

April 10, 1951

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2,548,339

FLUID MOTOR OF THE ROTARY ABUTMENT TYPE

Filed May 29, 1944

4 Sheets-Sheet 1

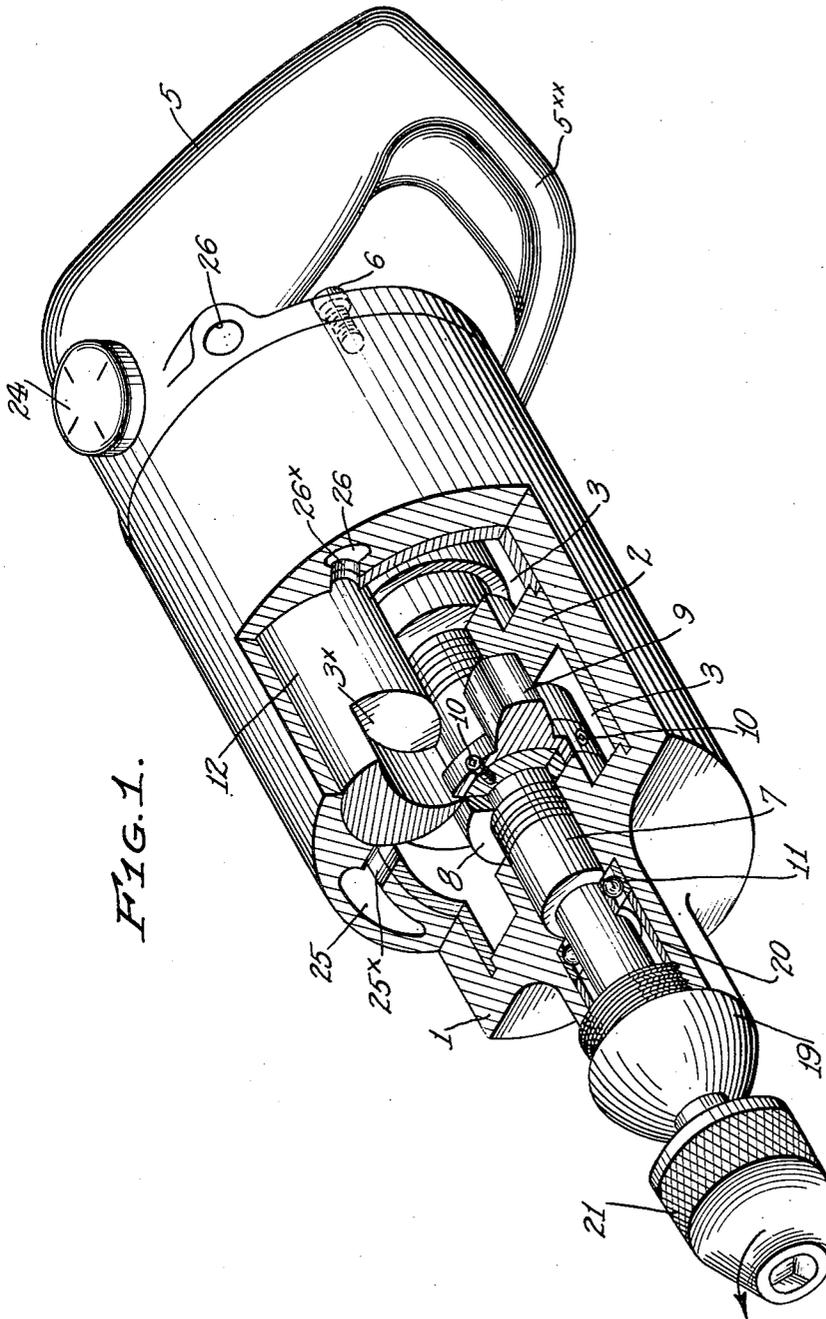


FIG. 1.

