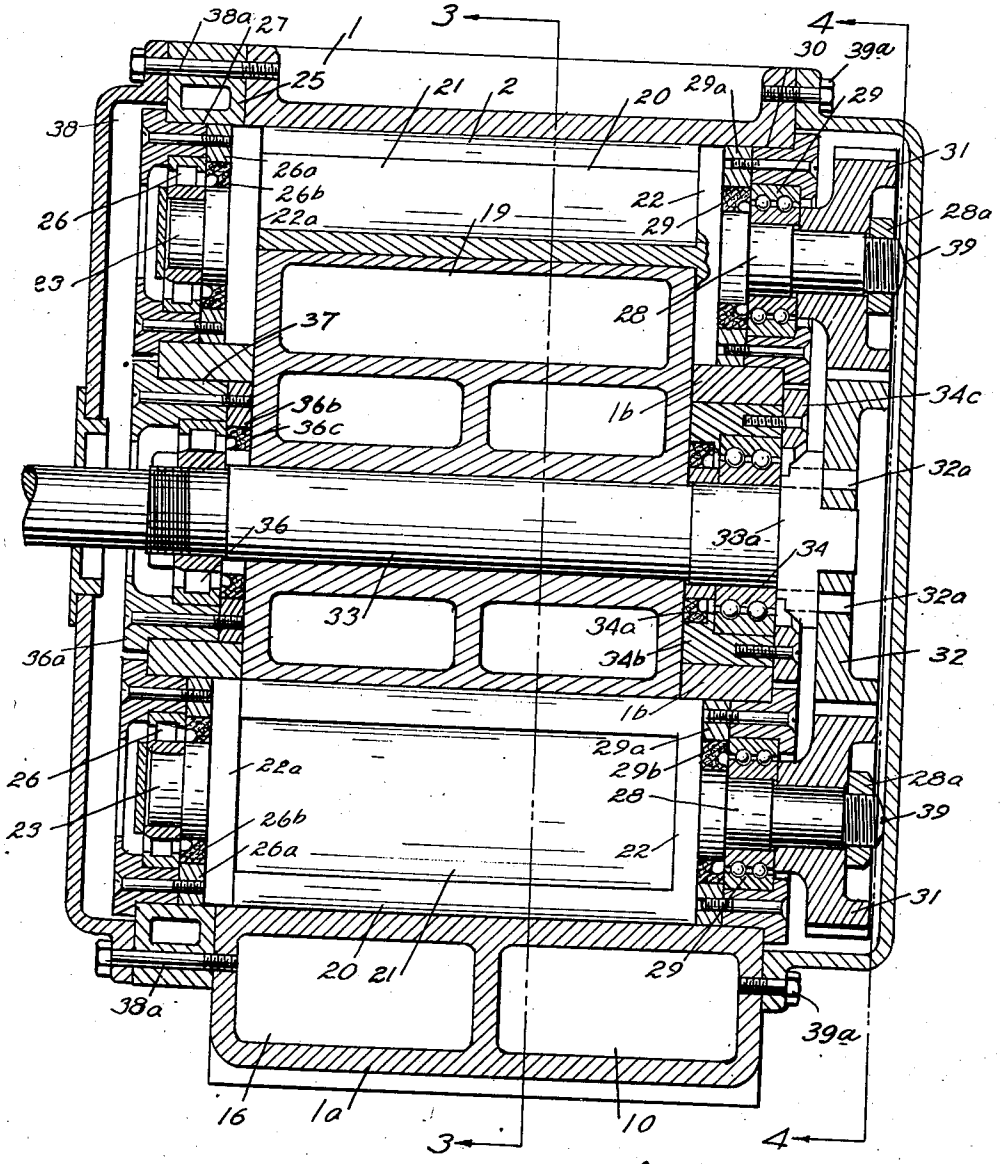
Nov. 21, 1939. J. E. WHITFIELD 2,180,378

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FIG. 1.



