J. J. STOETZEL.

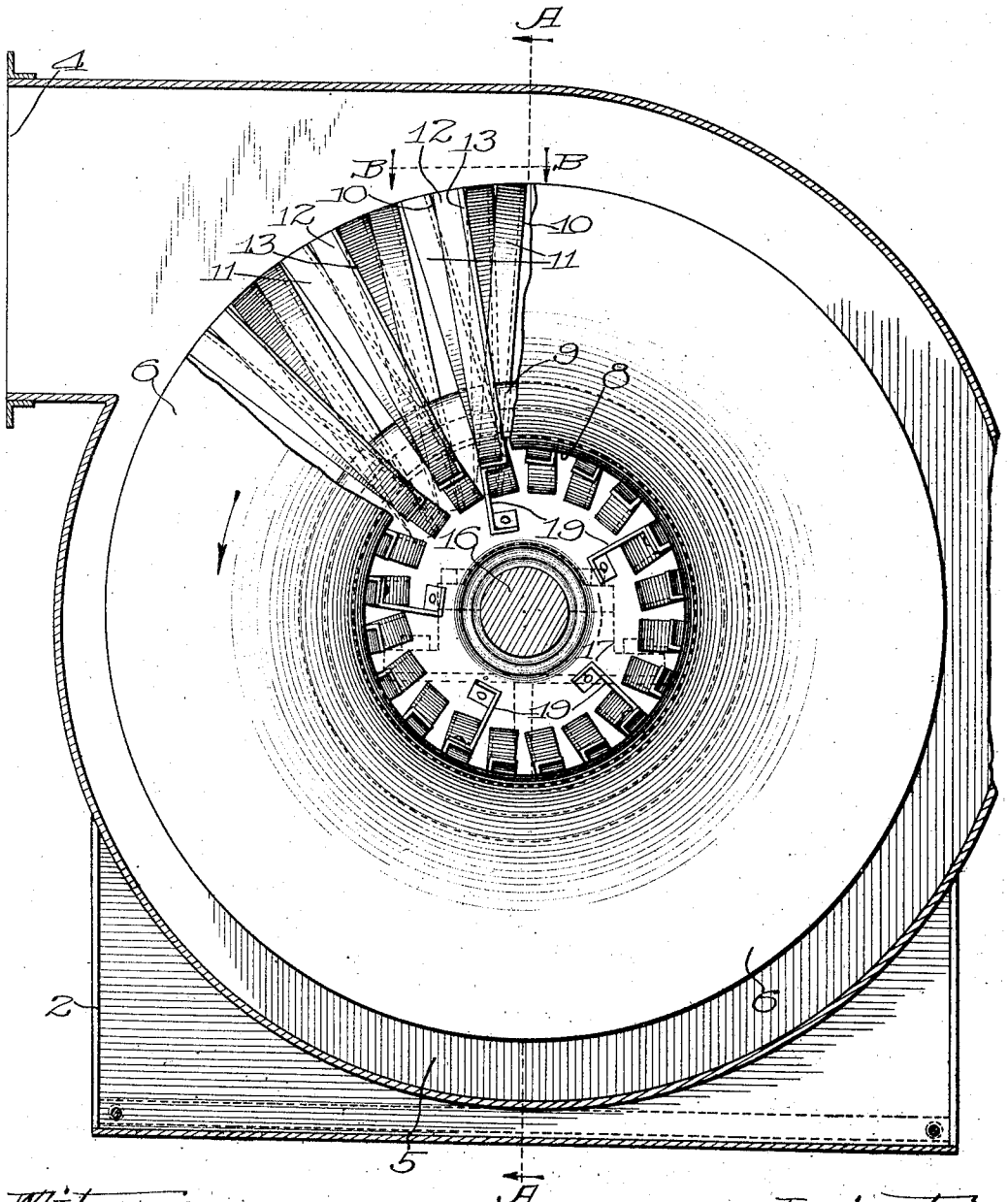
CENTRIFUGAL PUMP OR BLOWER.

APPLICATION FILED JUNE 5, 1911.

1,003,542. **Patented Sept. 19, 1911.**

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 2.
A-A.

