M. M. KOHN.

IMPELLER.

APPLICATION FILED MAR. 29, 1918.

1,321,378.

Patented Nov. 11, 1919.

2 SHEETS—SHEET 1.

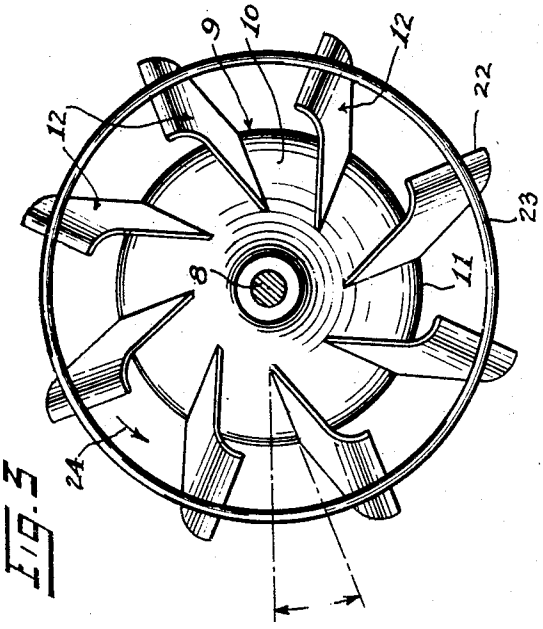


Fig. 3

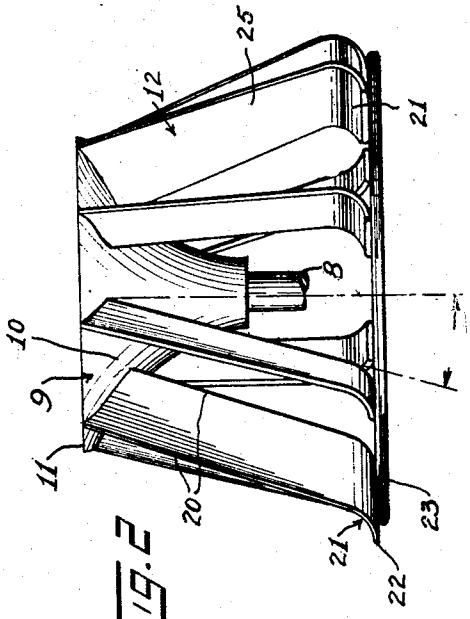


Fig. 2

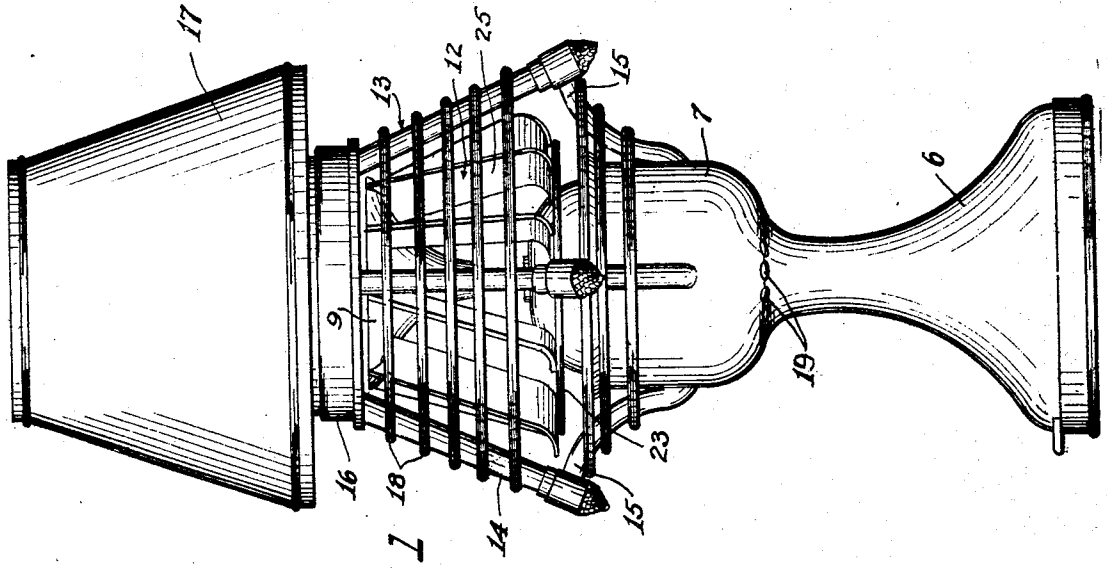


Fig. 1

Witnesses

Chas. E. Whiteman.