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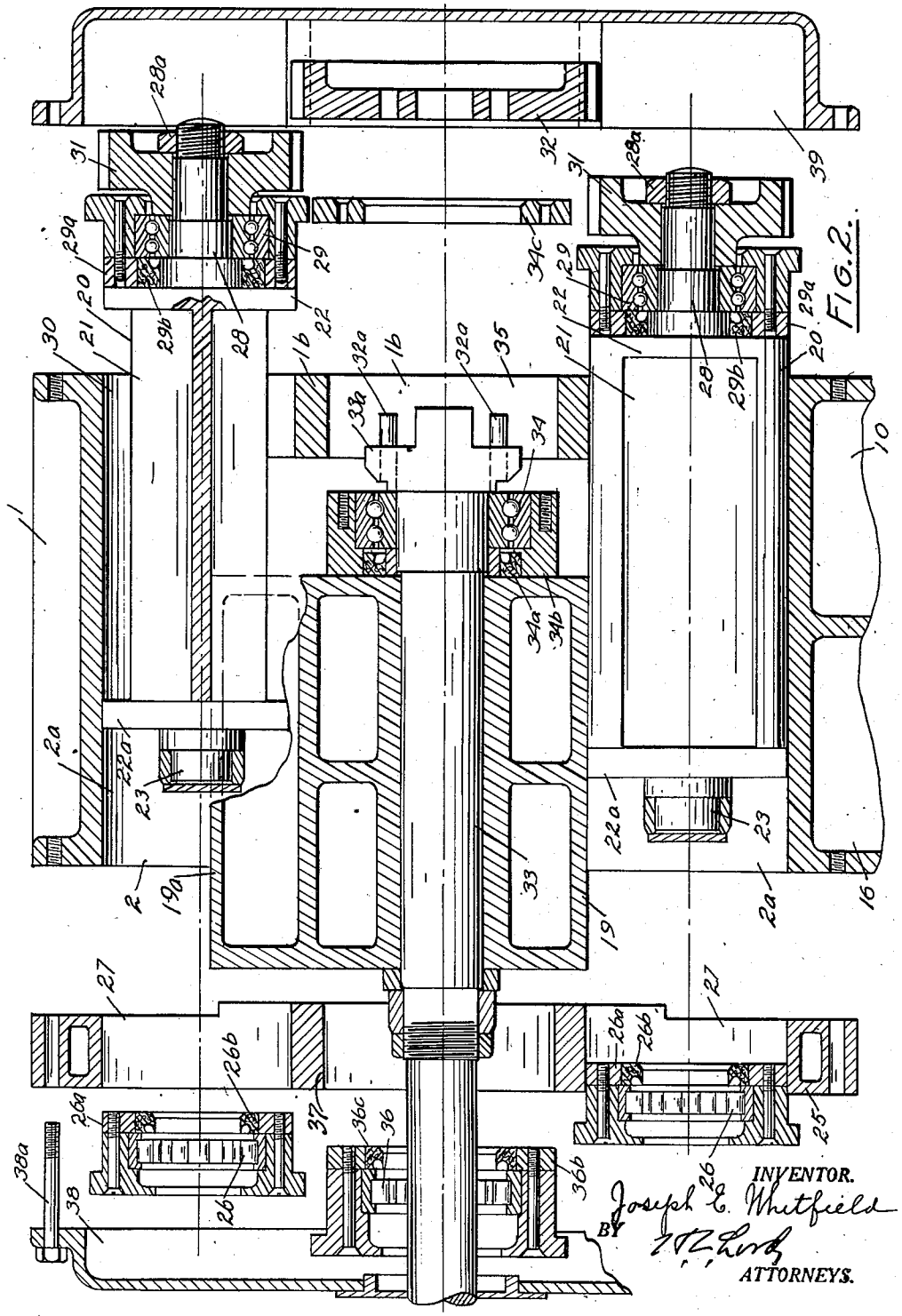


FIG. 2.

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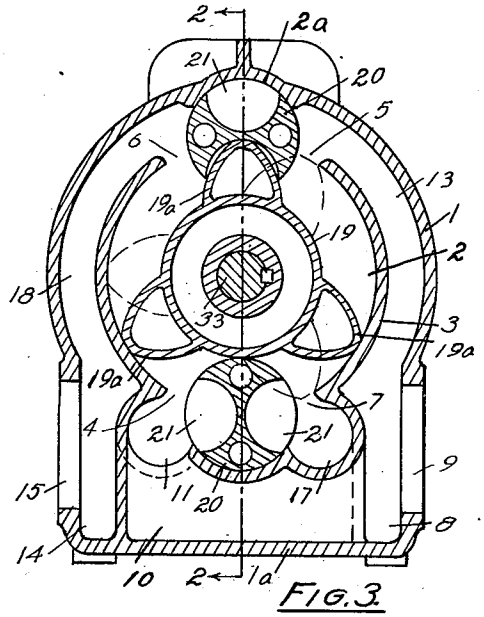


FIG. 3.

