June 25, 1935. M. R. HUTCHISON, JR 2,006,298

ROTARY PUMP, COMPRESSOR, ENGINE AND THE LIKE

Filed April 21, 1933 3 Sheets-Sheet 1

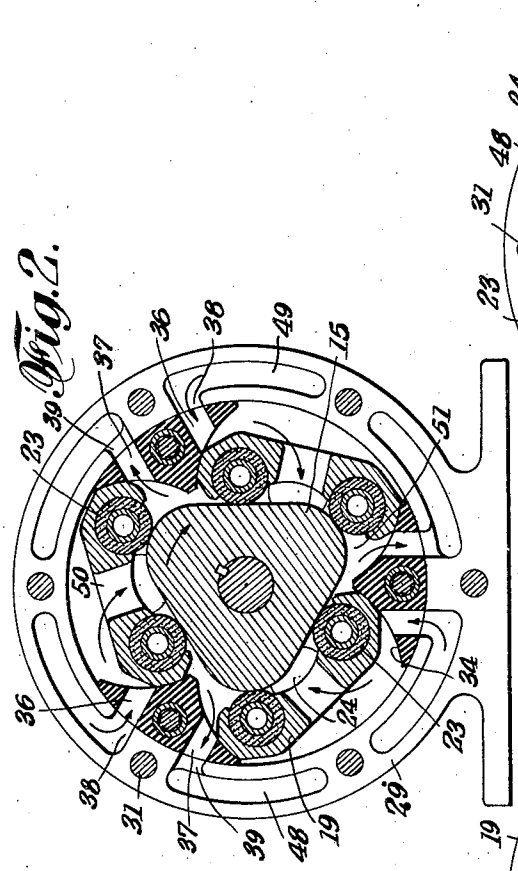

Fig. 2.

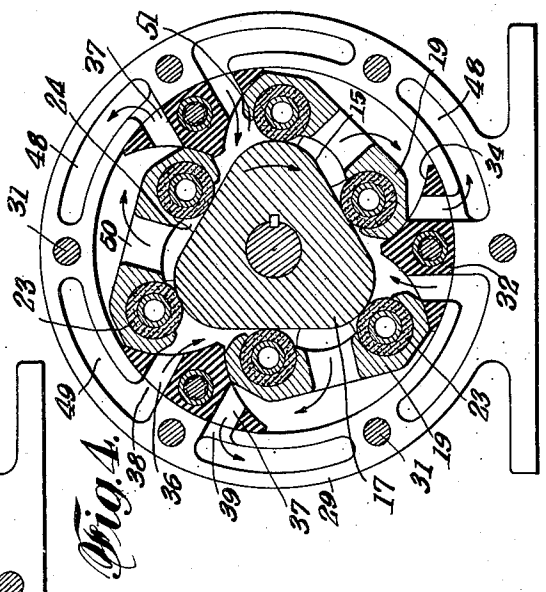

Fig. 4.

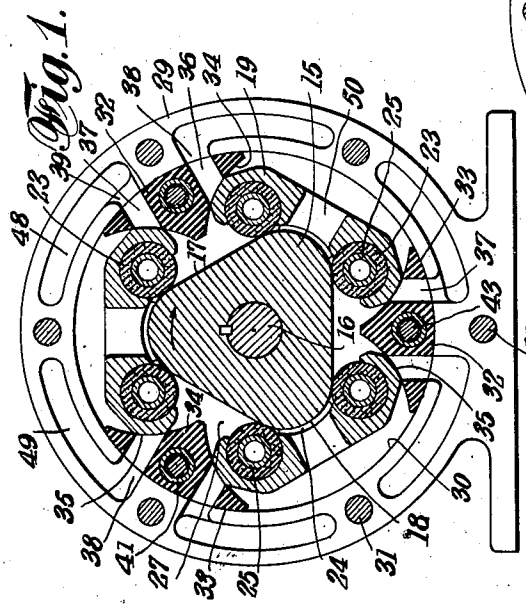

Fig. 1.

