

[54] **APPARATUS FOR CONVERTING HYDRAULIC OR PNEUMATIC ENERGY INTO KINETIC ENERGY OR VICE VERSA, SUCH AS A ROTARY MULTICHAMBER VANE-TYPE MOTOR OR PUMPS**

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3,251,308	5/1966	Dugan	418/175 X
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[51] Int. Cl.....**F01c 1/00**

[58] Field of Search.....418/71, 175, 249, 251, 186, 418/268

[56] **References Cited**

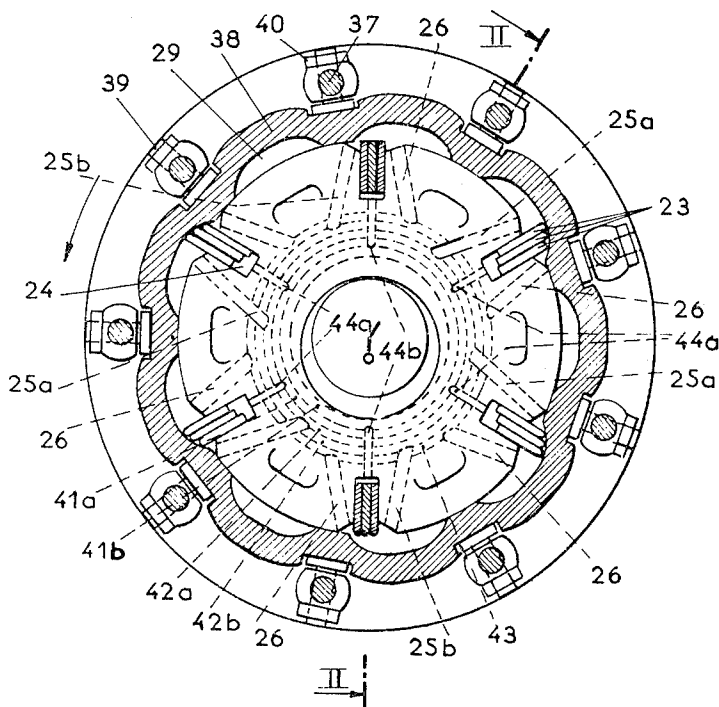
**UNITED STATES PATENTS**

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[57] **ABSTRACT**

Apparatus for converting hydraulic or pneumatic energy into kinetic energy and vice versa. An inner element carrying sliding vanes is mounted in an outer element defining a plurality of recesses defining variable-volume chambers with the easier element and the vanes. The elements are relatively rotatable. Inlet and outlet conduits are provided in the inner element on each side of each vane. Means including a distributor valve put independent groups of said inlet and for outlet conduits in communication with a high-pressure fluid source or a low-pressure fluid source. Means connect the housings to a source of fluid under pressure.