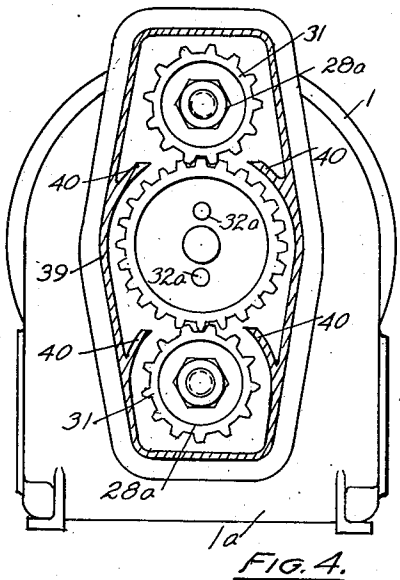


FIG. 4.

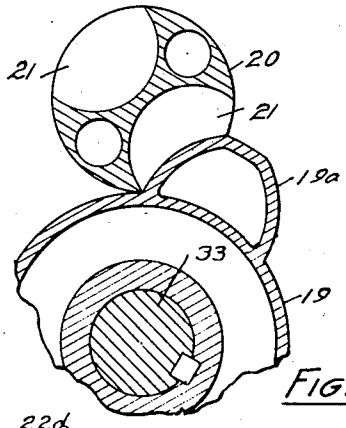


FIG. 5.

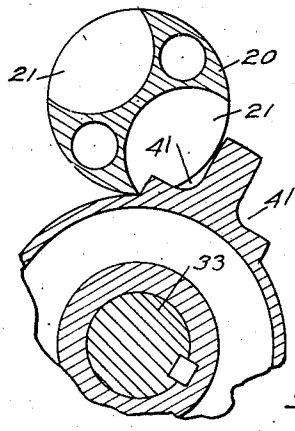


FIG. 6.

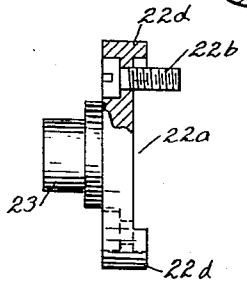


FIG. 7.

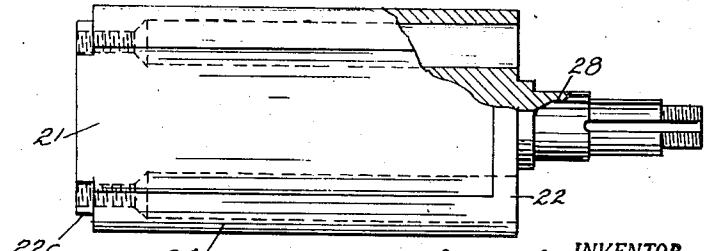


FIG. 8.

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UNITED STATES PATENT OFFICE

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PUMP

Joseph E. Whitfield, Grove City, Pa.

Application January 29, 1938, Serial No. 187,691

7 Claims. (Cl. 103—125)

Pumps have been made including a case and rotor in the case and rotating gates operating with relation to the rotor to draw in and discharge fluid as the rotor and gates rotate. Most of such structures provide an inlet or discharge through the rotor. The present invention is designed to avoid the objections incident to using the rotor as a passage for fluid, and provides a structure in which the ports leading to the space swept by the rotor are entirely in the case, thus making a cheaper form of rotor, obviating the objections of carrying the port passages past the bearings and placing the ports at a more advantageous position for efficient operation.

In forming the pump the rotor is preferably provided with three driving abutments operating through two gates, the gates being provided with opposing grooves for receiving and passing the abutment. The three abutments operating through two gates gives a continuous discharge and intake which greatly reduces noise and provides a more efficient flow through the apparatus. By making the number of abutments greater than the number of gates, the gates may be made larger and consequently may be provided with deeper receiving grooves and this permits of the use of abutments of greater radial dimensions, and as the gates must close on the rotor and the outer edges of the abutments sweep the wall of the chamber, the greater dimension of abutment permits of a greater radial depth of chamber and consequently an apparatus of greater capacity with the same size of machine. Thus in the present invention there is given a continuity of movement of fluid with a very great capacity for a given size of apparatus. While the structure is particularly desirable as an air blower a variation of the device may be used for moving liquids. One of the desirable features of the invention is the structure which permits of unit assemblies of the valve mechanism and the rotor in the case. This is desirable not only by way of servicing but in the ease of original assembly. Features and details of the invention will appear from the specification and claims.