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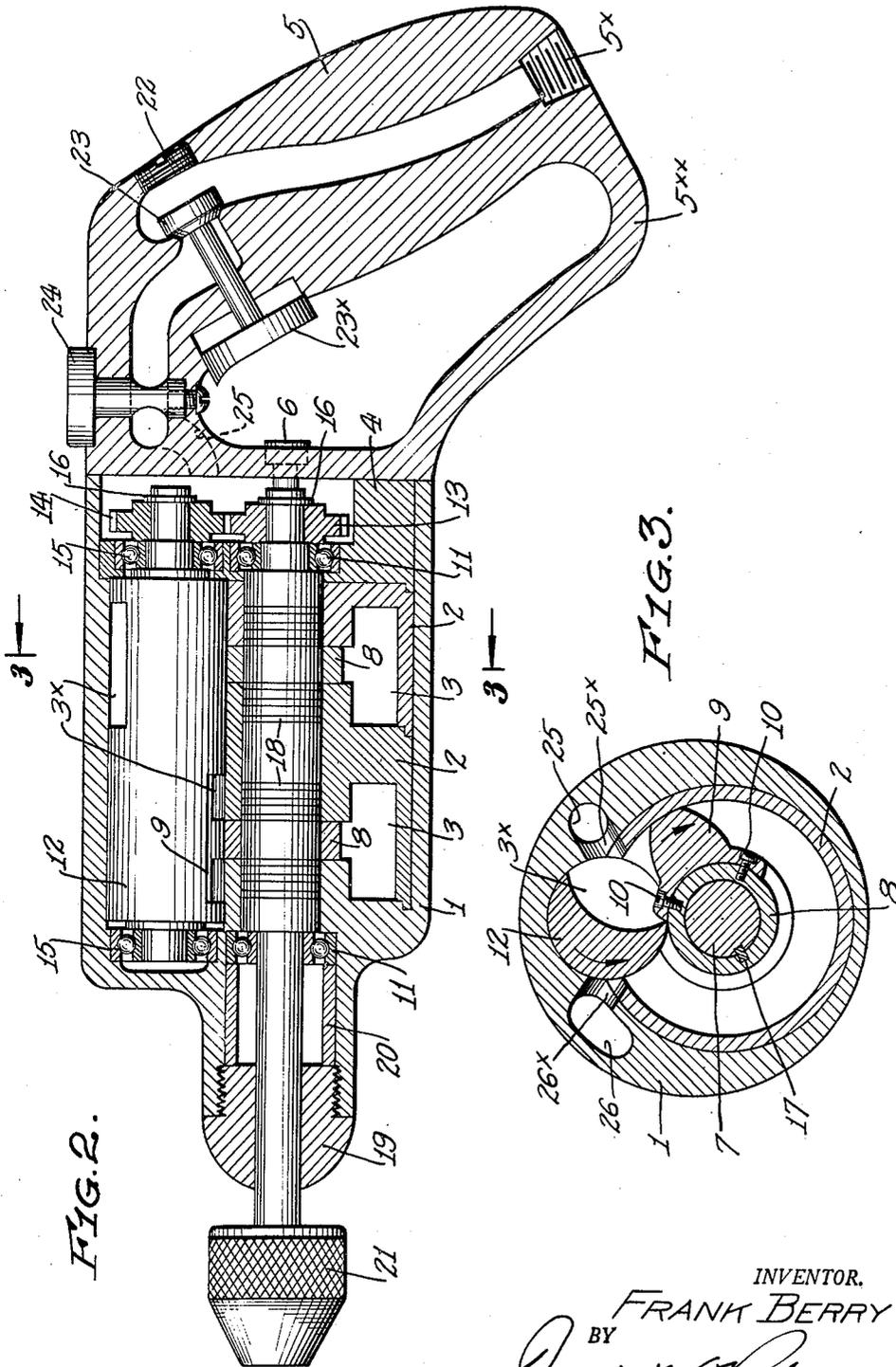


FIG. 2.

FIG. 3.