H. D. Penney

Inventor:

Milton M. Kohn,

By his Atty,

F. H. Richards.

M. M. KOHN.

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2 SHEETS—SHEET 2.

Fig. 4

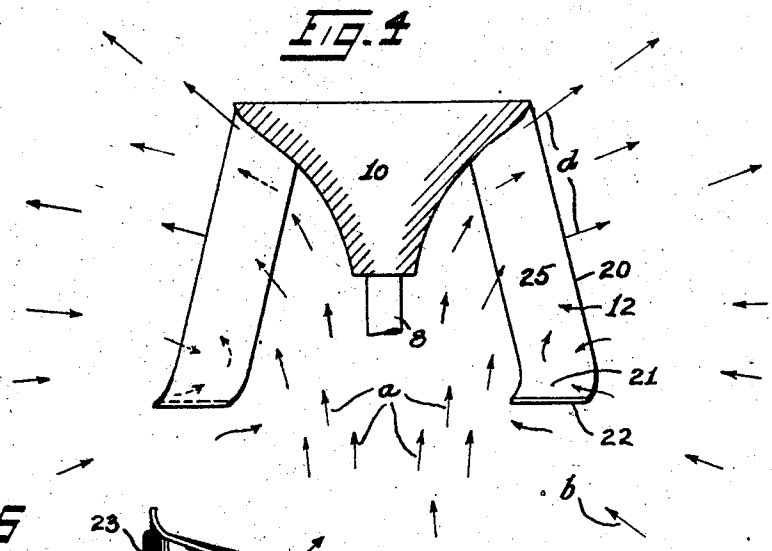


Fig. 6

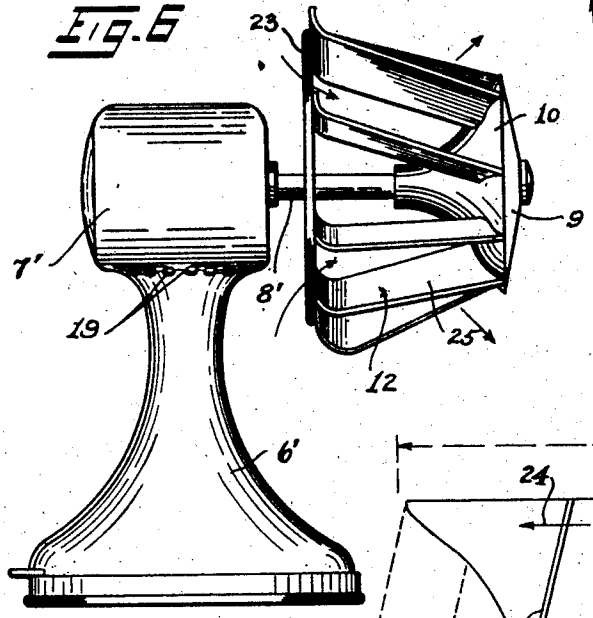
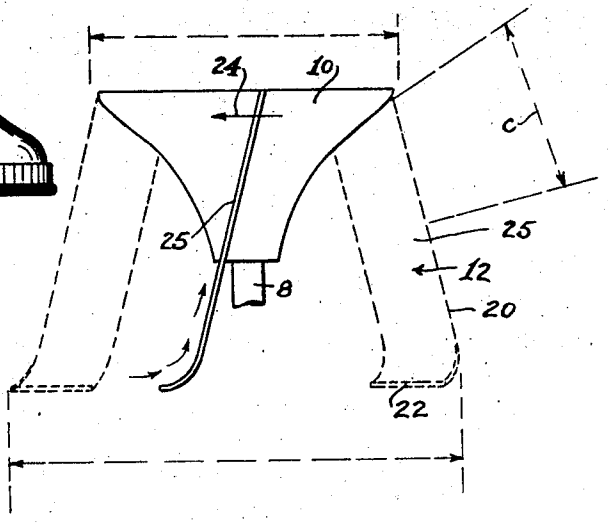


Fig. 5



Witnesses

Chas. E. Hunteman.

H. D. Penney

Inventor:

Milton M. Kohn,

By his Atty, F. H. Richards.

UNITED STATES PATENT OFFICE.

MILTON M. KOHN, OF MANHATTAN BOROUGH, NEW YORK, ASSIGNOR TO THE VENTILATOR FAN CO., INC., OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

IMPELLER.