A preferred embodiment of the invention is illustrated in the accompanying drawings as follows:

Fig. 1 shows a central vertical section through the rotor on the line 2—2 in Fig. 3.

Fig. 2 is a similar section enlarged and with the parts partly assembled.

Fig. 3 is a section on the line 3—3 in Fig. 1.

Fig. 4 is a section on the line 4—4 in Fig. 1.

Fig. 5 an enlarged view of a gate and portion of a rotor showing the valve closing surfaces and rotor abutment.

Fig. 6 a similar view but with a variation of abutment adapting the device to pumping liquids.

Fig. 7 a detached view, partly in section, of a valve flanged end.

Fig. 8 an enlarged elevation, partly in section, of a valve.

All figures except Figure 6 exemplify the invention as a blower.

A case 1 has a compression or working chamber 2 with a peripheral wall 3. This peripheral wall has the inlet ports 4 and 5 and the discharge ports 6 and 7. The case is provided with a base 1*a* and contains the inlet and outlet from the blower. By varying the porting or passages in the base these may be shifted to satisfy whatever conditions may be required. The base has the inlet chamber 8 with an inlet opening 9. The chamber 8 has a passage 10 which communicates with a passage 11 in the case. The passages 10 and 11 have parts of these passages extending only half way across the blower from front to rear. The passage 11 communicates with the port 4 and through a passage 13 in the case communicates with the port 5. The chamber 8 as to the passage 13 has direct communication with the passage 13. The base also has the discharge chamber 14 which has the discharge opening 15. It communicates with the passage 18. The passage 18 leads from the port 6. The passage 16 and the passage 17 lead from the port 7. The passage 16 extends half way from front to rear, a partition dividing it from the passage 10. The passage 17 extends from front to rear in the portion adjacent to the port 7. These passages 16 and 17 form a direct connection between the chamber 14 and the port 7.

A rotor 19 is arranged in the chamber 2 and has abutments 19*a* which form a closure with the peripheral surfaces 3*a* of the chamber. These abutments pass the gates 20 which gates rotate in gate chambers 2*a* in the case, the gates being adjacent to the ports, in fact separating the inlet and outlet ports 5 and 6, and 4 and 7 respectively. The gates have the grooves 21 which are adapted to receive the abutments 19*a* and are rotated so as to permit the passage of the abutments past the gate, the grooves and abutments continuing a closure of the abutment as it passes through the gate.

Preferably the rotors are provided with three abutments as shown, and two grooves 21 are preferably provided in the gates. As heretofore

indicated, this provides a continuous inflow and outflow of fluid. There is a discharge from one or the other of the chambers at all times and an intake to one or the other chamber at all times. The grooves of the gates are of a depth making the bottom walls of the groove closely adjacent, consequently giving the greatest possible dimension to the abutments. It will be understood that the pitch line of the driving gears (hereinafter described) corresponds to the rolling surfaces of the rotor and the gates. By making the abutments of greater dimension, the depth of the chambers is made greater, and consequenty the capacity of the apparatus is increased, it being understood that a full volume of the annular chamber is swept and discharged by each abutment with each rotation of the rotor.