**21 Claims, 10 Drawing Figures**



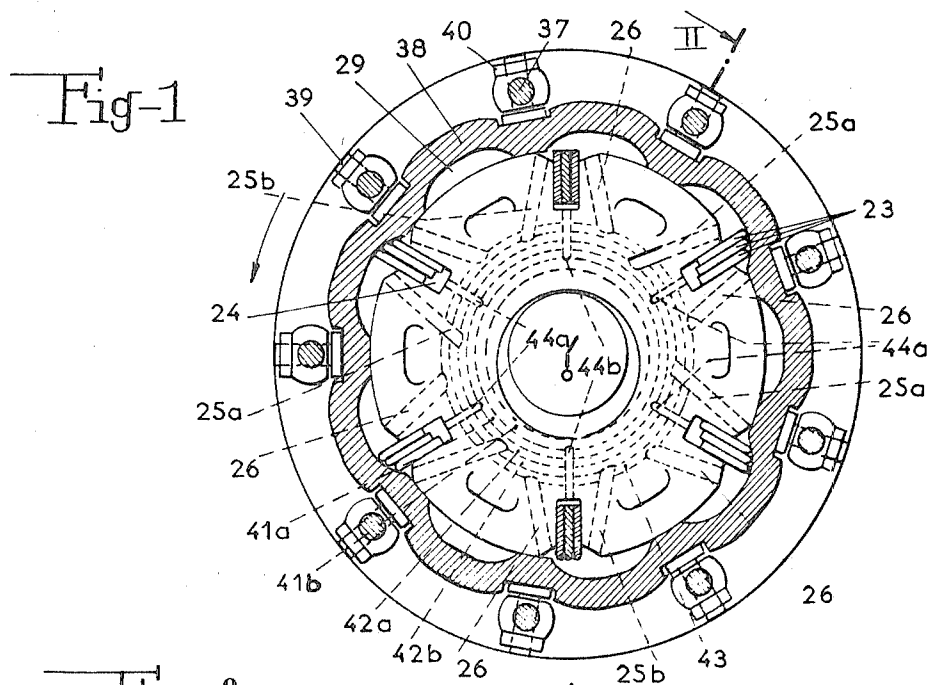


Fig-3

Fig-4

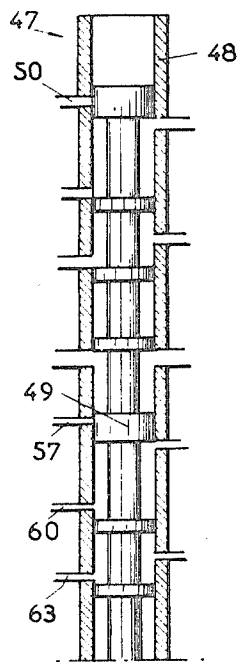
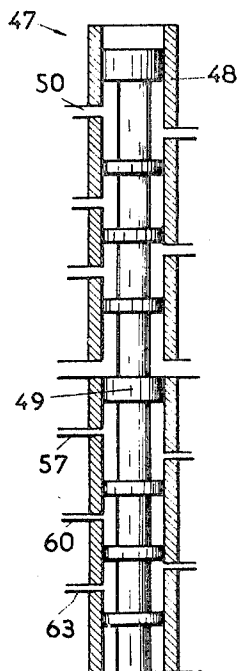
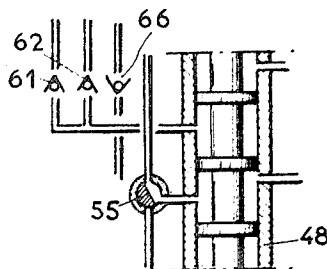


Fig-5



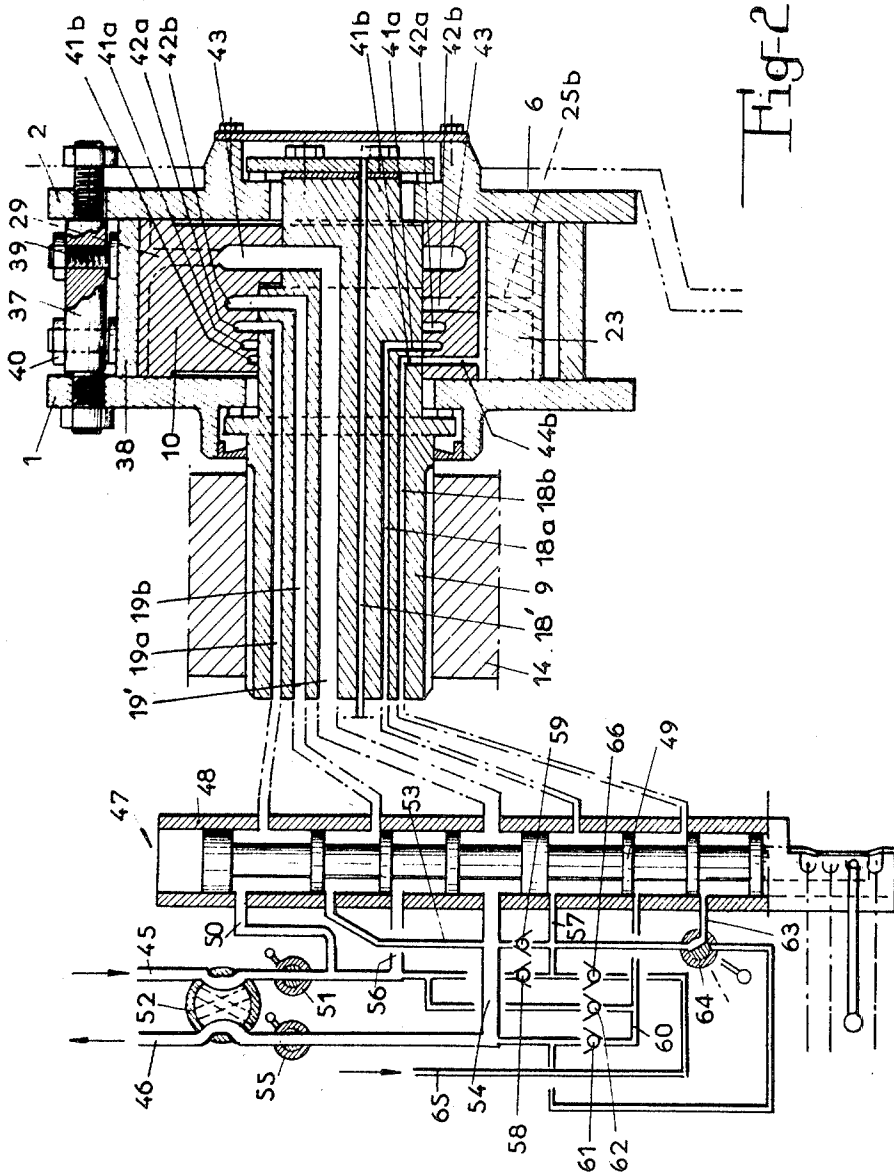
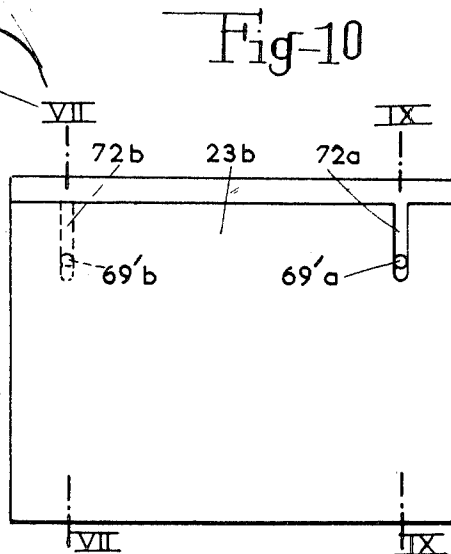
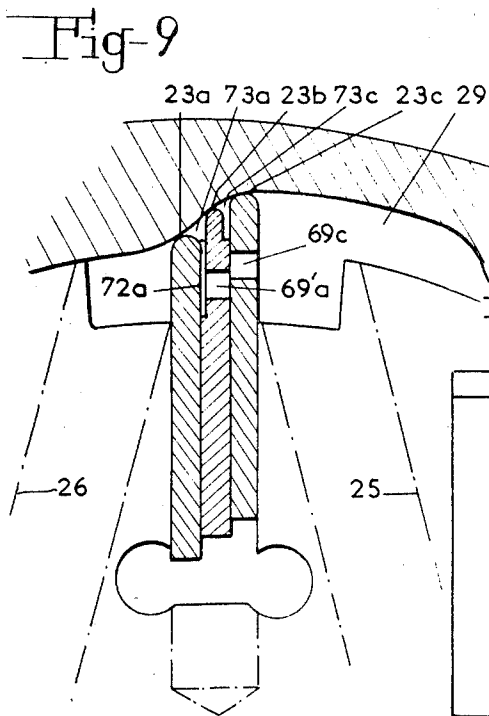
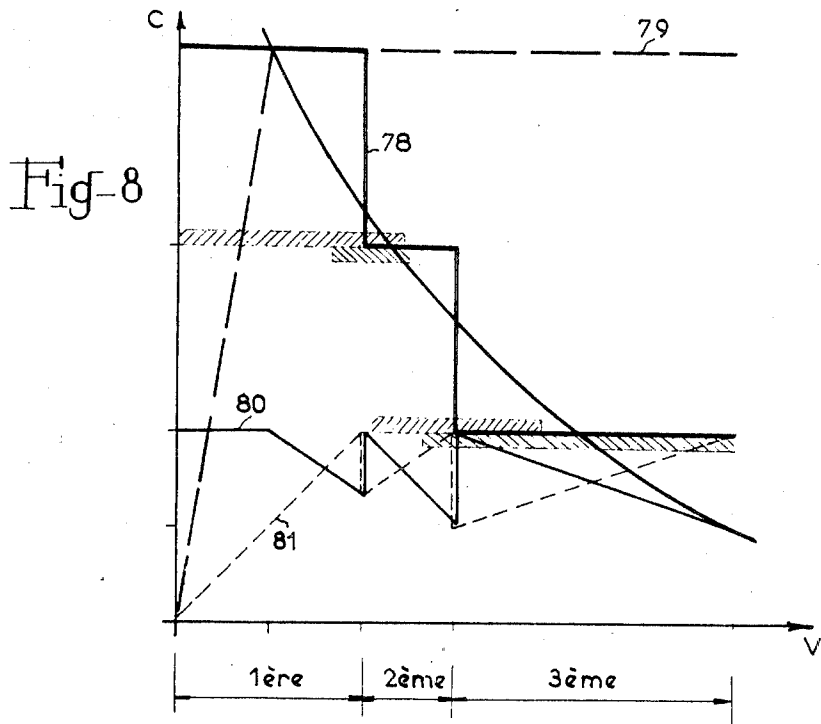