1,321,378. Specification of Letters Patent. Patented Nov. 11, 1919.

Application filed March 29, 1918. Serial No. 225,435.

To all whom it may concern:

Be it known that I, MILTON M. KOHN, a citizen of the United States, residing in borough of Manhattan, in the county of New York and State of New York, have invented certain new and useful Improvements in Impellers, of which the following is a specification.

This invention relates to fans of the circulating and ventilating type, and more particularly to portable fans and has to do with certain improvements in the control of the radial discharge of air therefrom, and the radial directing-control of the discharge of air therefrom.

Among the main objects of the present invention it is aimed to provide a fan which is especially adapted to be mounted on a suitable support to be placed on a table or the like whereby the air will be thrust upwardly and radially outward above the heads of those seated around the table, thereby obviating the annoyance, common to most fans, of a direct blast of air blowing upon the users and at the same time providing proper circulatory movements of the air in an efficient and substantially noiseless manner.

Another object of the present invention is to provide such a table fan which when operated will be unaccompanied by any noise that would be annoying to those in the immediate vicinity of the fan.

A particular feature of the present invention is the provision of a fan, which is mounted on a support to be placed on a table or other platform and is disposed to operate at a distance from the supporting table so that it can coöperate to draw the air from the lower surrounding area and thrust it radially outward, in which no air directing means are required to coöperate with the fan to properly direct the air other than the fan blades and the disk from which the fan blades are suspended. In other words, the present invention contemplates the provision of a fan or impeller which directs the air in the desired direction without the interposition of auxiliary deflector member, rotatable or fixed. I have found by actual trial that a stream of air from this type of fan or impeller, tends to leave the outer edge of the blade at substantially a tangent or at right angles thereto. This statement of course, refers only to the main volume of the air as it is obvious that the outer portions thereof will be slightly modified owing to the pressure within the center of the outgoing stream of air. By such construction as noted in the foregoing, I am enabled to provide a fan which not only creates an air stream but also directs it in the desired direction, and the desired tangent or angle of direction of the main stream flow may be varied at will by varying the flare of the impeller members in their relative angles to the axis of rotation.

To this end, a fan is provided, having a closure at one end to facilitate directing the air discharged, in the present instance being a deflecting disk which is rotatably mounted, having fan blades extending downwardly from the disk in a circumferential path and in planes inclined downwardly and forwardly relative to planes radiating from the disk, in the direction of travel of the fan, the edges of which blades are also inclined relative to the axis of the disk in an outward direction from the disk, and the toes of which fan blades are scoop-formed with their extremities facing in the direction of travel of the disk.

By this formation of fan, the rotation of the fan will centrifugally direct the air outwardly, thereby creating a suction about the center of rotation of the fan blades, which suction will draw the air inward to replace the displaced air. The scoop-formed toes of the blades coöperate in the rotation of the fan to permit the air struck thereby to be directed upwardly along the inclined blades and then be thrust radially outward and upward from such blades by the outwardly inclined edges of the blades.

These and other features, capabilities, and advantages of the invention will appear from the subjoined detail description of certain embodiments thereof illustrated in the accompanying drawings, in which—

Figure 1 is an elevation of a device equipped with the present invention;

Fig. 2 is an enlarged fragmental elevation of the fan itself;

Fig. 3 is an enlarged bottom plan view of the fan itself;

Figs. 4 and 5 are diagrammatic views showing the action of the fan on the air; and

Fig. 6 is an elevation of a modification.

