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R. P. McCULLOCH ET AL
INTERENGAGING IMPELLER ROTARY
POSITIVE DISPLACEMENT BLOWER
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Fig. 1.

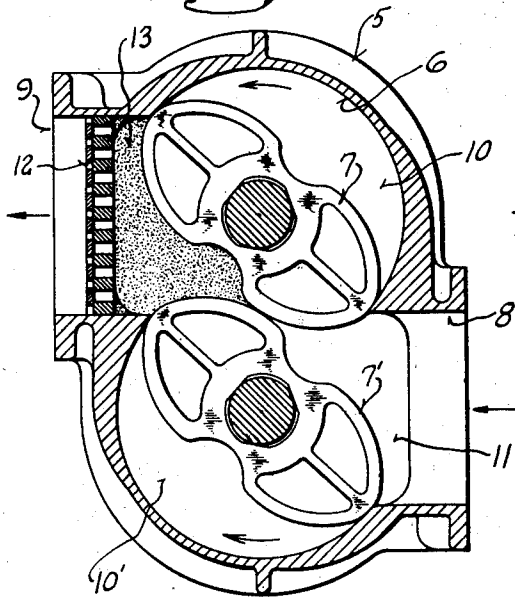


Fig. 2.

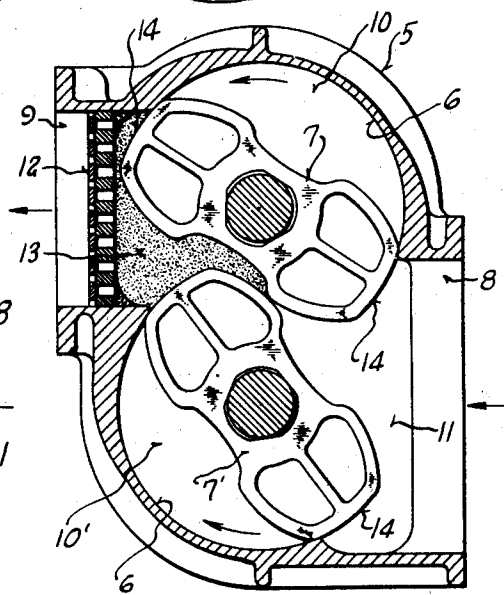


Fig. 4.

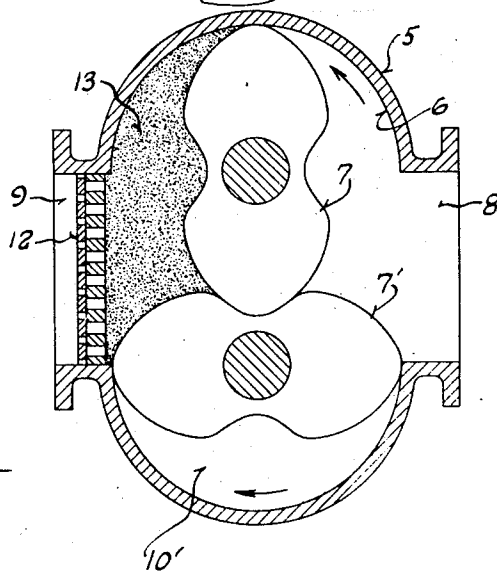
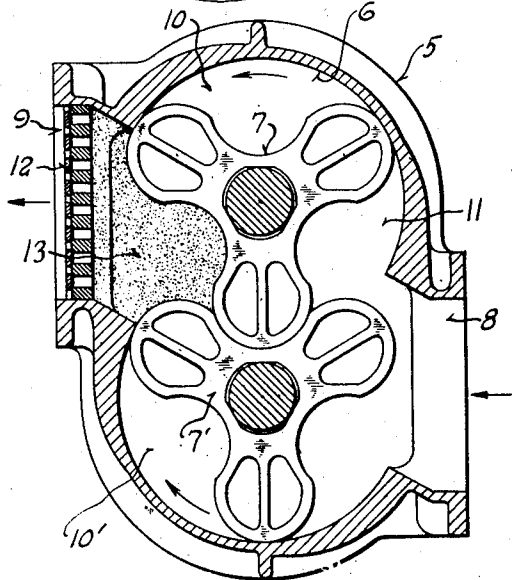


Fig. 3.



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UNITED STATES PATENT OFFICE

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INTERENGAGING IMPELLER ROTARY
POSITIVE DISPLACEMENT BLOWER

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1 Claim. (Cl. 230—141)

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This invention relates to positive displacement blowers of the Roots type wherein a pair of rotors with meshing lobes rotate within a housing to positively advance air or other fluid from an intake to a discharge port.

In the conventional Roots type blower the intake and discharge ports are directly opposite each other and in line. With this arrangement, the pockets of the two rotors communicate alternately with the discharge port. Thus in the conventional design of blower operating without a check valve in the discharge port, the air or fluid in the receiver at the discharge end of the blower normally expands back first into a pocket of one rotor and then into a pocket of the other rotor as rotation occurs. The resulting high pitched noise from a high speed blower of this type may in some cases be much more objectionable than would be a noise having only half this frequency.

Another limitation of the conventional design occurs when a check valve is used in the discharge port. The large clearance volume existing between the valve and rotors, which is an inherent characteristic of the conventional type of blower, results in a low efficiency due to re-expansion of the gas in this large clearance volume back into the rotor pockets. Heretofore this condition was accepted as a necessary evil.

It is, therefore, an object of this invention to provide an improved positive displacement blower of the Roots type in which (1) the noise produced within the blower is of a lower pitch, and (2) in which the ratio of the clearance volume to the rotor bucket volumes into which the clearance volume re-expands is a minimum.