Fig. 2





**APPARATUS FOR CONVERTING HYDRAULIC OR PNEUMATIC ENERGY INTO KINETIC ENERGY OR VICE VERSA, SUCH AS A ROTARY MULTICHAMBER VANE-TYPE MOTOR OR PUMPS**

The invention relates to converter devices designed to convert hydraulic or pneumatic energy into kinetic energy, or vice versa, of the type comprising a rotor and a stator and in which the inner wall of the outer element has at least two recesses capable of forming variable-volume chambers in cooperation with the outer wall of the inner element and vanes carried by the inner element, the inner element comprising at least two vanes slidable in housings and cooperating with the wall of said recesses, a fluid inlet conduit and a fluid outlet conduit being provided in the inner element respectively one side and on the other of each vane, the number of vanes being different from the number of recesses, said recesses embracing an arc of a circle whose angular extent is less than the angle between the edge of the inlet or outlet conduit pertaining to one vane and the nearest edge of the outlet or inlet conduit pertaining to the neighboring vane and the housings of the inner element being connected to a source of fluid under pressure adapted to apply the vanes against the inner wall of the outer element.

Devices of this type are described, in particular, in U.S. Pats. Nos. 2,730,076 (Hogue) and 2,992,616 (Rineer). For given dimensions of their components, these known devices afford only a single torque and speed at constant fluid pressure and flow.

Rotary hydraulic motors or pumps have also been described, in particular, in German Pats. Nos. 733,050 (Calzoni), 1,215,532 (Hartmann Manufacturing Co.), in which a distributor valve is provided to put a variable number of work chambers in communication with the high-pressure fluid source and thus vary the speed or change the direction of rotation.

These variable-speed converters are, however, very different from the type defined hereinbefore and are incapable of affording a relatively high number of speeds with low fatigue of the parts, high efficiency, and regular vibration-free operation.