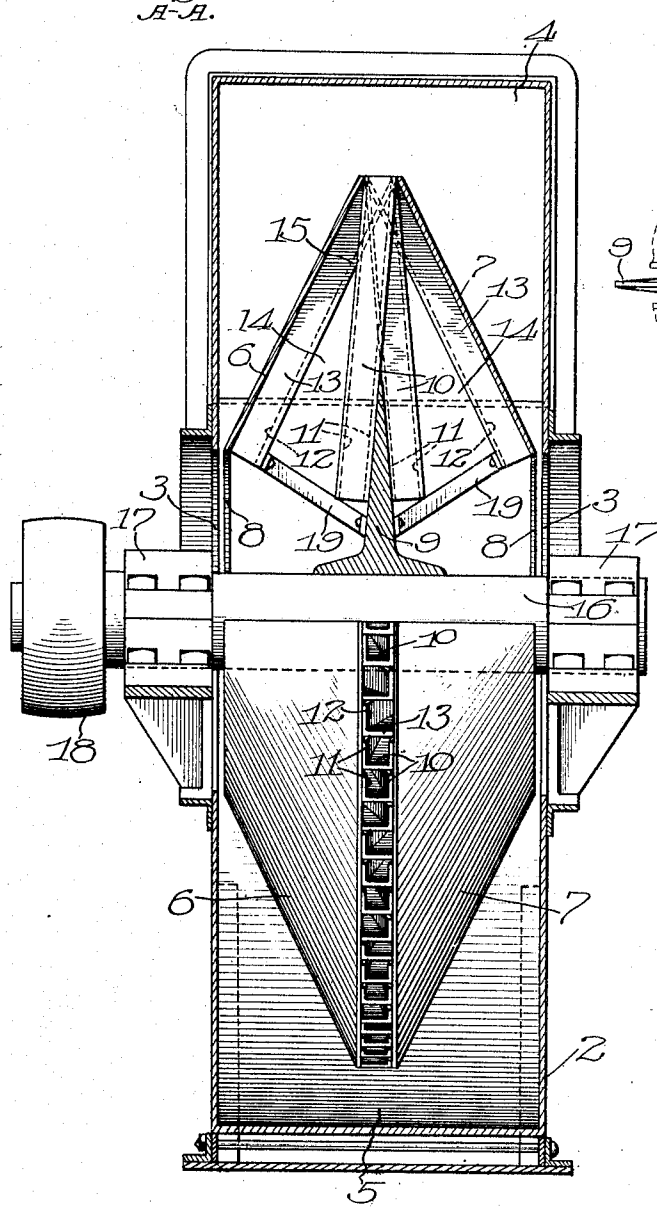
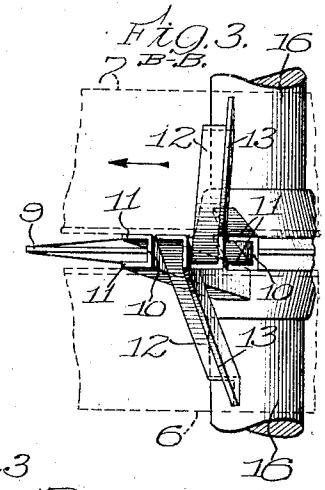


Fig. 3.
B-B.



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CENTRIFUGAL PUMP OR BLOWER.

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To all whom it may concern:

Be it known that I, JOSEPH J. STOETZEL, a citizen of the United States of America, and a resident of Chicago, county of Cook, State of Illinois, have invented certain new and useful Improvements in Centrifugal Pumps or Blowers, of which the following is a specification.

The main objects of this invention are to provide an improved form of centrifugal pump or blower having an improved construction and arrangement of its vanes, whereby the fluids operated upon will be gradually set in motion so as to reduce losses due to impact of the vanes upon the fluid, whereby the losses due to eddy currents will be reduced, and whereby the inlet passages may be substantially co-extensive with the radial extent of the vanes, thereby insuring that the fluid will completely fill the spaces between the vanes and also insuring a uniformly distributed discharge throughout the entire peripheral area of the rotary member.

An illustrative embodiment of this invention is shown in the accompanying drawing, in which—

Figure 1 is a side elevation, partly sectional, of a blower constructed according to this invention, the fan or rotary member being broken away to more clearly illustrate its internal construction. Fig. 2 is a transverse sectional elevation of the same taken on line A—A of Fig. 1. Fig. 3 is a fragmentary detail of the rotary member taken on line B—B of Fig. 1 and illustrating the relative arrangement of the vanes on the rotary member.

In the construction shown in the drawings, the housing or casing 1 is supported on the base 2 and has axial air inlet openings 3 on opposite sides thereof and a tangential air outlet opening 4. The casing 1 may be of any suitable form, and is shown in the drawings as being of the usual volute shape.