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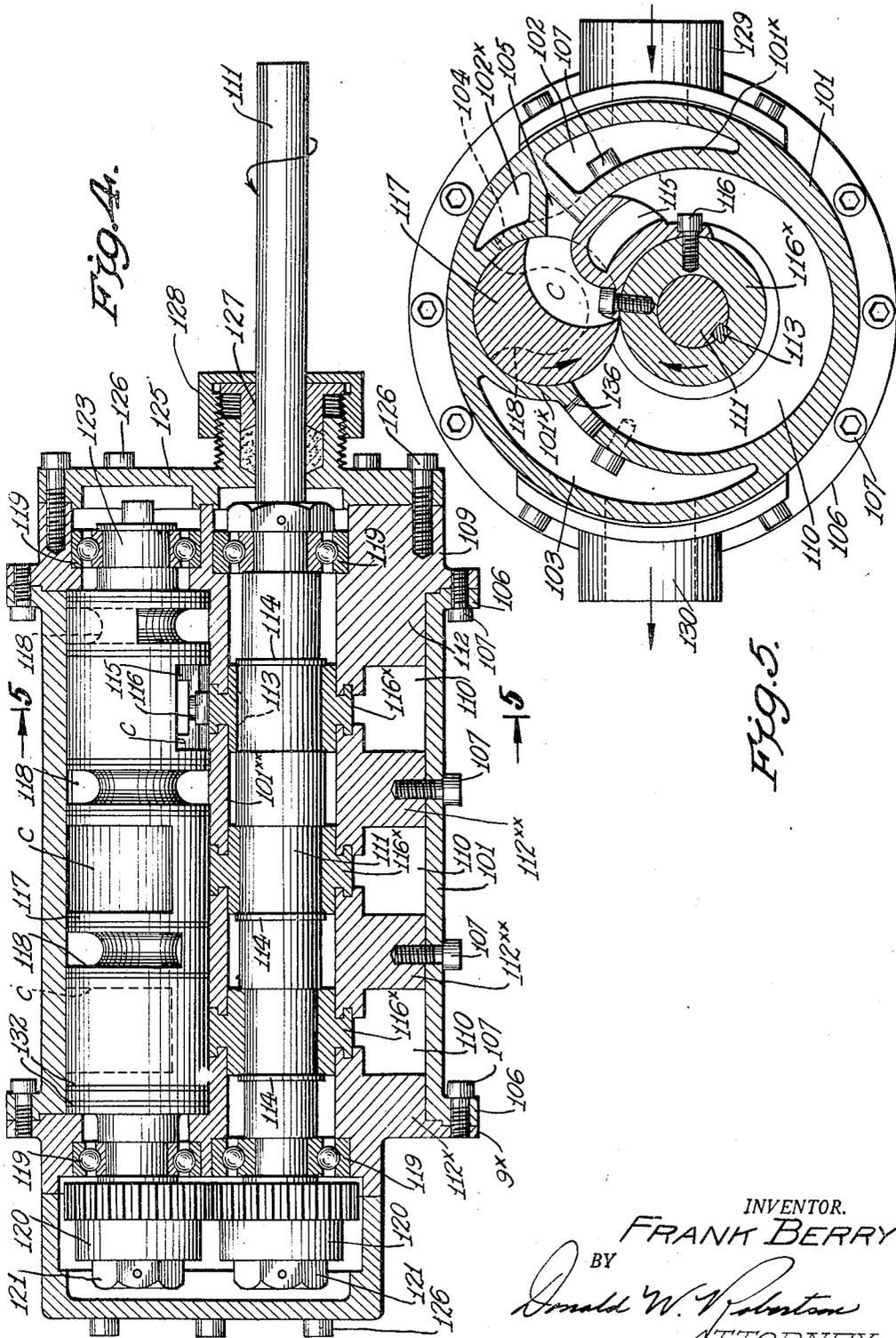
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FLUID MOTOR OF THE ROTARY ABUTMENT TYPE