As will be readily apparent to those skilled in the art, the accomplishment of these objectives results in a blower having less objection from the viewpoint of noise and also makes the use of a check valve in the discharge port far more efficient than heretofore.

Another object of this invention is to provide a blower of the type described wherein the lobes of the rotors are of an improved contour to provide minimum clearance volume and a better seal between the rotors and the housing wall. It also enables the intake port to be materially increased.

As will be brought out more fully hereinafter, the primary objectives of this invention are achieved by the simple expedient of offsetting the intake and discharge ports, and it is, therefore, a further object of this invention to provide a positive displacement blower wherein the housing has intake and discharge ports in the

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opposite walls thereof and offset with respect to each other.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claim, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claim.

The accompanying drawing illustrates several complete examples of the physical embodiment of the invention constructed according to the best modes so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a cross sectional view through a positive displacement blower illustrating one embodiment of this invention;

Figure 2 is a view similar to Figure 1, but illustrating a two lobed rotor of improved construction;

Figure 3 is a view similar to Figure 1, illustrating the application of this invention to a blower having three lobed rotors; and

Figure 4 is a diagrammatic view similar to Figure 1 illustrating the conventional Roots type blower, to facilitate comparison of the improvement effected by this invention with the conventional construction.

Referring now more particularly to the accompanying drawing, in which like numerals indicate like parts, the numeral 5 designates the housing of a blower constructed in accordance with this invention. This housing is preferably a casting with its inner walls 6 curved and concentric to the axes of a pair of rotors 7 and 7' rotatable in the housing. The curved walls of the housing thus in effect constitute the major portion of two connected parallel bores.

The median plane which bisects the housing transversely and which passes through the junctures of the bores, in the conventional Roots type blower also bisects the intake and discharge ports 8 and 9, respectively. According to the present invention, these ports are offset with respect to each other so that one lies substantially wholly on one side of the median plane while the other is at the opposite side of this plane.

Also, it may be said that one of the ports opens substantially entirely to one of the two parallel bores while the other communicates substantially entirely with the other of the two parallel bores.

The ports are of such width and are so located with respect to the contour of the rotors that at

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no time is there a direct path from one port to the other. The rotors always close the ports from each other and positively advance the fluid being pumped from the intake to the discharge port by entrapping the same in the bucket spaces 10 and 10' defined by the pockets of the rotors and the cooperating cylindrical wall surfaces of the housing.

The rotors are, of course, mounted in suitable bearings (not shown) carried by end plates 11 which are secured to and close the ends of the housing.

A check valve 12 of any suitable design and construction may be mounted in the discharge port. As will be readily apparent, this valve closes when the back pressure from the discharge receiver exceeds the pressure in the clearance volume 13 and is opened as the fluid entrapped between the rotors is compressed by the advancing rotor lobes to a pressure exceeding the back pressure in the receiver.

As explained hereinbefore, it is desirable from the standpoint of maximum efficiency, in the case where a check valve is employed to keep the clearance volume 13 as small as possible with respect to the rotor bucket volume or volumes into which it re-expands. The present invention achieves this desideratum by virtue of the offset disposition of the ports as follows:

Referring to Figure 4, which represents a conventional design of a Roots type blower employing a valve, it will be noted that the fluid in the relatively large clearance volume 13, while at the highest pressure existing in the system, re-expands into the relatively small bucket volume 10' where the fluid is at the lowest pressure in the system. This occurs when the rotor 7' advances in rotation, establishing communication between the volumes 13 and 10'. Thus, the resulting back pressure in the now combined volumes 13 and 10' acting upon the advancing rotors 7 and 7' will be relatively high, resulting in excessive power consumption during the compression period of the cycle.

In the case of the blower with offset ports as in Figure 1, the fluid in the relatively small clearance volume 13 re-expands simultaneously into the two bucket volumes 10 and 10'. Thus the resulting back pressure in the now combined volumes 13, 10, and 10' acting upon the advancing rotors 7 and 7' will be small as compared to the previous case, resulting in a much reduced power consumption during the compression period of the cycle.

As illustrated in Figure 3, the invention is equally as applicable to a blower having three lobed rotors as to one equipped with two lobed rotors, and as the elements are in all other respects the same as shown and described in connection with Figure 1, no specific description need be made of Figure 3.

A further improvement is achieved through the use of a special rotor contour as shown in

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Figure 2. In this case the extremities 14 of the rotor lobes are concentric to the rotor axes and have a close fit with the cylindrical walls 6 of the housing which, of course, are also concentric to the rotor axes.

The use of this special rotor contour further reduces the clearance volume 13 as is clearly evident from a comparison of Figures 1 and 2, and in addition has the advantage of providing a better seal between the rotor and the housing walls and of enabling the use of a larger intake port. This is particularly advantageous in high speed operation, and as will be evident, is made possible by the fact that the rotor lobes overlie the housing walls for a substantial circumferential distance.

From the foregoing description taken in connection with the accompanying drawing, it will be readily apparent to those skilled in the art that this invention provides a greatly improved positive displacement type blower and that the improvement is achieved in an exceedingly simple manner.

What we claim as our invention is:

25 A positive displacement type blower comprising a housing having cylindrical communicating bores; intake and discharge passages radial to said bores and communicating therewith at opposite sides of said housing, said passages having their axes offset with respect to each other; and a pair of cooperating rotors rotatable in said bores each arranged proximate the inward end of a passage and having intermeshing lobes which define bucket spaces with the walls of said bores, each rotor having its axis aligned with and intersecting the axis of its proximate passage, said rotor axes being parallel to each other in a common plane, and the axes of the passages being offset on opposite sides of a median plane between the rotor axes and approximately perpendicular to the aforesaid common plane of the rotor axes, whereby each passage opens substantially entirely into a respective bore.

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