The fan or rotary member comprises a pair of conical plates or end members 6 and 7 arranged with their concave faces opposed and spaced apart axially to form a contracted peripheral opening between their outer edges. These plates are of less diameter than the interior of the casing, affording the usual space 5 between the periphery of the plates and the casing 1. Each of these plates has a centrally disposed air inlet opening 8 located in axial alinement with the inlet openings 3 of the casing 1. A disk 9 of less diameter than the plates 6 and 7 and slightly tapered toward its periphery is centrally arranged between the plates 6 and 7 and rotatable therewith. Two sets of vanes 10 are respectively secured to the opposite sides of the disk 9 and extend radially outward to the peripheral opening between the outer edges of the plates 6 and 7, their outer ends being substantially in the same plane of revolution. The vanes 10 are of channel shaped cross-section and have side flanges 11 facing in the direction of rotation. Two additional sets of vanes 12 are secured to the inner surfaces of the conical plates 6 and 7 and extend outwardly to the peripheries of said plates. These vanes may be of angle-shaped cross section and are disposed with one leg or flange 13 spaced away from its respective end plate and facing in the direction of rotation. Thus the vanes 12, together with the respective end plates, are in effect also of channel cross section.

In the form shown, there are thus four sets of vanes and these are arranged in groups of four, one from each set, the inner ends of those in each group being in axial alinement. The outer ends of all of the vanes are arranged one in front of the other in circumferential alinement. The vanes 12 terminate at the edge of the openings 8, but the vanes 10 extend a little nearer to the axis. In the form shown, the vanes 10 and 12 are each of substantially uniform width throughout their length, the width being equal to the distance between the end members 6 and 7 at their peripheries. The inner ends of the different sets of vanes are spaced apart axially to provide the annular spaces 14 at opposite sides of the disk 9 between the adjacent edges of the vanes, these spaces communicating with the air inlet openings 3 and 8 and converging upwardly to the point 15 where the paths of rotation of the vanes of different sets become coincident. The disk 9 also serves to separate the air currents which enter from opposite sides of the casing.

The plates 6 and 7 and disk 9 are fixed on the shaft 16 journaled in bearing 17 at opposite sides of the casing 1. A pulley 18 is secured to the outer end of the shaft 16 by means of which the rotary member is driven. In the form shown, the plates 6 and 7, in ad-

dition to carrying the vanes 12, are secured at their outer edges to the vanes 10 and their edges are braced by arms 19.

The operation of the device shown is as follows:—As the vanes rotate, the air in the spaces between them is rotated and caused to flow centrifugally outward along the vanes 10 and 12. In devices of this nature, the air in the paths of the vanes increases in density as it approaches the periphery of the wheel by reason of its inertia and the impact of the vanes and there is a tendency to form a partial vacuum in the spaces immediately behind the vanes. If these spaces are not kept filled with air, the air will leave the vanes and in the form of a succession of jets which expand in the space within the casing and there is thus a decided loss in efficiency. In prior blowers, it has been found necessary to make the vanes comparatively short radially to reduce this tendency. In the present invention, by virtue of the spaces 14, air is supplied to the vanes not only at their inner ends, but also all along their edges. The vanes being of channel-cross section, their flanges prevent the air in front of them from escaping at the side, but allow new air from the spaces 14 to flow freely into the path of the vanes to off-set the tendency to the formation of partial vacuums immediately behind the vanes.

It will thus be seen that the spaces within the paths of the vanes 10 and 12 are kept full of air practically all of the time, and that for this reason, the air is discharged at the periphery of the wheel, not in the form of a series of jets but in the form of a continuous unbroken stream extending over the entire area of the periphery of the wheel. There is therefore no "back-lash" or tendency of the air to be drawn in from the space 5 back into the vanes at their ends, as is the case in structures where the vanes are not fully supplied with air. Thus, with this device it is possible to keep the air in the casing at a uniform pressure and as it is discharged from the outlet 4, the area of the discharging air current is substantially equal to the effective area of the opening.

Although but one specific embodiment of this invention is herein shown and described, it will be understood that numerous details of the construction shown may be altered or omitted without departing from the spirit of this invention, as defined by the following claims.

I claim:—

1. In a device of the class described, the combination of a set of radially disposed vanes adapted to receive fluid at their inner ends and discharge it at their outer ends, a second set of vanes also adapted to receive fluid at their inner ends and discharge it at their outer ends and having their inner ends spaced axially away from the inner ends of said first set of vanes, both of said sets of vanes having their outer ends located in substantially the same plane of revolution.