The object of the invention is to provide a converter of the type defined hereinbefore with which it is possible to vary the torque and the speed of the rotor inversely and reverse the direction of rotation, the converter having a much simpler structure than that of known, multispeed motors or pumps and affording all the aforementioned advantages.

According to the invention, the various inlet conduits of the inner element and/or the various outlet conduits are divided into at least two independent groups which are connectable to a high-pressure fluid source (inlet in the case of a motor and outlet in the case of a brake or pump) and to a low-pressure fluid source (inlet in the case of a brake or pump and outlet in the case of a motor) through a distributor valve whereby each of the groups of conduits can be put independently in communication with the high-pressure fluid source or with the low-pressure fluid source.

When the inlet and outlet conduits of a given vane are both connected by the valve to the same high-pressure or low-pressure fluid source and the pressure of the fluid exerting the thrust on the vanes is sufficiently low, the vane does not emerge from its housing and is therefore inoperative. The total hydraulic thrust area decreases and consequently the torque exerted on the rotor decreases and, at a constant power, the speed increases. The apparatus therefore also acts as a gear box.

When the inlet and outlet pressures  $P_a$  and  $P_e$  are both equal to the pressure  $P_c$  prevailing in the vane housing, it will be understood that the vane is in equilibrium and, in fact, inoperative.

Thus a vane may be rendered inoperative by placing its inlet and outlet conduits in communication with the high-pressure source, if the pressure in the housing has a value not exceeding

the value of the pressure. It is then merely necessary to put one of the outlet or inlet conduits in communication with the low-pressure with no need to change the pressure  $P_c$ , to render the vane operative and cause the apparatus to operate as a pump or motor, as the case may be.

To ensure that the vane is placed in the inoperative position, it is also possible to reduce the pressure in the housing for this blade. According to one embodiment, the blade housings are also divided into at least two groups, in the same way as the inlet and/or outlet conduits of these vanes, and these groups are connected to a high-pressure source and a source of lower pressure, for example the low-pressure source, through a distributor valve whereby each of these groups of housings can be put independently in communication with either fluid source.

According to this embodiment, to render a vane inoperative, its inlet and outlet conduits are put in communication with the high-pressure source at the same time that its housing is put in communication with the low-pressure source. To render it operative, the pressure in the housing must be raised and made equal, for example, to the high pressure value, and one of the inlet or outlet conduits must be put in communication with the low-pressure source.

In another embodiment, a vane may be rendered inoperative by putting its inlet and outlet conduits in communication with the low-pressure source, if the pressure in the housing does not exceed that of the low-pressure source. But in this case to render the vane operative the pressure in the housing must be increased and made equal, for example, to the high-pressure value. Consequently, in this embodiment also, the vane housings must be divided into two groups, the distributor valve enabling each of these housing groups to be put independently in communication with the low-pressure source and with a higher-pressure source, for example with the high-pressure source.

To render a vane operative, one of its inlet and outlet conduits as well as its housing have merely to be put in communication with the high-pressure source.

If the two groups of inlet and/or outlet conduits do not have the same number of conduits, or if there are more than two independent groups, there are more than two possible speeds.

Thus, in an apparatus comprising six vanes in which the conduits are divided into two groups, one of which interconnects the conduits of two vanes and the other the conduits of four vanes, the following can be obtained:

- a maximum speed and minimum torque, with two operative vanes;
- an intermediate speed and torque, with four operative vanes;
- a minimum speed and maximum torque, with six operative vanes;

Likewise, with eight vanes divided into three groups, (four, two and two), four different speeds can be obtained. With 10 vanes divided into three groups (six, two and two), and with 12 vanes divided into three groups (six, four and two), five and six speeds can be obtained respectively.

If all the vanes are made inoperative, the apparatus operates as a free wheel. Further, the direction of rotation of the rotor is reversed by reversing the connections of the inlet and outlet conduits to the high- and low-pressure sources. Thus it is possible to obtain a motor with several rotational speeds in either direction. Lastly, the apparatus can act as a brake if the outlet is throttled, and as a locking device if this outlet is closed.

When the rotor is the outer element, it should rotate practically without clearance on the inner element. Indeed, leakage increases as the third power of clearance, so that the efficiency drops considerably if there is much clearance.

Bearing this in mind, the rotor can comprise two sidewalls interconnected by crossmembers, an independent ring which has a small cross section and a substantially constant thickness

and is interposed between the side walls, the profile of the ring having a corrugated shape so as to define recesses, and means comprising for example thrust screws or eccentrics carried by the crossmembers for exerting a thrust on the outer face of the ring between said recesses and thus reduce the inside diameter of the ring.

Each vane can consist of several adjoining plates with curved ends. It has been found that, in operation, fluid under high-pressure leaks from that part of the recesses connected to the inlet conduits into the chambers located between the curved ends of the plates and the inner wall of the outer element; fluid can also arrive in these chambers from the housings in which the vane plates are mounted. This fluid opposes correct application of the plates on the inner wall of the outer element and tends to render these plates inoperative.