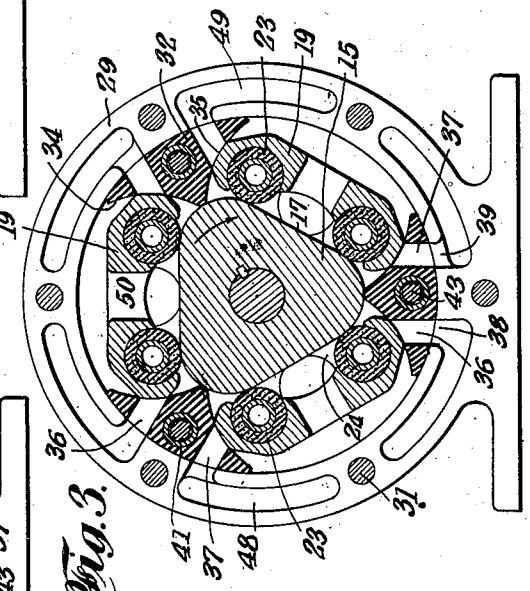

Fig. 3.

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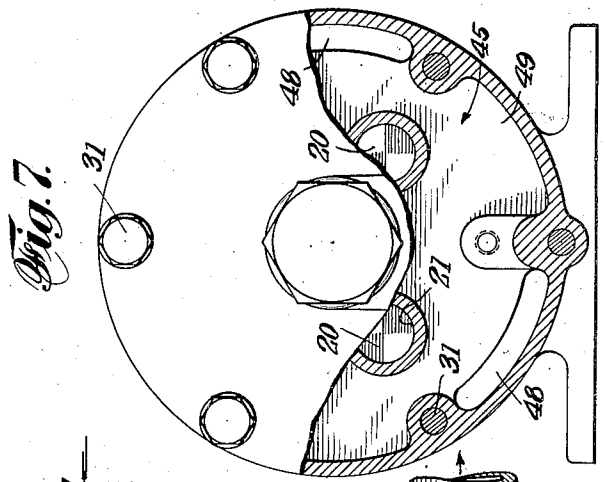
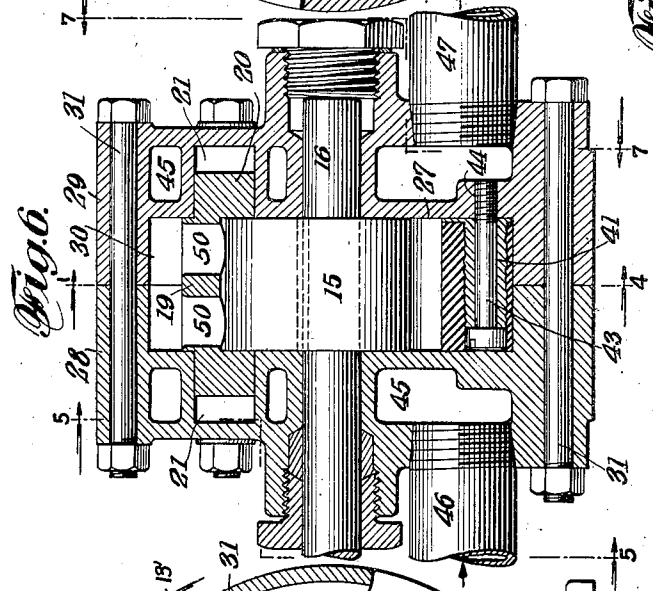
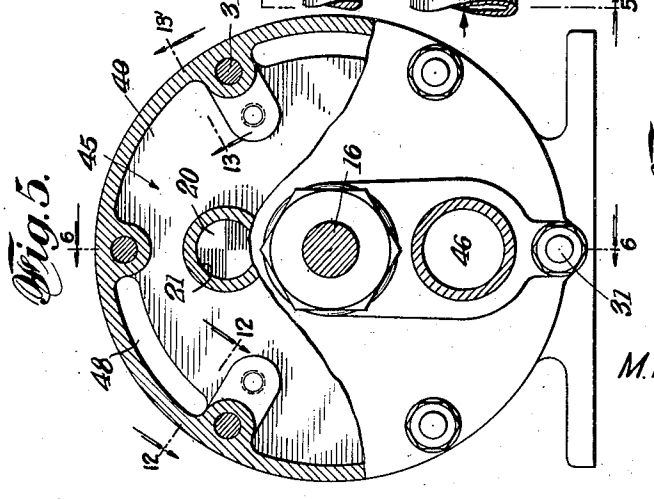
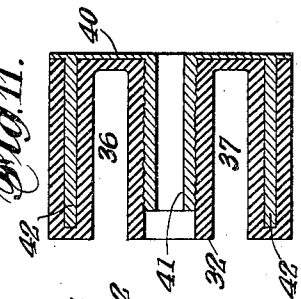
ROTARY PUMP, COMPRESSOR, ENGINE AND THE LIKE