2. In a device of the class described, the combination of two sets of radially disposed vanes each adapted to receive fluid at its inner end and discharge it centrifugally at its outer end, the inner ends of the vanes in one set being spaced axially from those in the other set and the outer ends of said vanes being located substantially in the same plane of revolution.

3. In a device of the class described, the combination of a plurality of sets of radially disposed vanes, each set being adapted to receive fluid at its inner end and discharge it at its outer end, the inner ends of the vanes in each set being spaced axially away from the inner ends of the vanes in the other sets, and all of said vanes being disposed so that their outer ends are substantially in the same plane of revolution.

4. In a device of the class described, the combination of a series of radially disposed vanes adapted to receive fluid at their inner ends and discharge it at their outer ends, said vanes having their outer ends arranged substantially in the same plane of revolution and having their inner ends arranged in staggered relation with respect to such plane of revolution.

5. In a device of the class described, the combination of two sets of radially disposed vanes each adapted to receive fluid at its inner end and discharge it centrifugally at its outer end, the inner ends of the vanes in one set being spaced axially from those in the other set and the outer ends of said vanes being located substantially in the same plane of revolution, the axial spacing of the inner ends of the vanes being such as to provide an annular air space between the paths of rotation of the vanes.

6. In a device of the class described, the combination of two sets of radially disposed vanes each adapted to receive fluid at its inner end and discharge it centrifugally at its outer end, the inner ends of the vanes in one set being spaced axially from those in the other set and the outer ends of said vanes being located substantially in the same plane of revolution, the axial spacing of the inner ends of the vanes and the shape of the vanes being such that the paths of rotation of said vanes are distinct and spaced apart adjacent to the axis, but converge toward each other at their outer ends.

7. In a device of the class described, the combination of two sets of radially disposed vanes each adapted to receive fluid at its inner end and discharge it centrifugally at its outer end, the inner ends of the vanes in one set being spaced axially from

those in the other set, and the outer ends of said vanes being located substantially in the same plane of revolution, and a disk interposed between the inner ends of the vanes of different sets so as to cause each to draw fluid from its respective side of the device.

8. In a device of the class described, the combination of two sets of radially disposed vanes each adapted to receive fluid at its inner end and discharge it centrifugally at its outer end, the inner ends of the vanes in one set being spaced axially from those in the other set and the outer ends of said vanes being located substantially in the same plane of revolution, each of said vanes being substantially channel-shaped in transverse section with its open side facing in the normal direction of rotation of the vanes.

9. In a device of the class described, the combination of two sets of radially disposed vanes each adapted to receive fluid at its inner end and discharge it centrifugally at its outer end, the inner ends of the vanes in one set being spaced axially from those in the other set and the outer ends of said vanes being located substantially in the same plane of revolution, and a pair of end plates secured against opposite sides of said vanes, being open at their middle part and spaced apart at their outer edges.

10. In a device of the class described, the combination of two sets of radially disposed vanes each adapted to receive fluid at its inner end and discharge it centrifugally at its outer end, the inner ends of the vanes in one set being spaced axially from those in the other set and the outer ends of said vanes being located substantially in the same plane of revolution, a pair of end plates secured against opposite sides of said vanes, being open at their middle part and spaced apart at their outer edges, and a casing surrounding said vanes and end plates, being in open communication with the space between said plates at the edges thereof and having an outlet opening.

11. In a device of the class described, the combination of two sets of radially disposed vanes each adapted to receive fluid at its inner end and discharge it centrifugally at its outer end, the inner ends of the vanes in one set being spaced axially from those in the other set, and the outer ends of said vanes being located substantially in the same plane of revolution, each vane in each set being of substantially uniform transverse sectional form throughout its length.

12. A device of the class described, comprising a supporting frame, a shaft journaled therein, a hub member rigidly mounted on said shaft, two sets of radially disposed vanes secured to respectively opposite faces of said hub member, being spaced apart at their inner ends and inclined toward each other at their outer ends, a pair of end plates spaced apart at their middle part and inclined toward each other at their periphery, one of said plates being open at its middle part, said plates being also spaced apart at their peripheries to provide a comparatively narrow discharge outlet, and a casing inclosing said vanes and plates and having a central inlet opening and a peripheral outlet.

13. In a centrifugal blower, the combination of a casing having air inlet and outlet openings, a fan member rotatably mounted in said casing and having vanes spaced apart axially at their inner ends so as to provide an annular space between the adjacent edges of said vanes, communicating directly with said air inlet.