To avoid this drawback, in the case of three vane plates, the center plate has on each face a recess in communication with an aperture extending through the plate, each assembly consisting of a recess and its aperture being in different planes and each end plate having an aperture facing the aperture of the center plate in communication with the recess on the face of this center plate in contact with the third plate.

With this arrangement, in the case of an odd number of plates, the chamber or chambers in which the recess or recesses open are put in communication with the low-pressure and the high-pressure on each side of the generatrix line of contact of each of these plates firmly applied against the inner wall of the rotor.

Further features and advantages of the invention will be apparent from the ensuing description with reference to the accompanying drawings.

In the drawings:

FIG. 1 is a cross-sectional view of a motor;

FIG. 2 is a sectional view taken along line II—II of FIG. 1 showing the distributor valve associated with the motor;

FIGS. 3 and 4 show two other positions of the distributor valve;

FIG. 5 is a detail sectional view of a modification;

FIG. 6 is a partial sectional view of a detail of a modification of the rotor;

FIG. 7 is a sectional view taken along line VII—VII of FIG. 10, of a detail of the motor having multiplate vanes;

FIG. 8 is a diagram illustrating the operation of the apparatus;

FIG. 9 is a sectional view taken along line IX—IX of FIG. 10, of a detail of the motor having multiplate vanes, and,

FIG. 10 is a side elevational view of the center plate of the multiplate vane shown in FIGS. 7 and 9.

In the embodiment shown in FIGS. 1 and 2, which comprises six vanes 23 and nine recesses 29, the outer element is the rotor. It comprises two sidewalls 1 and 2 which are interconnected by a series of crossmembers 37. Disposed within the latter is an independent ring 38 having a wall of small section and substantially constant thickness. This ring has a corrugated profile so as to define the recesses 29.

The cross members 37 are provided with thrust screws 39 which have a fine pitch and exert a thrust on the outer face of the ring 38 between the inner recesses 29, that is, in the hollows of the outer recesses. These screws are locked by locknuts 40.

By an adjustment of the screws, the inner profile of the ring can be modified so as to reduce the clearance between the rotor and the stator to a minimum in the regions between recesses 29.

An annular member 10, which constitutes the stator and is

disposed in ring 38, is movably mounted exactly on an eccentric part of a hub 9 which is concentric with the ring 38 so that it is prevented from rotating with respect to this hub. The stator 10 is interposed between walls 1 and 2. The hub 9 is fixed in a support element 14 and extends from the latter. The annular member 10 comprises, on its radially inner wall, five annular grooves, 41a and 41b, 42a and 42b and 43. Annular grooves 41a and 41b are in communication with conduits 18a and 18b bored in the hub 9 for the passage of a pressure fluid; the annular grooves 42a and 42b are in communication with conduits 19a and 19b normally for the inlet when the device operates as a motor. The annular groove 43 is in communication with a conduit 19' normally for the outlet when the device acts as a motor.

All the outlet conduits 26 are in communication with groove 43. On the other hand, the inlet conduits are divided into two groups 25a and 25b; conduits 25a, which are four in number, are in communication with groove 42a whereas the two other conduits 25b are in communication with groove 42b. Similarly, the pressure conduits supplying a pressure fluid to vane housings 24 are divided into two groups 44a and 44b; conduits 44a which correspond to the vane provided with the inlet conduits 25a, are in communication with groove 41a, whereas the two other conduits 44b are in communication with groove 41b.

Conduits 18a, 18b, 19a, 19b and 19' can be put in communication with a source 45 of high-pressure fluid at a pressure  $P_n$  or with a source 46 of low-pressure fluid at a pressure  $P_p$  through a distributor valve generally designated by reference numeral 47.

This distributor valve comprises a body 48 in which is slidably mounted a slide valve assembly 49 which may occupy any one of four successive positions. By suitably positioning the slide valve assembly, it is possible to:

close or cut off conduit 19a or put it in communication with a conduit 50 connected to the fluid sources through a throttling cock 51 and a reversing cock 52 or with a manifold 53 connected to the reversing cock 52 through a conduit 54 and throttling cock 55;

close conduit 19b or put it in communication with a conduit 56 connected to conduit 50 or with manifold 53;

close conduit 19' or put it in communication with conduit 54;

close conduit 18a or put it in communication with a manifold 57 which is connected to conduit 56 through a nonreturn valve 58 and to conduit 54 through a nonreturn valve 59, or with a manifold 60 which is connected to conduit 54 through a nonreturn valve 61 and to conduit 56 through a nonreturn valve 62. The nonreturn valves 58, 59 are so arranged as to allow circulation of the fluid when the pressure in manifold 57 is no more than that prevailing downstream of these valves, whereas valves 61 and 62 are so arranged as to allow circulation of the fluid when the pressure in manifold 60 is no less than that prevailing downstream of these valves;

close conduit 18b or put it in communication with manifold 60, or manifold 63. The latter can be put in communication with conduit 54 alone or with conduit 54 and manifold 57 through a three-way drain cock 64.

Reference numeral 65 designates a gorging circuit connected to manifold 57 through a nonreturn valve 66 which is so arranged as to allow circulation of the fluid, when the pressure downstream of the valve is lower than the gorging pressure.

The operation of the apparatus just described will be clear from the following table.