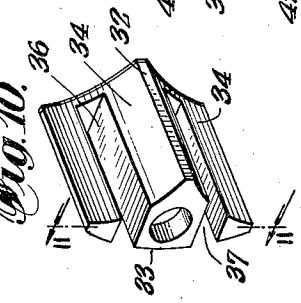
Filed April 21, 1933 3 Sheets-Sheet 2

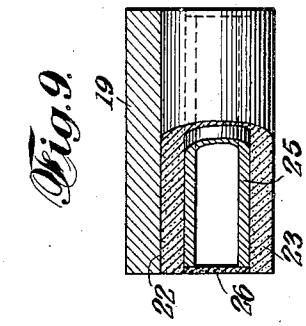


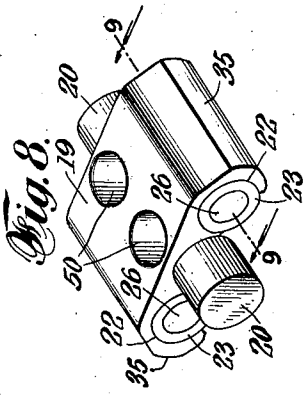












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ROTARY PUMP, COMPRESSOR, ENGINE AND THE LIKE

Filed April 21, 1933 3 Sheets-Sheet 3

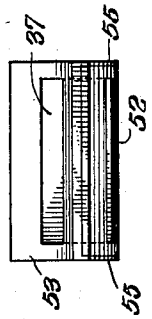

Fig. 16.

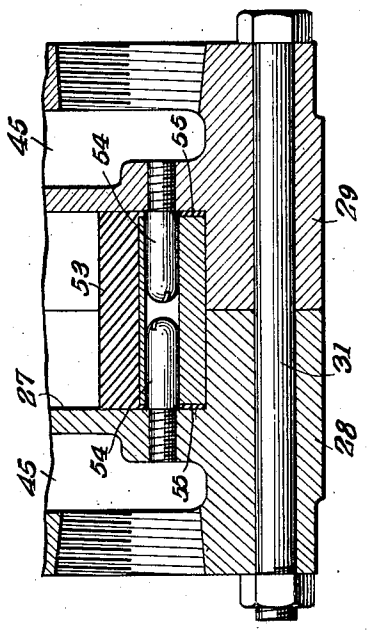

Fig. 15.

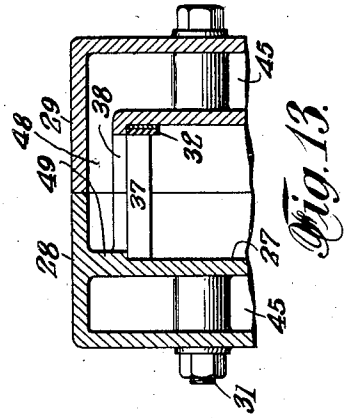

Fig. 13.

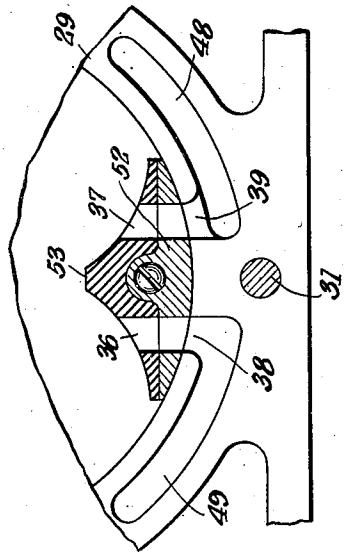

Fig. 14.

