOR, MOTOR, ENGINE, AND LIKE MACHINERY.

No. 819,674. Specification of Letters Patent. Patented May 1, 1906.

Application filed October 12, 1903. Serial No. 176,637.

To all whom it may concern:

Be it known that I, FERDINAND J. ROCHOW, of Brooklyn, New York, have invented certain Improvements in Rotary Pumps, Compressors, Motors, Engines, and Like Machinery, of which the following description, in connection with the accompanying drawings, is a specification, like numerals on the drawings designating like parts.

This invention relates to pumps or like devices particularly applicable to the compression or pumping of air, &c., although I contemplate the embodiment of my improvements in motors, engines, and like machinery whatever the character in any field where the nature of my improvements render them of value.

My invention relates more specifically to the type of machine illustrated in the rotary pump forming the subject of United States Letters Patent No. 33,961, granted to me upon the 17th day of December, 1861, and which has for many years been a standard form of pump, simple and efficient in operation at low pressures, but lacking efficiency at high pressures by reason of a certain amount of leakage which is difficult to avoid in a single-cylinder pump of this kind. I contemplate the compounding of several units of this type of pump, and the accomplishment of this feature forms the subject of the following specification, with drawings, wherein the various features of my invention will be described and illustrated fully and pointed out in the claims.

In the drawings, Figure 1 is a view in plan of a compound rotary pump in the construction of which my improvements have been embodied. Fig. 2 is a view in longitudinal vertical section on the line *x x*, Fig. 1. Fig. 3 is a view in transverse vertical section on the line *y y*, Fig. 2. Fig. 4 is a view similar to Fig. 1 of a compressing-pump. Fig. 5 is a vertical longitudinal section of the shaft, and Fig. 6 a transverse section thereof.

In the embodiment of my invention selected for description and illustration as a convenient form to enable ready and complete understanding of my improvements the part designated by the reference-numeral 1 is a pump-casing constructed substantially in accordance with my Letters Patent to which reference has been made above and in which operate pistons or blades 2 3, actuated by a shaft 4, chambered at 5 to receive the blades, a slot 6 in the piston 2 permitting passage of the leg 7 of the piston 3. The construction of these pistons and the shaft may be varied, as found suitable and convenient, and as one form of construction the blades may be divided into two parts, as indicated at 8 upon the blade 2, one part having a recess 9 (see Fig. 2) in which lies a spring 10, a similar provision being made at 11 in the piston 3 to hold the pistons out against the cylinders.

The fluid to be pumped may be introduced to the casing at 13, passing into the chamber 14, in which it is acted upon by the pistons in usual manner and carried around to the outlet 15, whence in accordance with my invention a connection 16, preferably formed as a channel 17 in the casing, leads to a similar connection 26 upon the adjacent casing 21, the channel 17 in this connection leading to the inlet-port 25 of the cylinder 21.

The shaft portion 24 may be in continuation of and integral with the shaft 4, and additional casing or pump units may be connected up, as that illustrated at 31, with blades 32 33, similar to those already described, and provided with connections 36 39, and the shaft may be driven from any suitable source of power. (Not shown.)

In operation, connection having been made with a suitable source of supply of fluid, the latter will be drawn in at the inlet 13 of the casing 1 and under the action of the pistons therein in the direction of the arrow will be delivered to the casing 21 at a pressure of, say, twenty-five pounds to be acted upon by the pistons 22 23 in turn and delivered at an increased total pressure of, say, fifty pounds to the casing 31, where the pressure will be still further increased. In accordance with my invention the ports and the connections between them are so arranged that the fluid will pass from one casing to another and be acted upon within the casings with the least possible deflection from its natural course, eliminating friction and resistance due to counter currents—a feature of primary importance dynamically.

By locating the ports in the periphery of the casings I enable a wider range of form and size of the ports, as well as promoting the easy flow of the fluid above mentioned.

The casings will preferably be formed separately for ease of construction and open at one end, respectively, to permit ready introduction of the moving parts, and they may be provided, as illustrated, with flange-and-bolt connections 40 41.

In assembling the parts when constructed as illustrated the parts comprising the piston-blades 2 and 3 for the cylinder 1 are first placed in the cross-slots 42 (see Fig. 5) of the shaft 4 between the partition 43 and the shaft end 44, after which filling or distance pieces 45 are placed in the slots 42, as best shown in Fig. 6, where one of the pieces is partly in place in the slot at the bottom of the figure, two of these pieces being fully inserted in the side slots. Grooves 46 are formed in the periphery of the shaft and distance-pieces to receive packing-rings 48, which will be put in place before introduction of the shaft to the casing, and when the shaft, with blades 2 3, has been thrust home until the distance-pieces lie in the circular aperture between the casing 1 and the casing 21 the blades 22 23 may be put in position in the slots 42, being separated from the blades 2 3 by the distance-pieces 45, and similar distance-pieces 49 will be used beyond the blades 22 23 and the casing 21 slipped over them against the flange of the casing 1 and there bolted in place. The casing 31 will be added in similar fashion and succeeding casings, if any, the last casing preferably having a bearing 51 for the end of the shaft, a friction metal bushing 52 being provided, if found necessary, and an oil-cup 53. A cylinder-head is shown at 54, held in place by bolts 55, and through the central aperture 56 in this head extends the shaft end, which may be tapered at 57 to coöperate with taper 58 in the bore of a bushing 59, screwed into the cylinder-head and adjustable therein to take up wear, a split lock-nut 60 being provided, preferably. At the outer end of this bushing may be provided a stuffing-box gland 61, formed with a feather 62 and having a retaining cap or nut 63. It is desirable that the ends of the piston-blades 32 33 at the opposite end of the shaft shall abut snugly against the outer end of the casing 31 to prevent leakage, and this may be accomplished conveniently by a spring 64 between the cylinder-head 54 and the end of the enlarged medial portion of the shaft, a loose washer 65 being interposed between the shaft end and spring, if found desirable, and preferably kept from rotating by a suitable device, as the feather 66, said spring permitting also a slight play between the shaft and pistons upon expansion or contraction of the former within the latter.