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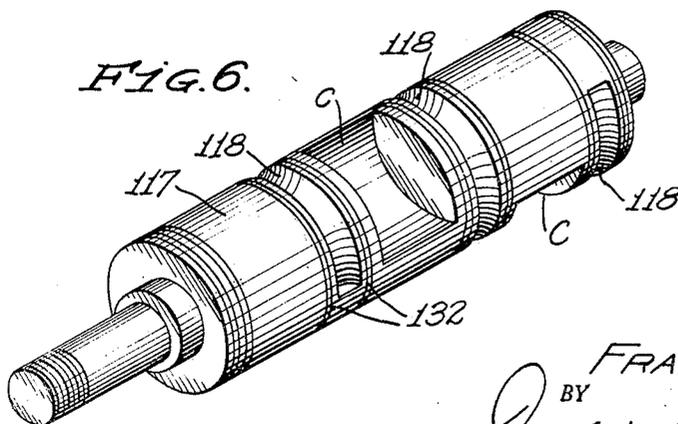
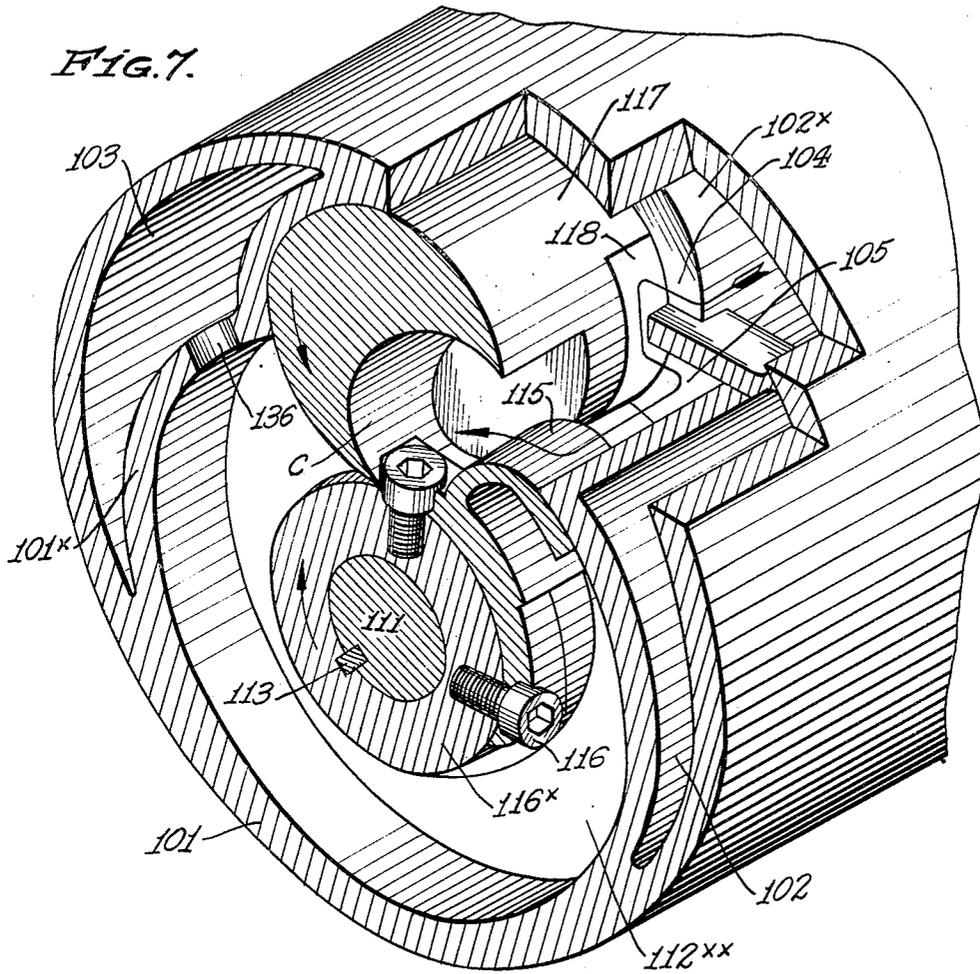
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FLUID MOTOR OF THE ROTARY ABUTMENT TYPE

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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,548,339

FLUID MOTOR OF THE ROTARY ABUTMENT TYPE

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Application May 29, 1944, Serial No. 537,909

6 Claims. (Cl. 121—34)

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The present invention relates to a fluid operated motor of the type employing rotary pistons on a common driven shaft, in conjunction with a rotary abutment member, the pistons with their abutments being arranged for mutual balance of weight and power. The motor shaft and the abutment member, the latter being a unitary rotor, are geared together in one to one rotation ratio.