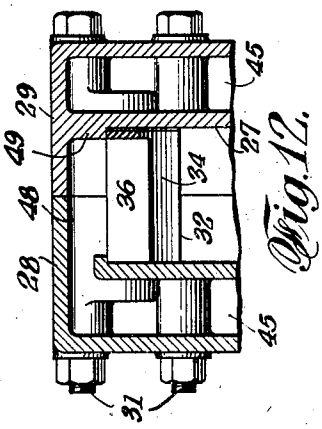

Fig. 12.

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Patented June 25, 1935 2,006,298

UNITED STATES PATENT OFFICE

2,006,298

ROTARY PUMP, COMPRESSOR, ENGINE, AND THE LIKE

Miller R. Hutchison, Jr., Madison, N. J., assignor to Multicycol Pump & Engine Corporation, New York, N. Y., a corporation of New York

Application April 21, 1933, Serial No. 667,140

11 Claims. (Cl. 103—124)

This invention relates to machines in the nature of rotary pumps, compressors, engines and the like, for handling or passing fluids.

Special objects of the invention are to attain high effective useful displacement per revolution in a simple compact unit, to keep friction at a minimum, to effectively utilize all displacement and to balance pressures, so as to maintain quiet running conditions.

Additional objects and the many novel features of the invention are set forth in the following specification, illustrated in the accompanying drawings and broadly covered in the claims.

The drawings illustrate present preferred embodiments of the invention, but it should be understood that the structure is susceptible of further possible variations and modifications, all within the true intent and broad scope of the invention.

Figs. 1, 2, 3, 4 are mid-sectional views as on line 1—4, Fig. 6, of a pump structure embodying the invention, illustrating the parts in successive positions.

Fig. 5 is a broken and part sectional end view of the pump, this view appearing as on substantially the planes of line 5—5, Fig. 6.

Fig. 6 is a longitudinal sectional view of the pump, substantially as on line 6—6 of Fig. 5.

Fig. 7 is a broken and sectional elevation of the opposite end portion of the pump, substantially as on line 7—7 of Fig. 6; Fig. 8 is a detached perspective view of one of the so-called rocker elements; Fig. 9 is an enlarged sectional detail of the latter as on line 9—9 of Fig. 8; Fig. 10 is a perspective view of one of the segmental valve seat elements which are disposed in the pump chamber between adjoining ends of the rockers; Fig. 11 is an enlarged sectional view of the same, substantially as on line 11—11 of Fig. 10; Figs. 12 and 13 are sectional details as on lines 12—12 and 13—13 respectively, Fig. 5; Fig. 14 is a fragmentary mid-sectional view illustrating another form of construction for the valve seat segments and Fig. 15 is a broken longitudinal sectional view showing particularly the valve seat insert; Fig. 16 is a detached detail view of the valve seat insert.

High effective displacement per revolution and smooth pumping action is attained in the present invention by the employment of a cam-like impeller 15, cooperating with a series of hollow rockers grouped about the same and by valving so as to utilize the displacement of both the rockers and the spaces between the same.

The impeller cam or rotor is here shown as a substantially triangular shaped member fixed on shaft 16, and having three substantially flat sides 17, joined by equi-distantly spaced rounded lobes 18.

The rockers, three in number in the disclosure, are identical and consist each of a rocker frame member 19, having shaft extensions 20, at opposite ends, journalled in end bearings 21, and provided with cylindrical seats or cavities 22, at opposite sides of the pivotal axis, holding rolls 23, in sealing engagement with the face of the cam. These rolls with the hollow intervening face of the rocker serve, in conjunction with the face of the cam, to form variable displacement chambers 24.

The cam face engaging sealing rolls, preferably have a rolling fit in their bearings or seats 22, in the rockers, so as to continually present fresh lines of contact with the cam. These rolls may be made of rubber or other suitable, somewhat resilient material, and may be constructed as indicated in detail in Fig. 9, having a hollow expanding plug 25 inserted therein and closed at opposite ends by caps or plugs 26 of rubber or the like, having sealing engagement with the inside end faces or walls 27, defining the pump chamber.