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TABLE

Distributor valve	Reverser	Throttle	Purge	Pressure in the conduits					Number of operative vanes	Operation of the apparatus
A..... Position I.....	Normal.....	Open.....	Normal.....	$P_e$	$P_a$	$P_a$	$P_a$	$P_a$	6	Motor forward first speed.
B..... Position II.....	do.....	do.....	do.....	$P_e$	$P_a$	$P_e$	$P_a$	$P_e$	4	Motor forward second speed.
C..... Position III.....	do.....	do.....	do.....	$P_e$	$P_e$	$P_a$	$P_e$	$P_a$	2	Motor forward third speed.
D..... Position I.....	Reversed.....	do.....	do.....	$P_a$	$P_e$	$P_e$	$P_a$	$P_a$	6	Motor reverse first speed.
E..... Position II.....	do.....	do.....	do.....	$P_a$	$P_e$	$P_a$	$P_e$	$P_a$	4	Motor reverse second speed.
F..... Position III.....	do.....	do.....	do.....	$P_a$	$P_e$	$P_e$	$P_a$	$P_a$	2	Motor reverse third speed.
G..... Position I.....	do.....	Throttle.....	do.....	$P_a \rightarrow P_e$	$P_e \rightarrow P_a$	$P_e \rightarrow P_a$	$P_a$	$P_a$	6	Motor reverse braked.
H..... do.....	do.....	Closed.....	do.....	$d^o$	$d^o$	$d^o$	$d^o$	$d^o$	6	Motor reverse locked.
I..... do.....	Normal or reversed.....	Open.....	Reverse.....	$P_e$	$P_e$	$P_e$	$P_e$	$P_e$	0	Freewheel motor.
J..... do.....	Normal.....	Throttle.....	Normal.....	$P_e \rightarrow P_a$	$P_a \rightarrow P_e$	$P_a \rightarrow P_e$	$P_a$	$P_a$	6	Motor forward braked.
K..... do.....	do.....	Closed.....	do.....	$d^o$	$d^o$	$d^o$	$d^o$	$d^o$	6	Motor forward locked.

In this table,  $P_a$  is the high-pressure (feed),  $P_e$  the low-pressure (outlet). Position I of the distributor valve is that shown in FIG. 3; position II is that shown in FIG. 2 and position III is that shown in FIG. 4; in a position 0 (not shown) all the conduits are closed. The normal position of cock 52 is that shown in FIG. 2, its other position being the reverse position. The normal position of the purging cock is that shown in FIG. 2, its reverse position being that in which it puts manifold 63 in communication with conduit 54 and with manifold 57.

It is clear from the table that, when the motor is in forward operation, a vane is rendered inoperative (states B and C) by connecting the three conduits pertaining to that vane to the outlet or exhaust, whereas when the motor operates in reverse, it is rendered inoperative (states E and F) by connecting the associated inlet and outlet conduits to the high-pressure source and the housing 24 of the vane to the exhaust.

In states G and J, the motor is braked and is in first speed or gear, distributor valve 47 being in position I. It is also possible to brake in second or third speed, by bringing the distributor valve to position II or III, but the braking torque is then less.

Further, the apparatus can function as a pump; a table similar to the foregoing can be drawn up,  $P_e$  and  $P_a$  being simply interchanged in respect of conduits 44a and 44b.

The curve 78 shown in FIG. 8 shows the variation of the motor torque (as ordinates) as a function of rotor speed abscissal at different speeds. It can be seen that the power, which is represented by the curve 79, is constant. The variations of pressure and flow rate, respectively, are also shown at 80 and 81. These curves show that different fluid thrust sections produce different torques for a given pressure and a variation of speed for a given flow rate. The apparatus described hereinbefore can therefore be fed by a pump having a capacity which is a third of that of a conventional apparatus.

It should be noted that, in all the distributor valve positions described hereinbefore, when a blade is inoperative it does not contact the rotor wall (hence reducing wear) and no longer divides the recesses 29 into two chambers. The pressure  $P_e$  in the cavity behind the vane then does not exceed the pressure prevailing the corresponding recess 29. The inoperative vane is in equilibrium and produces no loss of hydraulic power.

FIG. 5 shows a modification in which the positions of valves 61 and 62 have been reversed. In this case, the vanes are rendered inoperative in reverse operation by putting the three conduits pertaining to a vane in communication with the high-pressure source (feed).

In the embodiment shown in FIG. 6, the thrust screws 39 have been replaced by eccentrics 67 integral with portions 68 which externally are shaped as hexagonal nuts. The clearance between the stator and ring 38 can thus be easily regulated by turning the eccentric 67 by means of a spanner engaged on portion 68.

FIGS. 7, 9 and 10 show a vane comprising three independent plates 23a, 23b and 23c.

The center plate 23b comprises, on one of its faces, a recess 72a which communicates with an aperture 69a, and, on its opposite face, a recess 72b which communicates with an aper-

ture 69b. As can be seen in FIG. 10, recess 72a and aperture 69a are provided at one of the ends of the plate and recess 72b and its aperture 69'b are provided at the opposite end of the plate.

Aperture 69'a faces aperture 69c of plate 23c; similarly, aperture 69'b faces aperture 69a of plate 23a.