In the embodiment illustrated in Fig. 1 there is shown a device having a base 6

from which the enlargement 7 continues in an upward direction. The enlargement 7 is preferably provided to form a housing for a motor to which is operatively connected the shaft 8 on which is operatively mounted a fan, having a closure at one end to facilitate directing the air being discharged, which in the present instance, comprises a blade support fixedly mounted on the shaft 8 assuming the form of the conical deflector 9 having its deflecting surface 10 flaring outwardly and upwardly from said shaft 8 in a radial direction, the outer upper peripheral edge 11 of which deflector is preferably concentric to the shaft 8. From the flaring surface 10 extend the fan blades 12 downwardly and as shown in Fig. 1, preferably so inclined outwardly that their lower extremities project beyond the outer periphery of the housing 7. The blades 12 as shown in Fig. 1 are spaced relative to one another so as to produce a continued even flow of air as distinguished from a pulsating current of air. As a safeguard to users, the fan in the present instance is shown as provided with a guard 13, set forth more in detail in my copending application Serial No. 223,387, filed March 19th, 1918, and composed essentially of the outwardly inclined supporting rods 14, the lower ends of which are secured to arms 15 formed on and extending upwardly from the casing 7, these arms being disposed at an angle of substantially 90 degrees to one another while the upper ends of the rods 14 are connected to a cap 16 on which a lamp may be mounted inside of the shade 17, also mounted on said cap 16, and encircling said rods 14 and connected thereto at successive levels, preferably equally spaced from one another, are provided the rings 18. In the construction illustrated in Fig. 1, which is similar to the construction set forth in my copending patent application as above set forth, there are provided a series of openings 19 in the lower portion of the housing 7 so that in the operation of the fan, the air will be sucked in through said openings 19 to pass around the motor disposed in the housing 7 and thus cool the same, which air will also serve to replace a part of the air being thrust outwardly from about the axis of the fan interiorly of the blades 12.

Of the fan itself which forms the main part of the present invention, the blades 12 are, as more clearly shown in Figs. 2 and 3, preferably composed of plane sheet metal plates with their edges 20 substantially parallel to one another, which blades have their upper ends preferably embedded in the deflector 9 and extending from the surface 10, with one of their edges 20 substantially adjacent to the peripheral edge 11 of the deflector 9, downwardly so that the planes of the blades 12 are inclined relative to the imaginary planes radiating from the shaft 8. The inclination of the blades 12 relative to the radial planes projected from the shaft 8 is downwardly from the deflector 9 and forwardly in the direction of rotation of the deflector 9. Furthermore the edges 20 of the blades 12 are inclined from the deflector 9 downwardly and outwardly relative to the shaft 8. The lower ends or toes 21 of the blades 12 are preferably scoop-formed with their extremities 22 facing in the direction of rotation of the deflector 9, the lower surfaces of the scoop-formed toes 22 being substantially in the same plane so as to be connected to the ring 23 which merely serves as a brace for the blades and is formed consistent with its function of the smallest cross-sectional area possible so as not materially to obstruct or resist the incoming air.

The action of the fan is substantially as follows: When the shaft 8 is rotated in the direction of the arrow 24 of Fig. 3, the air disposed about the shaft 8 will be thrust outward by the centrifugal whirling action created by the blades 12, and due to the resulting suction formed in the center of such whirling column of air, other air will be drawn in to replace the air thus thrust outwardly. Due to the closed end of the whirling column of air formed by the deflector 9, and following the path of least resistance, as indicated by the arrows *a* in Fig. 4, the air will be drawn in from below the lower edges of the blades 12, creating an inward current of air as indicated by the arrows *b*. With the embodiment illustrated in Fig. 1, the air indicated by the arrows *a*, will of course, consist essentially of that which is being drawn up through the housing 7, while the air indicated by the arrows *b*, will consist mainly of that drawn from the exterior of the housing 7. As the air *a*, reaches the flaring surface 10, it will be gradually deflected outward to assist the centrifugal whirling action created by the rotation of the fan blades 12. Some of this inwardly moving current of air will pass into the path of movement of the toes 21 and be engaged by the same and directed up the inclined surfaces 25 until it reaches the zone indicated by the line *c* where the air so drawn in will then be directed outwardly with the main body of discharging air *d*. The scoop-form of the toes 21 will coöperate to facilitate the engagement and upward direction of the inward current of air *b*. The edges 20 of the circumferentially angled, axially inclined blades 12 will coöperate with the discharging air from the zone *d*, Fig. 4, to direct the said air in an upwardly inclined direction and in an annular angularly inclined stream. This angular upward discharge of the air is due to the tendency of the air in the main portion

of its stream to move away from the outer leaving edge 20 of the blades 12 at a tangent, the outer zones of the outflowing stream tending to flare somewhat away from said tangent owing to the pressure in the middle of the stream.

In fans of this type heretofore, it has been found in practice that that portion of the blades nearest the intake end of the fan show the least efficiency and in order to obviate rotating or eddy currents and to increase the "pick-up" of the air at these fan ends, I have curved the said ends forwardly in the direction of rotation of said fan as at 21. I have found that this intake capacity of the fan somewhat increases the discharge zone *c*, Fig. 5, so that the natural increase of discharge follows the natural increase of efficiency of said intake portion 21.