The pump housing is shown as made up of duplicate casing sections 28, 29, cooperatively defining the circular cavity 30, which with parallel end walls 27, forms the pump housing. These sections are conveniently secured together by through bolts, such as indicated at 31.

Pumping chambers for the rockers and the spaces between the rockers are provided in the structure illustrated, by separately formed segmental inserts 32, secured in equi-distantly spaced relation between the end walls of the casing. One of these inserts is illustrated in Fig. 10, which shows it as having a circular outer surface 33, to closely fit the cylindrical wall 30, of the main pump chamber and convergent circular inner surfaces 34, formed as arcs drawn from the rocker centers to cooperate with the arcuate end faces 35, of the rockers. The curved inner faces 34 of the substantially triangular partitioning segments are ported through from the back as indicated at 36, 37, to form by cooperation with ports 38, 39, in the housing, inlet and outlet passages respectively, as indicated by the arrows in Figs. 2 and 4.

The partitioning segments also may be made of rubber and when so constructed, they may be reinforced as indicated in Figs. 10 and 11, by a back plate 40, carrying a screw boss 41, for the central portion of the member and rod re-

inforcements **42**, for the end portions which are cut off from the main body of the element by the through ports **36**, **37**. Screws **43** inserted through the screw bosses **41** into screw seats **44**, in one of the housing sections serve to secure these partition elements firmly in place.

Passages or chambers **45**, cored or otherwise provided in the housing sections in back of the pump chamber walls **27**, provide for inlet and outlet of fluid. These chambers are shown as having pipe connections **46**, **47**, which in the present illustration constitute the inlet and outlet respectively, with rotation as indicated by the arrows.

Figs. 5 and 7, with Figs 12 and 13, show how the end chambers are alternately ported and closed at **48** and **49** respectively, to provide in the one instance, passages from the end chambers to the inlet and outlet ports **38**, **39**, and in the other instance, to close off said chambers from one set of such ports. The two housing sections being identical, it follows that when they are put together face-to-face, the ports or passages **48** in one will register with the closed portions **49** of the other, thus placing one end chamber **45**, the left handed one in Fig. 6, in communication through the three passages **48**, with the three inlet ports **38** and the other end chamber **45**, at the right in Fig. 6, in communication through the three passages **48** therein, in register with the three outlet ports **39**. The meeting faces of the housing sections may be ground to fit tightly without the use of gaskets or the like, and the through bolts **30** serve as dowels for bringing the casing sections accurately together. The ports **36**, **37**, in the inserts **32**, are accurately molded or otherwise formed, so as to register properly with the intake and outlet ports **38**, **39**, in the casing sections, so that the mere act of assembly brings the parts together into properly coordinated relation without machine work.

The operation as a pump will be clear from Figs. 1 to 4. The first of these views illustrates what may be considered a dead center position with the lobes of the cam in the hollows of the rockers, which thereby are positioned with the rounded valvular ends **35** of the same closing the arcuate inlet and outlet ports **36**, **37**, at opposite sides thereof. As the cam rotates right-handedly to the position shown in Fig. 2, the rockers will be tilted left-handedly to open both sets of ports, placing the rocker chambers **24** in communication with inlet ports **36**, through opening or openings **50**, in the rockers and the pumping chambers **51** between the ends of adjoining rockers in communication with discharge ports **39**. As the cam reaches the position of Fig. 3, the rockers will be leveled off against the flat faces of the cam momentarily again closing both sets of ports, the movement to this position effecting discharge of the inter-rocker spaces **51** and the filling of the rocker chambers **24**. In the movement to the Fig. 4 position, the inter-rocker pumping chambers **51**, by the right-handed tilting of the rockers, are connected up with the intake ports **36** to charge these spaces and the rocker chambers **24** are placed in communication with discharge ports **37**, to enable the cam lobes to force liquid therethrough by way of openings **50** through the backs of rockers. The ends of the rockers thus serve as oscillating valve elements for alternately admitting fluid to the rocker chambers and to the pumping spaces between rockers and for alternately enabling discharge from the inter-rocker spaces and from the rocker chambers, the outward pulses of the inter-rocker pumping chambers following immediately the outward pulses of the rocker pumping chambers and there being for each cam revolution, in the illustration, a complete cycle of three pumping impulses.