14. In a centrifugal blower, the combination of a casing having air inlet and outlet openings, a fan member rotatably mounted in said casing and having vanes thereon, the inner ends of said vanes being spaced apart axially and the outer ends being spaced peripherally in the same plane of rotation, so as to provide an annular air space between the paths of adjacent edges of said vanes.

15. In a centrifugal blower, the combination of a casing having air inlet and outlet openings, a pair of members rotatably mounted in said casing, said members being spaced apart axially and relatively inclined toward each other, a plurality of radially disposed vanes carried on the opposed surfaces of said members, the width of the inner ends of said vanes being less than half the distance between the adjacent parts of said members so as to provide an annular air space between the adjacent edges of said vanes.

16. In a centrifugal blower, the combination of a casing having air inlet and outlet openings, a pair of conical end members rotatably mounted in said casing, said members being spaced apart axially with their concave surfaces opposed, a plurality of radially disposed vanes carried on the concave surfaces of said members, said vanes having a uniform width substantially equal to the distance between said members at their peripheries, and the concavity of said members being such as to provide an annular air space between the adjacent edges of said vanes and communicating with said air inlet.

17. In a centrifugal blower, the combination of a casing having axial inlet and peripheral outlet openings, a pair of conical end members rotatably mounted in said casing and provided with axial air inlet openings, said end members being spaced apart axially with their concave surfaces opposed, a disk of less diameter than said members arranged centrally between said members and rotatable therewith, a plurality of vanes carried on the opposed surfaces of said mem-

bers and disk, said vanes being of a substantially uniform width substantially equal to the distance between said members at their peripheries whereby they are spaced apart axially at their inner ends so as to provide annular air spaces between the adjacent edges of said vanes and disk and communicating with said air inlet openings.

18. In a centrifugal blower, the combination of a casing having air inlet and outlet openings, a pair of conical members rotatably mounted in said casing, said members being spaced apart axially with their conical surfaces opposed, a disk of less diameter than said members arranged between them and rotatable therewith, a plurality of vanes carried on the opposed surfaces of said members and disk, the vanes carried by said disk being of channel cross section with side flanges disposed in the direction of rotation, and the vanes on said members being of angle cross section with the flange spaced away from said members and disposed in the direction of rotation, said vanes being substantially equal in width to the space between said members at their peripheries and being shaped so as to be spaced apart at their inner ends so as to provide annular air spaces between the adjacent edges of the adjacent sets of vanes.

19. In a centrifugal blower, the combination of a casing having air inlet and outlet openings, a pair of members rotatably mounted in said casing and spaced apart axially, a plurality of vanes carried by one of said members, said vanes extending across the space between said members at their peripheries and being spaced away from the other member at their inner ends so as to provide an annular air space between said vanes and said other member.

20. In a centrifugal blower, the combination of a casing having air inlet and outlet openings, a pair of members rotatably mounted in said casing and spaced apart axially, a plurality of vanes extending across the space between said members at their peripheries and being spaced away from the other member at their inner ends so as to provide an annular air space between said vanes and said other member, and each of said vanes having a forwardly extending flange on the edge opposed to said other member.

21. A device of the class described, comprising a pair of end plates rotatably mounted, being spaced apart and open at their middle part and converging toward each other at their peripheries, two sets of radially disposed vanes respectively secured against said plates, said vanes being each of a width at their outer ends corresponding substantially to the space between the peripheries of said plates, and being of a width at their inner ends considerably less than the space between the adjacent parts of said end plates, thereby providing a conical air space between the two sets of vanes and communicating with the middle openings of said plates, each of said vanes having at its inner edge a forwardly directed flange adapted to collect the air in front of the advancing face thereof and direct said air radially outward along such face.

22. A device of the class described, comprising a pair of end plates, rotatably mounted, being spaced apart and open at their middle part and converging toward each other at their peripheries, two sets of radially disposed vanes respectively secured against said plates, said vanes being each of a width at their outer ends corresponding substantially to the space between the peripheries of said plates and being of a width at their inner ends considerably less than the space between the adjacent parts of said end plates, thereby providing a conical air space between the two sets of vanes and communicating with the middle openings of said plates, each of said vanes having at its inner edge a forwardly directed flange adapted to collect the air in front of the advancing face thereof and direct said air radially outwardly along such face, said forwardly directed flanges being of a width at their inner ends considerably less than the space between successive vanes of the same set.

Signed at Chicago this 3rd day of June 1911.

JOSEPH J. STOETZEL.

Witnesses:
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