In the embodiment illustrated in Fig. 6, I have shown my device attached to an ordinary standard fan motor in which the motor 7′ is attached to the customary base 6′, the shaft 8′ thereof being extended in order to receive thereon the rotated impeller member generally denoted by 25. In the present instance, the point of connection between the motor housing and the base member 6′ may be provided with a series of ventilating openings 19, so that part of the suction flowing into the impeller will be drawn through the armature space at the motor, not shown, thereby tending to keep the motor cool. In this embodiment as set forth there is not shown the customary fan guard for purposes of safety although it is obvious that these may be used or not, in accordance with location and use.

From a careful consideration of the foregoing, it is obvious that my impeller creates a discoidal discharge somewhat flaring, the flare or angularity of discharge being entirely within the control of the angle of rotation of the blades about the axis of rotation and that the discharge therefrom is of a high velocity, therefore counting for economy in current consumption and at the same time rendering it more noiseless than fans of this type heretofore used owing to the dispensing of any form of deflectors within the path of the flowing or discharging air.

It is obvious that various changes and modifications may be made to the details of construction without departing from the general spirit of the invention.

I claim:

1. In an apparatus of the character described, the combination of a flaring deflector; and a plurality of revoluble blades arranged around said deflector and each extending from near a zone of the larger part of the deflector in a direction away from a transverse plane passing through said larger part, an effective portion of each blade being forwardly inclined relative to its direction from said plane, thereby serving to squeeze the discharging air against said zone.

2. In an apparatus of the character described, the combination of, a flaring deflector; and a plurality of revoluble blades arranged around said deflector and each extending from near a zone of the larger part of the deflector in a direction away from a transverse plane passing through said larger part; each blade being forwardly inclined relative to its direction from said plane, and the space surrounding said zone being substantially free of structure tending materially to limit the circumferential discharge of air.

3. In an apparatus of the character described, the combination of, a flaring rotary deflector; and a plurality of revoluble blades arranged around said deflector and secured thereto and each extending from near a zone of the larger part of the deflector in a direction away from a transverse plane passing through said larger part; the space surrounding said zone being substantially free of structure tending materially to limit the circumferential discharge of air; an effective portion of each blade being forwardly inclined relative to its direction from said plane.

4. In an apparatus of the character described, the combination of, a flaring deflector; and a plurality of revoluble blades arranged around said deflector and each extending from near a zone of the larger part of the deflector in a direction away from a transverse plane passing through said larger part; an effective portion of each blade being forwardly inclined relative to its direction from said zone, said inclination increasing at the portion of the blade more remote from said zone.

5. In an apparatus of the character described, the combination of, a flaring deflector; and a plurality of revoluble blades arranged around said deflector and each extending from near a zone of the larger part of the deflector in a direction away from a transverse plane passing through said larger part; the space surrounding said zone being substantially free of structure tending materially to limit diffusion resulting from the flare of the deflector; an effective portion of each blade being forwardly inclined relative to its direction from said zone, said inclination increasing at the portion of the blade more remote from said zone.

6. In an apparatus of the character described, the combination of, a rotary flaring deflector; and a plurality of revoluble blades arranged around said deflector and secured thereto and each extending from near a zone of the larger part of the deflector in a direction away from a transverse plane passing

through said larger part; the space surrounding said zone being substantially free of structure tending materially to limit the lateral discharge of air; an effective portion of each blade being forwardly inclined relative to its direction from said zone, said inclination increasing at the portion of the blade more remote from said zone, thereby to form a sharper forwardly curved end portion.

7. In an apparatus of the character described, the combination of, a flaring deflector serving to divert air moving along said deflector into an outwardly flaring path; and a plurality of slightly divergent revoluble blades arranged around said deflector and each extending approximately longitudinally of said deflector from near a zone of the larger part of the deflector in a direction away from said zone; the space surrounding said zone being substantially free of structure tending materially to limit diffusion resulting from the flare of the deflector; a part of each blade being forwardly inclined relative to its direction from said zone, said blade being wide and said inclination increasing at parts more remote from said zone, thereby to form a forwardly curved end portion; said forward inclination and curve coöperating to scoop the air at the end part of the blade and to force it along the blade, whereby said blade and deflector coöperate to squeeze together the air at said zone to discharge it at said zone at an angle to the axial line of the defleetor.