Passing to the modification illustrated in Fig. 4, it will be noticed that the casings 101, 121, and 131, respectively, differ in size, so that a fluid, such as air, introduced to the largest, 101, will be subject to compression when acted upon by the piston devices in the smaller casing 121 and will be still further compressed in the still smaller casing 131. This latter type of compressor may be operated as a compound steam-engine by introducing steam at high pressure to the casing 131 and exhausting from it into the casing 121 and 101 in turn, which utilize the steam at respectively lower pressures.

The operation of the device illustrated above will be understood clearly from the above description, and it will be obvious that any leakage which was objectionable in a single-casing machine of the above type is taken care of in the compound casings, and when my improvements are applied to steam-engines the leakage is utilized in the lower-pressure casing to perform work, availing to the full of the natural efficiency of this type of rotary apparatus.

It is preferred to arrange the adjacent casings with their eccentricities at one hundred and eighty degrees to enable the port connections from outlet to inlet to be made as short as possible; but it will be understood that I do not limit myself to the exact construction illustrated and described above nor in general otherwise than as set forth in the claims read in connection with this specification.

What I claim, and desire to secure by Letters Patent, is—

1. Rotary apparatus of the class described comprising a plurality of directly-abutting open-ended cylinders having peripheral inlet and outlet ports; a rotatable shaft extended through said cylinders respectively and provided with means to separate said cylinders respectively; piston devices rotatable with said shaft; and connections intermediate the outlet-port of one cylinder and the inlet-port of the adjacent cylinder, to operate substantially in the manner set forth.

2. Rotary apparatus of the class described comprising a plurality of open-ended abutting cylinders having respectively peripheral outlet and inlet ports, and peripheral channels connecting the outlet-port of each cylinder directly with the inlet-port of the adjacent cylinder; and rotatable separating devices intermediate said cylinders, substantially as described.

3. Rotary apparatus of the class described comprising a plurality of directly-abutting open-ended cylinders having peripheral inlet and outlet ports and integral channels in extension of said ports, said cylinders being disposed eccentrically with respect to a shaft rotatable within said cylinders, adjacent cylinders being arranged at angles of one hundred and eighty degrees to bring the mouth of the channel from the inlet-port of one cylinder opposite the mouth of the channel from the outlet-port of the neighboring cylinder; and rotatable separating devices intermediate said cylinders.

4. Rotary apparatus of the class described comprising a plurality of communicating open-ended cylinders, a shaft rotatable in said cylinders respectively and slotted for the reception of piston plates or devices to oper-

ate in each cylinder and division-pieces intermediate said plates and rotatable with said shaft, substantially as described.

5. Rotary apparatus of the class described comprising a plurality of communicating open-ended cylinders, a shaft rotatable in said cylinders respectively and slotted for the reception of piston plates or devices to operate in each cylinder and division-pieces intermediate said plates and rotatable with said shaft, and peripheral packing-rings surrounding said shaft and division-pieces between said cylinders, to prevent leakage therebetween.

6. A shaft for compound rotary apparatus having a plurality of cylinders, consisting of a cylindrical casting having a central axial bore divided by a plurality of transverse webs into a series of axial chambers, and a plurality of longitudinal slots intersecting the central chambers intermediate said webs to form transverse bearing-slots for piston devices, to operate in said cylinders.

7. A shaft for compound rotary apparatus having a plurality of cylinders, consisting of a cylindrical casting having a plurality of transverse webs, and a plurality of longitudinal slots intersecting the central chambers intermediate said webs to form transverse bearing-slots for piston devices, to operate in said cylinders, with division-pieces in said slots to separate said piston devices and maintain the same in position relatively to each other in their respective cylinders.

8. Rotary apparatus comprising a series of abutting cylinders, a rotatable shaft therein carrying piston-blades for each cylinder and means to permit expansion and contraction of said shaft without binding of said pistons.

9. Rotary apparatus of the class described comprising a plurality of cylinders; a piston device for said cylinders respectively; a shaft recessed to receive said piston devices; and a spring acting upon one end of said series of piston devices to maintain said piston device farthest therefrom in constant contact with the adjacent head of its cylinder, substantially as described.

10. Rotary apparatus of the class described, comprising a series of cylinders having at each end bearings to receive a shaft, one of said bearings being adjustable and having a tapered bore; a shaft in said bearings, having a peripheral taper to coöperate with said tapered bearing; piston devices capable of slight axial motion relative to said shaft; and a spring acting upon one end of said series of pistons to maintain the same constantly in proper position regardless of the position of said shaft, substantially as described.

11. Rotary apparatus of the class described comprising a series of open-ended cylinders having respectively an eccentric opening at one end a circular opening at the other end, said cylinders being formed separately and arranged to be fitted together; and means to secure said cylinders in assembled relation.

Signed at New York, in the county of New York and State of New York, this 3d day of October, A. D. 1903.

FERDINAND J. ROCHOW.

Witnesses:
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