The driving fluid may be so controlled so as to be staged and compounded for high efficiency, and the various forms herein described and illustrated are applicable to small hand tools where light weight and high speed and power are the desired factors, as well as to heavier forms.

The specific object of the invention is to provide a fluid motor of high power and speed per unit of weight.

The multi-piston form of my motor is particularly desirable for use in connection with air pressure systems where high power in comparison with weight is a prime factor.

The invention will be described with reference to the accompanying drawings, in which:

Figure 1 is a perspective view, partly broken away, showing a motor adapted for use as a pneumatic hand tool.

Figure 2 is a vertical section through the structure of Figure 1.

Figure 3 is a transverse section on the line 3—3, Figure 2, showing the feed and exhaust ports and certain construction details.

Figure 4 is a vertical section through a modified form of the invention.

Figure 5 is a transverse section on the line 5—5, Figure 4, showing the inlet and exhaust openings and certain construction details. In this view, the piston rotor and abutment are turned back slightly from the positions shown in Fig. 4.

Figure 6 is a perspective view of the abutment rotor shown in Figure 1.

Figure 7 is a fragmentary isometrical view, partly in section, particularly showing the feeder valve and controlled cut-off.

The construction illustrated in Figures 1 to 3, inclusive, is adapted as a small hand tool. The motor consists of a main casing 1, containing a plurality of cylinder sections 2, which are arcuate in form and which co-act with themselves and a front wall of the casing to form a plurality of cylinder chambers indicated at 3. The open end of the barrel-like casing 1 is closed by a head 5, formed as a handle, the head being bolted in place by screws such as indicated at 6.

A drive shaft 7 receives a plurality of piston-holding sleeves 8, the sleeves carrying pistons 9,

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the latter being formed with curved ridges which receive bolts 10 threaded into the sleeves 8.

The piston rotor, which comprises the shaft 7 and the sleeves 8, is held in position by bearings 11 which are seated in suitable chambers formed in the front of the casing and in a bearing block 4.

The abutment rotor 12 is, as shown in Figure 3, disposed within a longitudinal chamber formed in the casing 1, and it rides upon sleeves 8 of the piston rotor. The said abutment valve carries a driven gear 14 in mesh with a drive gear 13, carried by the piston rotor, and the piston rotor and abutment rotor are driven in 1 to 1 ratio. Bearings 15 support the abutment rotor. Adjacent the gears 13 and 14 the respective piston and abutment rotors are formed as stubshafts, and channelways are provided at the ends of these shafts to receive clip-rings 16. The sleeves 8 may be keyed to the piston rotor as by keys of the type indicated at 17, Figure 3.

It may be found desirable to employ one or a plurality of sealing rings 18, at opposite faces of each sleeve 8, these rings being seated in grooves formed in the periphery of the piston rotor, as shown in Figure 2.

In the present embodiment the front end of the casing is reduced in diameter and internally threaded to receive an apertured closure 19, which serves as a bushing for the projected shaft-like front end of the piston rotor, the latter carrying a chuck, which may be of usual construction, for receiving the tool to be driven by the device.

The handle 5 may be formed with a front guard 5^x and with a fluid intake duct at 5^x which is divided into a lower and an upper section to be controlled by a valve 23 having a finger trigger 23^x. Opposite valve 23 the handle may be formed with a threaded aperture to receive a plug. Upon removal of the latter, the valve may be inspected and refaced whenever desired. The valve stem may be threaded in the trigger 23^x for the purpose of assembly and ready detachment.

Outflow from fluid passageway 5^x is controlled as to volume by any suitable valve means operable from a point exterior the handle, the type illustrated at 24 being rotatable to reduce the passageway as desired for controlling the maximum fluid outflow to be permitted by operation of the trigger valve.

At opposite sides of the abutment rotor 12 casing 1 is formed with fluid intake duct 25 and fluid exhaust duct 26. In the embodiment shown two pistons are employed at 9, and the abutment rotor is formed with two piston clearance pas-

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sageways at 3^x. In the casing and in register with the cylinders are two sets of ports 25^x and 26^x, the first ports leading to the fluid intake duct 25 and the second ports, 26^x, leading to the exhaust port 26. At a suitable point in the casing the latter will be apertured to permit the discharge of exhaust fluid to a point exterior the motor.