The rockers are journalled on their own end pivots **20** and so are located for proper and free oscillating movements with respect to both the cam and the valve seats. The particular construction of the rockers enables use of the same for the purpose of honing the cam, this being effected prior to final assembly by inserting cylindrical hones in the roll seats **22** in the rockers and turning the cam until a proper finish is obtained. The cam may preferably be made of an aluminum bronze of the glazing variety, but hardened steel is suitable for some purposes. The rockers may be made of phenolic condensation products or metal, machined, die cast or molded.

The rollers also may be made of a material like bakelite or metal, the construction disclosed enabling, when desired, the substitution of parts of one material for parts of different materials, as for handling different liquids or fluids, also ready substitution of new parts for worn parts. The use of rubber rolls in the rockers is particularly advantageous where the fluid may contain a certain amount of grit or dirt, these rolls then yielding to pass such matter without injuring the parts. The smaller end bearings for the rockers provide reduced frictional surfaces and hence less rubbing friction. Shims or the like, may be used between the housing sections to vary the length of the cylindrical chamber between parallel end faces to enable compensation for wear and adjustment of end clearances between the rockers and cam. The net pressure is balanced on both cam and rockers at all times, reducing the bearing loads accordingly.

The structure may be modified in various ways, for example, the partitioning valve seats may be constructed as indicated in Figs. 14 to 16, with a metallic backing portion **52**, shaped to fit the cylindrical chamber of the housing and having a facing **53** of rubber, or other suitable material, molded or otherwise shaped and bonded thereto, to provide the ported valve seats. Also in this construction, these inserts are shown as located and held in place by dowel screws **54**, set in the opposite end faces of the casing sections. These dowels, as indicated particularly in Fig. 15, center the inserts between the two casing sections and this view shows also how the rubber facing may be extended over the ends of the metal backing as at **55**, to seal the ends of these inserts in the working chamber.

As the rockers are spaced equi-distantly about the cam and are all operating simultaneously to the same effect, there are no unbalanced fluid loads on the cam and, since both sides of the rockers are exposed to the same pressures, Figs. 2 and 4, the rockers operate in a balanced state and hence freely and smoothly. The arcuate valve seats with which the rockers cooperate serve in effect also as guides and thus to an extent aid in the smooth quiet operation of the machine.

The invention is of broad scope as will be appreciated from the claims following and the terms employed have been used in a descriptive rather than in a limiting sense, except possibly for limitations that may be imposed by the state of the prior art.

What is claimed is:

1. A machine of the character disclosed, comprising a lobed impeller, hollow faced rockers having their opposite sides in sealing engagement with said lobed impeller and provided with passages through from back to front of the same, a housing enclosing said impeller and rockers and providing with the impeller and rockers a variable displacement chamber for each rocker and variable displacement chambers between the rockers, said housing having admission and exhaust valve ports at opposite sides of the rockers and valving elements on the rockers and cooperatively related to said ports to alternately place the same in communication with the rocker chambers and with said chambers between the rockers.

2. A machine of the character disclosed, comprising a lobed impeller, hollow faced rockers having their opposite sides in sealing engagement with said lobed impeller and provided with passages through from back to front of the same, a housing enclosing said impeller and rockers and providing with the impeller and rockers a variable displacement chamber for each rocker and variable displacement chambers between the rockers, said housing having admission and exhaust valve ports at opposite sides of the rockers, valving elements on the rockers and cooperatively related to said ports to alternately place the same in communication with the rocker chambers and with said chambers between the rockers and manifolding passages for the admission and exhaust ports respectively in the opposite end portions of the housing.

3. A machine of the character disclosed, comprising a lobed impeller, hollow faced rockers having their opposite sides in sealing engagement with said lobed impeller and provided with passages through from back to front of the same, a housing enclosing said impeller and rockers and providing with the impeller and rockers a variable displacement chamber for each rocker and variable displacement chambers between the rockers, said housing having admission and exhaust valve ports at opposite sides of the rockers, valving elements on the rockers and cooperatively related to said ports to alternately place the same in communication with the rocker chambers and with said chambers between the rockers and said valving mechanism including convergently disposed valve seats between the rockers through which the ports enter and cooperating arcuate valve faces on the sides of the rockers.