8. In an apparatus of the character described, the combination of, a flaring deflector; and a plurality of revoluble blades arranged around said deflector and each extending from near a zone of the larger part of the deflector in a direction away from a transverse plane passing through said larger part; the space surrounding said zone being substantially free of structure tending materially to limit the lateral discharge of air; said blade and deflector cooperating to concentrate the air at said zone to discharge it at said zone at an angle to the axial line of the deflector; the outer edge of each blade being somewhat more advanced than the inner edge to increase the speed of the egress at the part nearer said zone, and to facilitate ingress at the part more remote from said zone, and to coöperate with said inclinations to assist in the scooping-movement.

9. In an apparatus of the character described, the combination of a flaring deflector, and revolving blades arranged around said deflector and extending away from the plane of the larger part of the deflector, and longitudinally forwardly inclined relative to the direction of rotation, in order to move the air along the blade and squeeze it against the air at said larger part to discharge the air outwardly, at an angle to the axial line of the deflector; said support being adapted to produce a current having a form approximating a cone surface inclosing a comparatively calm cone of air free from direct drafts and moved only by entrainment.

10. In an apparatus of the character described, the combination of an upwardly flaring rotary blade-support serving to divert upwardly moving air into an outwardly flaring path surrounding the upper surface zone of said support; and a plurality of downwardly disposed blades secured to said support at said zone, each blade as a whole being, from the top down, forwardly inclined thereby serving to squeeze the discharging air against said zone.

11. In an apparatus of the character described, the combination of an upwardly flaring rotary blade-support serving to divert upwardly moving air into an outwardly flaring path surrounding the upper surface zone of said support, and a plurality of downwardly disposed blades secured to said support at said zone, the lower end of each blade being forwardly curved, the blade as a whole being, from the top down, forwardly inclined; said forward inclination and curve coöperating to scoop up the air at the lower part of the blade and to force it upwardly of the blade, whereby said blade and support coöperate for concentrating and discharging the air at said zone.

12. In an apparatus of the character described, the combination of an upwardly flaring rotary blade-support serving to divert upwardly moving air into an outwardly flaring path, the space surrounding the upper surface zone of said support being substantially free of obstructions; and a plurality of downwardly disposed blades secured to said support at said zone, the lower end of each blade being wide and forwardly curved, the blade as a whole being, from the top down, forwardly inclined; said forward inclination and curve coöperating to scoop-up the air at the lower part of the blade and to force it upwardly of the blade, whereby said blade and support coöperate for squeezing together and concentrating the diverted and scooped-up air at said zone to discharge it freely at said zone in a substantially cone-shaped path at a pressure increasing toward the upper part of the zone.

13. In an apparatus of the character described, the combination of an upwardly flaring rotary blade-support serving to divert upwardly moving air into an outwardly flaring path, the space surrounding the upper surface zone of said support being substantially free of obstructions; and a

plurality of downwardly disposed blades secured to said support at said zone, the lower end of each blade being wide and forwardly curved, the blade as a whole being, from the top down, forwardly inclined; said forward inclination and curve coöperating to scoop up the air at the lower part of the blade and to force it upwardly of the blade, whereby said blade and support coöperate to squeeze together and concentrate the air at said zone to discharge it at said zone at an angle approximating 30° and at a pressure increasing toward the upper part of the zone; the outer edge of each blade being somewhat more advanced than the inner edge to increase the speed of the egress at the upper part and to facilitate ingress at the lower part and to coöperate with said inclinations to assist in the scooping-up movement.

14. In an apparatus of the character described, the combination of an upwardly flaring rotary blade-support serving to divert upwardly moving air into an outwardly flaring path surrounding the upper surface zone of said support, a plurality of downwardly disposed blades secured to said support at said zone, the lower end of each blade being forwardly curved, the blade as a whole being, from the top down, forwardly inclined; said forward inclination and curve coöperating to scoop up the air at the lower part of the blade and to force it upwardly of the blade, whereby said blade and support coöperate for concentrating and discharging the air at said zone; and a ring securing together and mutually bracing the lower ends of the blades and formed sufficiently narrow to permit the scooping-up action to take place freely.

15. In an apparatus of the character described, the combination of a rotary flaring blade support; and blades secured to said support and extending away from the plane of the larger part of the support, the blades being longitudinally forwardly inclined relative to the direction of rotation, in order to move the air along the blade and squeeze it against the air at said larger part to discharge the air outwardly, at an angle to the axis of the blade support; said support being adapted to produce a current having a form approximating a cone surface inclosing a comparatively calm cone of air free from direct drafts and moved only by entrainment.

MILTON M. KOHN.

Wttnesses:
G. Drews,
H. D. Penney.