Each gate has an annular flange **22** at each end. As shown, one flange is formed in a detachable end **22***a* for convenience of machining, this being secured to the valve by screws **22***b*. The end of the valve has the cut-away portion **22***c* to receive projections **22***d* on the detachable end. A trunnion **23** extends from the detachable end of the gate into a roller bearing assembly **26** which is mounted in an opening **27** formed in a closure plate **25**. This assembly includes a seal ring **26***a* in which a seal **26***b* is arranged. The opposite end of the gate has a trunnion **28** which extends into a ball bearing assembly **29**, the assembly including a ring **29***a* having a seal **29***b*. This assembly is inserted into openings **30** in the side wall of the case **1**. A gear **31** is fixed on the trunnion **28** secured by a nut **28***a* and meshes with a gear **32**. The gear **32** is fixed on a shaft **33** on which the rotor is mounted. It is locked by pins **32***a* which extend through the gear into a flange **33***a* on the shaft **33**. The shaft **33** is mounted at the closed end of the case in a ball bearing assembly **34**. The ball bearing assembly is inserted into an opening **35** in the side wall **1***b* of the case. The assembly includes a seal **34***a* in a seal ring **34***b*. The ring **34***b* abuts a removable ring **34***c* secured to the side wall of the case and overlapping the ring **34***b*. The opposite end of the shaft extends into a roller bearing assembly **36** which assembly is carried by a ring **36***a* which ring is inserted into an opening **37** in the closure plate **25**. A seal **36***b* is also arranged in the opening and carries a seal **36***c*, the seal ring being secured to the ring **36***a*. The gears **31** and **32** have a two to three ratio so that the gates make three revolutions to two of the rotor.

A cover plate **38** is provided over the closing ring **25** and screws **38***a* extend through the cover plate and the ring **25** into the case. A cover plate **39** covers the gears and is secured to the case by screws **39***a*. Shields **40** are provided in the plate **39** encircling the gear **32**. This assures the return of the lubricant thrown off by the gears to the gears when the blower is running at high speed.

It will be noted that the rotor bores and the gate bores may be readily fabricated and the case may be arranged to receive the bearings at one end of the gates and the rotor. The gates with the bearings and the gear at one end may be completely assembled and the trunnions at the opposite end will pass into the rollers at the left end of the gate cavity (see Fig. 2) so that this entire gate assembly may be readily withdrawn and replaced. In like manner the entire rotor with the abutments may be withdrawn toward the left when the closure plate **25** is removed. In reassembling the securing of the gear **32** to the flange **33***a* locks the parts together. While in Fig. 2 the roller bearings at the left are shown as detached from the closure plate it is not necessary to withdraw these rings from their openings when the closure plate is removed in that the roller bearings will stay in place in their cages and receive the trunnions. Likewise the plate **34***c* which is shown removed need not be removed from the case as the rotor is withdrawn. The ball bearings at one end lock the rotor and gates against end movement.

The flanges **22** on the gates make a closure at the ends of the gates more certain. Where the device is arranged as a blower with the abutment and gate having the curve shown in Fig. 5 the closure surfaces of the abutment follow along the gate and provide plural closure lines throughout portions of the movement. There is, however, a slight trapping, or compressure of air in this movement which prevents the use of this more desirable closure for air being also used for liquid. In order to give the proper clearance for liquid the abutment has spaces **41** which give the proper clearance for the liquid.

It will be noted that the tips of adjacent abutments just span the distance between two ports so as to give the greatest capacity. The three abutment structure readily lends itself as to this, particularly with valves of proper size, the valve spaces equalling each one half of this space between the abutments. The load is carried entirely by the rotor so that there is no particular load on the gears, the gears simply timing the valves or gates. By placing the ports in the peripheral surfaces rather than through the gates, or through the rotor, large capacities can be given so that the heat may be readily dissipated and the port losses may be very much reduced. By utilizing the three abutments with two gates the largest capacity with few parts is attained. By arranging the trunnions directly on the ends of the gates the gate grooves may be carried very close together, thus permitting of large radial dimensions of abutments and, therefore, greater capacity.

This application is in part a continuation of my application, Serial Number 130,040.

What I claim as new is:

1. In an apparatus of the character described, the combination of a case having a base; a rotor chamber with an outer cylindrical chamber wall; a rotor mounted in the chamber, the rotor being spaced from the walls of the chamber forming an enclosed space; three driving abutments on the rotor closing and sweeping the walls of the chamber; two rotating gates across the space, one at the top and one at the bottom, said gates by their rotation passing the abutments past the gates, the peripheral chamber walls being provided with a pair of ports for each gate, said ports accommodating the major portion of the fluid passing through the apparatus; an inlet and a discharge passage leading to and from the upper ports from the base along the outer peripheral of the cylindrical wall; the passages extending axially over the major portion of said wall and a cross inlet and discharge passage connecting the inlet and discharge ports at the bottom with the inlet and discharge passages respectively.