4. A machine of the character disclosed, comprising a lobed impeller, hollow faced rockers having their opposite sides in sealing engagement with said lobed impeller and provided with passages through from back to front of the same, a housing enclosing said impeller and rockers and providing with the impeller and rockers a variable displacement chamber for each rocker and variable displacement chambers between the rockers, said housing having admission and exhaust valve ports at opposite sides of the rockers, valving elements on the rockers and cooperatively related to said ports to alternately place the same in communication with the rocker chambers and with said chambers between the rockers, said housing consisting of complemental parts with chambers in the end portions of the same manifolding the admission and exhaust ports respectively.

5. A machine of the character disclosed, comprising duplicate casing sections meeting to form a working chamber and each having a manifolding chamber outside said working chamber, said sections being ported through from said manifolding chambers to said working chamber for admission and outlet purposes and having alternate passages and blank walls in the manifolding chambers which are staggered when the sections are assembled to place one manifolding chamber in communication only with admission ports and the other manifolding chamber in communication only with outlet ports, a lobed member journalled in the casing sections and operating in the working chamber, a hollow faced rocker journalled to operate in the working chamber and having sealing engagement with the lobed member at opposite sides of the hollow therein, said rocker further having valve faces and companion ported valve seats in the working chamber in communication with the admission and outlet ports of the casing sections.

6. In a machine of the character disclosed, companion casing sections defining a working chamber therebetween and provided with passages cooperating when the sections are assembled to provide admission and exhaust passages for the working chamber, stationary partition members of yielding material secured in the working chamber between the casing sections and provided with ports in register with the passages of the casing sections, said compressible partition members having reinforcements holding same to shape under compression, a lobed member operating in the working chamber and rocker means cooperating with said lobed member and with said ported partitions.

7. A machine of the character disclosed, comprising in combination, a lobed rotor, chambered rockers cooperating therewith, a housing enclosing said rotor and rockers and having inlet and outlet ports opening to the chambers within the rockers and to spaces between the rockers, valving elements on the rockers and cooperating with said ports to simultaneously establish flow to all the rocker chambers and from all the spaces between the rockers and then simultaneously establish flow from all said rocker chambers and to all said spaces between the rockers.

8. A machine of the character disclosed, comprising a lobed rotor, a hollow faced rocker having opposite sides in sealing engagement with said lobed rotor, a housing enclosing said rotor and rocker and providing with the rotor and rocker a variable displacement chamber between rotor and rocker and a variable displacement chamber in the housing at one side of and outside the rocker, said housing having admission and exhaust valve ports at opposite sides of the rocker and controlled thereby and means operating in the combined movements of rotor and rocker to alternately establish communication of said valve ports with said variable displacement chambers within and without the hollow faced rocker.

9. A machine of the character disclosed, comprising a lobed impeller, a hollow faced rocker having opposite sides of the hollow therein in sealing engagement with said lobed impeller and provided with a passage through from the back to the front of the same, a housing enclosing said impeller and rocker and providing with the impeller and rocker variable displacement chambers within and without the rocker, said housing having admission and exhaust valve ports at opposite sides of the rocker and valving elements on the rocker cooperatively related to said ports to alternately place the same in communication with the variable displacement chambers within and without the rocker.

10. A machine of the character disclosed, comprising in combination, a lobed rotor, a chambered rocker cooperating therewith, a housing enclosing said rotor and rocker and having inlet and outlet ports opening to the chamber within the rocker and to a space outside the rocker and valving elements on the rocker and cooperating with said ports to alternately establish communication with said rocker chamber and with said space in the housing outside the rocker.

11. A machine of the character disclosed, comprising a lobed rotor, a hollow faced rocker having opposite sides in sealing engagement with said lobed rotor, a housing enclosing said rotor and rocker and providing with said rotor and rocker a variable displacement chamber between rotor and rocker and a variable displacement chamber in the housing outside said rocker, said housing having admission and exhaust valve ports at opposite sides of the rocker and said rocker having means for alternately placing said displacement chambers within and without the rocker in communication with said valve ports.

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