Reference to Figure 3 will show that the inlet and exhaust ducts 25^x and 26^x are, for each cylinder, disposed at opposite sides of the abutment rotor, and that the latter can be designed to open and close the inlet duct, or both of the ducts, so far as flow of fluid into a cylinder and discharge of fluid therefrom is concerned. However, in the present embodiment, and in consideration of quick action and maximum power with relation to weight of the motor, the intake port 25^x and hence the fluid intake duct 25 is in constant communication with its appropriate cylinder and the abutment rotor only partially controls the said port. The same is true with respect to the exhaust port.

Thus it will be seen that in the operation of the embodiment illustrated in Figures 1 to 3, fluid under pressure is admitted to the handle at 5^x and its flow through said passageway is controlled by manipulation of trigger valve 23, 23^x, by setting valve 24 a desired maximum pressure may be controlled. The fluid under pressure flows into intake duct 25 and from that duct through the two ports 25^x into the cylinders back of the pistons. Back flow of the fluid is prevented by the abutment rotor, and after the pistons have been given full power stroke, and as each piston enters its clearance passageway in the abutment rotor an appropriate discharge port 26^x is passed by the piston and the fluid is exhausted.

Referring to Figures 4 to 7, inclusive, it will be seen that I have provided a pneumatic motor with an automatic valving arrangement which effects control of the passage of fluid under pressure to each cylinder from the feed line.

The motor consists of a barrel-like casing 101, having an internal web 101^x dividing the interior into a lower hemi-cylindrical chamber and an upper similar chamber of lesser area. Extending longitudinally within the casing at one side thereof and internally bounded by web 101^x is a fluid pressure intake duct 102, which communicates with a longitudinal manifold at the top thereof as indicated at 102^x, Figure 5. In the inner wall of chamber or manifold 102^x are formed a plurality of fluid pressure intake passages 104, which communicate with an abutment rotor now to be described. The abutment rotor is formed with a set of peripheral arcuate valve channels at 118, each in register with one of the intake passages 104, and periodically bringing each of the passages 104 into communication with an elongated duct 105 leading to a port in the wall of one of the piston cylinder chambers now to be described.

The outermost piston cylinder chambers 110 are bounded at their outer faces by heads 112 and 112^x. The central one of the three cylinder chambers is bounded at its sides by cylinder separators 112^x. These cylinder chamber separators, are disks bolted in position as by the bolts 107, clearances being cut in the top of the disks for the abutment rotor. The cylinder separators also are formed with hubs which may be channeled to receive annular ribs or sealing rings carried by piston sleeves 116^x.

The piston sleeves are mounted on piston shaft 111, which with its sleeves constitutes a piston rotor.

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The pistons 115 are each formed with an arcuate base, formed with forwardly and rearwardly projecting ridges which are apertured to receive bolts 116.

The heads 112, 112^x of the casing are each formed with seats for spaced sets of bearings 119, for the piston rotor shaft 111 and for the abutment rotor shaft 123.

It will be understood that the abutment rotor will be formed with clearance passageways C for the pistons, and that at the sides of each passageway, the abutment rotor may be channeled to receive sealing rings 132. Snap rings may be provided for the piston rotor at 114, these rings being snapped into grooves formed in said rotor, for abutment with the piston sleeves 116^x, as shown in Figure 4.

In each cylinder chamber 110 there is formed through web 101^x a discharge port 136 leading to a discharge duct 103 from which exhaust fluid may pass to the atmosphere through discharge pipe 130.

In the operation of the motor, it being understood that the pistons will be spaced 120° apart, and that the piston clearance passages C will be correspondingly placed, with a length of each valve channel 118 as desired, a length of 240° being suitable; fluid under pressure is passed into duct 102 via pipe 129 and, inasmuch as said duct is in communication with manifold 102^x, the fluid under pressure will pass into the said manifold, and to passages 104. These passages 104 are successively brought into communication with the peripheral valve channels 118 in the abutment rotors 117. When a channel of the abutment rotor registers with one of the passages 104 the fluid flows into the channel, thence into one of a series of longitudinal recesses 105 formed in the casing web and bridging channel 118 and the appropriate cylinder. This action takes place when the piston of that cylinder is in the position of Figures 5 and 7 and ready for a power stroke.