In operation, the driving fluid leaks from that portion of chamber 29 under high pressure into the space or chamber 73c defined by the curved ends of plates 23b and 23c and rotor 38. This fluid can escape through recess 72b and apertures 69'b and 69a. Chamber 73c is then at low pressure and the plates are applied firmly against the inner face of recess 29.

When the functions of conduits 25 and 26 are reversed and the rotor rotates in the opposite direction, the fluid from chamber 73a escapes through the recess 72a and apertures 69'a and 69c.

Owing to this arrangement, the space or chamber 73c between plate 23b and plate 23c adjacent the part of recess 29 in communication with the inlet conduit 25, is in communication with the outlet, whereas chamber 73a between plate 23b and plate 23a is in communication with the inlet. Thus, the end of each of the plates is located between a space under high pressure and a space under low pressure.

Although specific embodiments of the invention have been described, many modifications and changes may be made therein without departing from the scope of the invention, as defined in the following claims.

I claim:

1. An apparatus for converting hydraulic or pneumatic energy into kinetic energy, or vice versa, comprising a rotor and stator, in which the internal wall of the external element has at least two recesses capable of forming, in cooperation with the external wall of the internal element and the vanes carried by this internal element, chambers with a variable volume, in which the internal element comprises at least two vanes sliding into housings and cooperating with the wall of said recesses, an inlet line and an exhaust line for fluid being provided in the internal element respectively on either side of each vane, the number of vanes being different from that of the recesses, these recesses embracing an arc of a circle which extends over an angle which is smaller than that existing between the edge of the inlet or exhaust line relative to a vane and the edge which is nearest to the exhaust or inlet line relative to the neighboring vane, and in which the housings of the internal element are connected to a source of fluid under pressure resulting in the application of the vanes against the internal wall of the external element, said apparatus being characterized in that the different inlet lines of the internal element and/or its different exhaust lines are subdivided into at least two independent groups which are connected to a high-pressure fluid source (inlet in the case of the motor and exhaust in the case of the brake or pump and exhaust in the case of the motor) through a distributor valve making it possible to independently put in communication each of the groups of lines with the high-pressure fluid source or with the flow pressure fluid source.

2. An apparatus according to claim 1, wherein the distributor valve is adapted to put the inlet and outlet conduits of the vane simultaneously in communication with the high-pressure source, the vane housings being constantly in communication with the high-pressure source.

3. An apparatus according to claim 1, wherein the vane housings are equally divided into at least two groups, in the same way as the inlet and/or outlet conduits of said vanes said groups being connected to the high-pressure source and to a source of lower pressure, for example, the low-pressure source, through a distributor valve whereby each of said housing groups can be put independently in communication with either fluid source, a vane being rendered inoperative by putting said inlet and outlet conduits in communication with the high-pressure source, at the same time that its housing is put in communication with the low-pressure source.

4. An apparatus according to claim 1, wherein the vane housings are equally divided into at least two groups, in the same way as the inlet and/or outlet conduits of said vanes, said groups being connected to the low-pressure source and to a source of higher pressure, for example, to the high-pressure source, through a distributor valve whereby each of said housing groups can be put independently in communication with either fluid source, a vane being rendered inoperative by putting its inlet and outlet conduits and its housings in communication with the low-pressure source.

5. An apparatus according to claim 1, wherein the distributor valve comprises means for putting all the housings in communication with the low-pressure source and thus rendering all the vanes inoperative.

6. An apparatus according to claim 1, wherein the distributor valve is associated with a reversing cock for interchanging the high-pressure and low-pressure fluid sources.

7. An apparatus according to claim 1, wherein the distributor valve is associated with a throttling cock for limiting the low-pressure fluid flow rates.

8. An apparatus according to claim 1, wherein the rotor is located outside the stator and comprises two sidewalls interconnected by crossmembers, an independent ring which has a small cross section and constant thickness and is interposed between the crossmembers and had a profile having a corrugated shape so as to define the recesses, and means carried by the crossmembers and adapted to exert a thrust on the outer face of the ring in regions of the ring between said recesses.

9. An apparatus according to claim 1 wherein each vane comprises three vane plates and the center plate comprises, on each of its faces, a recess which is in communication with an aperture extending through the center plate, each assembly consisting of a recess and its aperture being in different planes and each of the end plates comprising an aperture facing the aperture in the center plate in communication with the recess in the face of said center plate in contact with the recess in the face of said center plate in contact with the third plate.

10. An apparatus for converting hydraulic or pneumatic energy into kinetic energy and vice versa, comprising: an outer element and an inner element which are relatively rotatable about an axis, one of said elements constituting a rotor and the other of said elements constituting a stator, said inner element comprising a plurality of housings and an outer face, a plurality of vane means respectively slidably mounted in said housings, said outer element having an inner face which said vane means are capable of contacting and which defines a plurality of recesses capable of defining with said outer face of said inner element and said vane means variable volume chambers, said inner element comprising a first fluid conduit and a second fluid conduit respectively on one side and on an opposite other side of each vane means, one of said conduits constituting an outlet conduit, the number of vane means being different from the number of recesses, each recess occupying an arc of a circle which angularly extends relative to said axis an extent less than the angle subtended at said axis by an edge of the first conduit pertaining to one vane means and a nearest edge of the second conduit pertaining to a neighboring vane means, means connecting said housings to

a source of fluid under pressure for applying said vane means against said inner face of said outer element, means dividing said first conduits into a plurality of independent first conduit groups and means including a distributor valve for putting said independent groups independently in communication selectively with a high-pressure fluid source and a low-pressure fluid source.