2. In a device of the character described, the combination of a case comprising rotor and gate bores; a rotor in the rotor bore spaced from the walls thereof, said rotor having a driving abutment sweeping and closing the space; a bearing for the rotor; a gate in the gate bore having a

groove receiving and passing the abutment through the gate; a bearing for the gate; means carrying the bearing for the rotor; and gears maintaining the timing of the rotor and gate, said rotor and its bearing forming an assembly unit so related to the rotor bore as to permit the removal of the rotor and its bearing as a unit from the case without removal of the gate and its bearing.

3. In a device of the character described, the combination of a case comprising rotor and gate bores; a rotor in the rotor bore spaced from the walls thereof, said rotor having a driving abutment sweeping and closing the space; a bearing for the rotor; a gate in the gate bore having a groove receiving and passing the abutment through the gate; a bearing for the gate; means carrying the bearings for the rotor; and gears maintaining the timing of the rotor and gate, said rotor and its bearing forming an assembly unit so related to the rotor bore as to permit the assembly and removal of the rotor and its bearing as a unit from the case independently of the presence or absence of the gate and its bearing in the assembly.

4. In a device of the character described, the combination of a case comprising a cylindrical rotor bore and a cylindrical gate bore; a rotor in the rotor bore spaced from the walls thereof, said rotor having a driving abutment sweeping and closing the space; a gate in the gate bore having a groove receiving and passing the abutment through the gate; a bearing for the gate; means carrying the bearing; gears maintaining the timing of the rotor and gate, said gate, bearing and carrying means forming an assembly unit so related to the gate bore as to permit the assembly of the gate, bearing for the gate and carrying means to be assembled as a unit within the case; and a bearing for the rotor, said rotor and its bearing being related to the case to permit the removal of the rotor and its bearing as a unit from the case, the two units being independently removable in any sequence.

5. In a device of the character described, the combination of a case comprising a rotor bore and a gate bore; a rotor in the rotor bore spaced from the walls thereof, said rotor having a driving abutment sweeping and closing the space; a gate in the gate bore having a groove receiving and passing the abutment through the gate; a bearing for the gate; means carrying the bearing; gears maintaining the timing of the rotor and gate, said gate, bearing, carrying means and gear forming an assembly unit so related to the gate bore as to permit the assembly of the gate, bearing for the gate, carrying means and gear to be assembled as a unit within the case; and a bearing for the rotor, said rotor and its bearing being so related to the case as to permit the assembly and removal of the rotor and its bearing as a unit with respect to the case, the two units being capable of independent removal and assembly in any sequence.

6. In a device of the character described, the combination of a case having a rotor chamber with an outer cylindrical peripheral wall provided with a plurality of pairs of inlet and outlet ports; a rotor mounted in the chamber, the rotor being spaced from the cylindrical walls of the chamber forming an enclosed space; a plurality of driving abutments on the rotor closing and sweeping the walls of the chamber; a plurality of rotating gates across the space, said gates having opposed abutment passing grooves of a depth approximating the radii of the gates, said grooves being formed with relation to the abutments to pass the abutments through the gates and to make a substantial closure with the abutments during the pass, the number of abutments being greater than the number of gates but not a multiple thereof; and means driving the rotor and gates in timed relation, the inlet and outlet ports being adjacent to the sides of the gates, each gate defining one side of an exhaust port and an inlet port, said ports extending through the major portion of the width of the chamber and the pairs of ports opening to the same space between gates being spaced apart a greater distance than the outer faces of the adjacent abutments, and substantially the entire flow of fluid through the device passing through said ports.

7. In a device of the character described, the combination of a case having a rotor chamber with an outer cylindrical peripheral wall provided with two pairs of inlet and outlet ports; a rotor mounted in the chamber, the rotor being spaced from the cylindrical walls of the chamber forming an enclosed space; three driving abutments on the rotor closing and sweeping the walls of the chamber; two rotating gates across the space, said gates having opposed abutment passing grooves of a depth approximating the radii of the gates, said grooves being formed with relation to the abutments to pass the abutments through the gates and to make a substantial closure with the abutments during the pass; and means driving the rotor and gates in timed relation, the inlet and outlet ports being adjacent to the sides of the gates, each gate defining one side of an exhaust port and an inlet port, said ports extending through the major portion of the width of the chamber and the pairs of ports opening to the same space between gates being spaced apart a greater distance than the outer faces of the adjacent abutments, and substantially the entire flow of fluid through the device passing through said ports.

JOSEPH E. WHITFIELD.