When the piston completes its power stroke and passes discharge port 136 the spent fluid flows out through duct 103 and pipe 130.

It will be understood that various modifications may be made in the form and arrangement of the elements constituting the embodiment illustrated in the drawings, without departing from the spirit of the invention, what I claim and desire to secure by Letters Patent, being as follows:

1. A rotary-piston fluid motor, comprising a cylindrical casing having provided therein a longitudinal intake duct and an opposed longitudinal exhaust duct, a plurality of sets of communicating chambers intermediate said ducts, one chamber of a set being an abutment chamber and the second a piston chamber, an abutment rotor having abutments in said abutment chambers, a set of intake and exhaust ports being provided in the wall of at least one of said piston chambers and leading respectively to the intake duct and to the exhaust duct, the abutment rotor being adapted to meet and partially close an intake port at the wall of a piston chamber, and a piston rotor carrying a plurality of pistons, the abutment rotor being formed with a plurality of peripheral arcuate valve-channelways, one preceding each abutment, each valve-channelway periodically being brought into simultaneous registration with an intake passage in the casing leading to the intake duct and the intake port formed in the wall of the appropriate piston chamber; said

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intake port bridging the valve-channelway and piston chamber.

2. A rotary-piston fluid motor, comprising a casing having intake and exhaust ducts, a plurality of sets of communicating chambers, one chamber of each set being an abutment chamber and the second a piston chamber, an abutment rotor having abutments in said abutment chambers, a set of intake and exhaust ports being provided in the wall of each of said piston chambers, the abutment rotor at each abutment being adapted to meet and partially close an intake port at the wall of a piston chamber, and a piston rotor carrying a plurality of pistons, the intake ports being located in their respective piston chambers adjacent the intersections of the piston chambers with the abutment chamber whereby fluid is admitted behind the pistons while each is passing through its respective abutment.

3. A rotary-piston fluid motor, comprising a casing having intake and exhaust ducts, a plurality of sets of communicating chambers, one chamber of each set being an abutment chamber and the second a piston chamber, an abutment rotor having abutments in said abutment chambers, a set of intake and exhaust ports being provided in the wall of each of said piston chambers, the abutment rotor at each abutment being adapted to meet and partially close an intake port at the wall of a piston chamber, and a piston rotor carrying a plurality of pistons, the intake ports being located in their respective piston chambers adjacent the intersections of the piston chambers with the abutment chamber whereby fluid is admitted behind the pistons while each is passing through its respective abutment, the abutment rotor being formed with a plurality of peripheral arcuate valve-channelways, one preceding each abutment, each valve-channelway periodically being brought into simultaneous registration with two ports, an intake port in the casing leading to the intake duct and a second port formed in the wall of the appropriate piston chamber, said second port bridging the valve-channelway and piston chamber.

4. A rotary-piston fluid motor, comprising a cylindrical casing having provided therein a longitudinal intake duct and an opposed longitudinal exhaust duct, a plurality of sets of communicating chambers intermediate said ducts, one chamber of a set being an abutment cham-

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ber and the second a piston chamber, an abutment rotor having abutments in said abutment chambers, a set of intake and exhaust ports being provided in the wall of at least one of said piston chambers and leading respectively to the intake duct and to the exhaust duct, the abutment rotor being adapted to meet and partially close an intake port at the wall of a piston chamber, and a piston rotor carrying a plurality of pistons.

5. A rotary-piston fluid motor constructed in accordance with claim 4, the piston chamber walls being laterally bounded by a plurality of spacing members endwise removable from the casing, and having bearing apertures to receive the piston rotor.

6. A rotary-piston fluid motor constructed in accordance with claim 4, the piston chamber walls being laterally bounded by a plurality of spacing members endwise removable from the casing, having bearing apertures to receive the piston rotor, and the abutment rotor intersecting a peripheral area of each spacing member.

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