11. An apparatus for converting hydraulic or pneumatic energy into kinetic energy and vice versa, comprising: an outer element and an inner element which are relatively rotatable about an axis, one of said elements constituting a rotor and the other of said elements constituting a stator, said inner element comprising a plurality of housings and an outer face, a plurality of vane means respectively slidably mounted in said housings, said outer element having an inner face which said vane means are capable of contacting and which defines a plurality of recesses capable of defining with said outer face of said inner element and said vane means variable-volume chambers, said inner element comprising a first fluid conduit and a second fluid conduit respectively on one side and on an opposite other side of each vane means, one of said conduits constituting an inlet conduit and the other of said conduits constituting an outlet conduit, the number of vane means being different from the number of recesses, each recess occupying an arc of a circle which angularly extends relative to said axis an extent less than the angle subtended at said axis by an edge of the first conduit pertaining to one vane means and a nearest edge of the second conduit pertaining to a neighboring vane means, means connecting said housings to a source of fluid under pressure for applying said vane means against said inner face of said outer element, means dividing said first conduits and said second conduits respectively into a plurality of independent first conduit groups and independent second conduit groups and means including a distributor valve for putting said independent groups independently in communication selectively with a high-pressure fluid source and a low-pressure fluid source.

12. An apparatus as claimed in claim 11, wherein said distributor valve is adapted to put said inlet conduits and said outlet conduits simultaneously in communication with said high-pressure source, said housings being in constant communication with said high-pressure source.

13. An apparatus as claimed in claim 11, comprising means dividing said housings into a plurality of independent housing groups, means including a distributor valve for putting said housing groups independently in communication selectively of lower pressure whereby a vane means can be rendered inoperative by putting the corresponding first and second conduits in communication with said high-pressure source at the same time as the housing of the vane means is put in communication with said source of lower pressure.

14. An apparatus as claimed in claim 11, comprising means dividing said housings into a plurality of independent housing groups, means including a distributor valve for putting said housing groups independently in communication selectively with said low-pressure source and a source of higher pressure than said low-pressure source, whereby a vane means can be rendered inoperative by putting the corresponding first and second conduits and its housing in communication with said low-pressure source.

15. An apparatus as claimed in claim 10, wherein said distributor valve comprises means for putting all said housings in communication with said low-pressure source whereby all said vane means can be rendered inoperative.

16. An apparatus as claimed in claim 10, wherein said distributor valve is associated with a reversing cock for interchanging said high-pressure source and said low-pressure source.

17. An apparatus as claimed in claim 10, wherein said distributor valve is associated with a throttle cock for limiting the rate of flow of fluid from said low-pressure fluid source.

18. An apparatus as claimed in claim 10, wherein said rotor is the outer element and comprises two sidewalls, crossmem-

bers arranged around said axis and interconnecting said side walls, an independent ring having a small radial sectional size and a substantially constant thickness interposed between said walls within said crossmembers, said ring having a profile of corrugated shape defining a plurality of recesses, and thrust means carried by said crossmembers for exerting a thrust on an outer face of said ring in regions thereof between said recesses.

19. An apparatus as claimed in claim 18, wherein said thrust means are adjustable thrust-exerting screw means.

20. An apparatus as claimed in claim 18, wherein said thrust means comprise rotatable eccentric members carried by said crossmembers.

21. An apparatus for converting hydraulic or pneumatic energy into kinetic energy and vice versa, comprising: an outer element and an inner element which are relatively rotatable about an axis, one of said elements constituting a rotor and the other of said elements constituting a stator, said inner element comprising a plurality of housings and an outer face, a plurality of vane means respectively slidably mounted in said housings, said outer element having an inner face which said vane means are capable of contacting and which defines a plurality of recesses capable of defining with said outer face of said inner element and said vane means variable volume chambers, said inner element comprising a first fluid conduit and a second fluid conduit respectively on one side

and on an opposite other side of each vane means, one of said conduits constituting an outlet conduit, the number of vane means being different from the number of recesses, each recess occupying an arc of a circle which angularly extends relative to said axis an extent less than the angle subtended at said axis by an edge of the first conduit pertaining to one vane means and a nearest edge of the first conduit pertaining to a neighboring vane means, means connecting said housings to a source of fluid under pressure for applying said vane means against said inner face of said outer element, means dividing said first conduits into a plurality of independent first conduit groups and means including a distributor valve for putting said independent groups independently in communication selectively with a high-pressure fluid source and low-pressure fluid source, each vane means comprising three vane plates in adjoining relation, a center plate of said plates comprising two opposed faces in contact with two other plates of said plates, each of said center plates having a recess communicating with an aperture extending through said center plate, each assembly consisting of a plate face recess and the associated aperture being in different planes, each of said two other plates comprising an aperture in facing relation to said aperture of said center plate and in communication with the corresponding recess in said center plate face.

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