No. 865,962. PATENTED SEPT. 10, 1907.

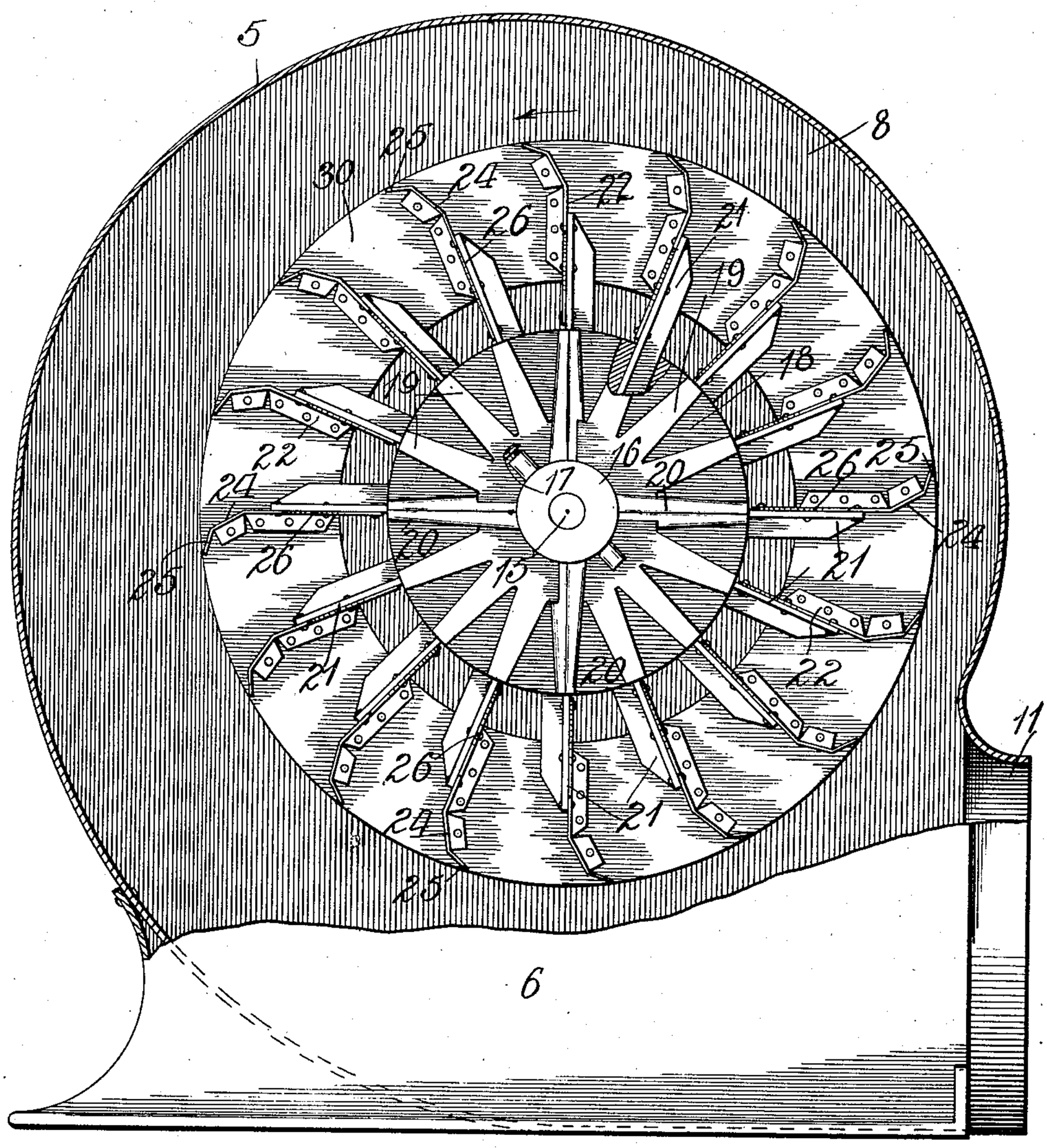
W. E. ALLINGTON.

CENTRIFUGAL FAN.

APPLICATION FILED JUNE 18, 1906.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
Ray White.
Harry R. White

Inventor:
William E. Allington
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By

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2 SHEETS—SHEET 2.

Fig. 2.

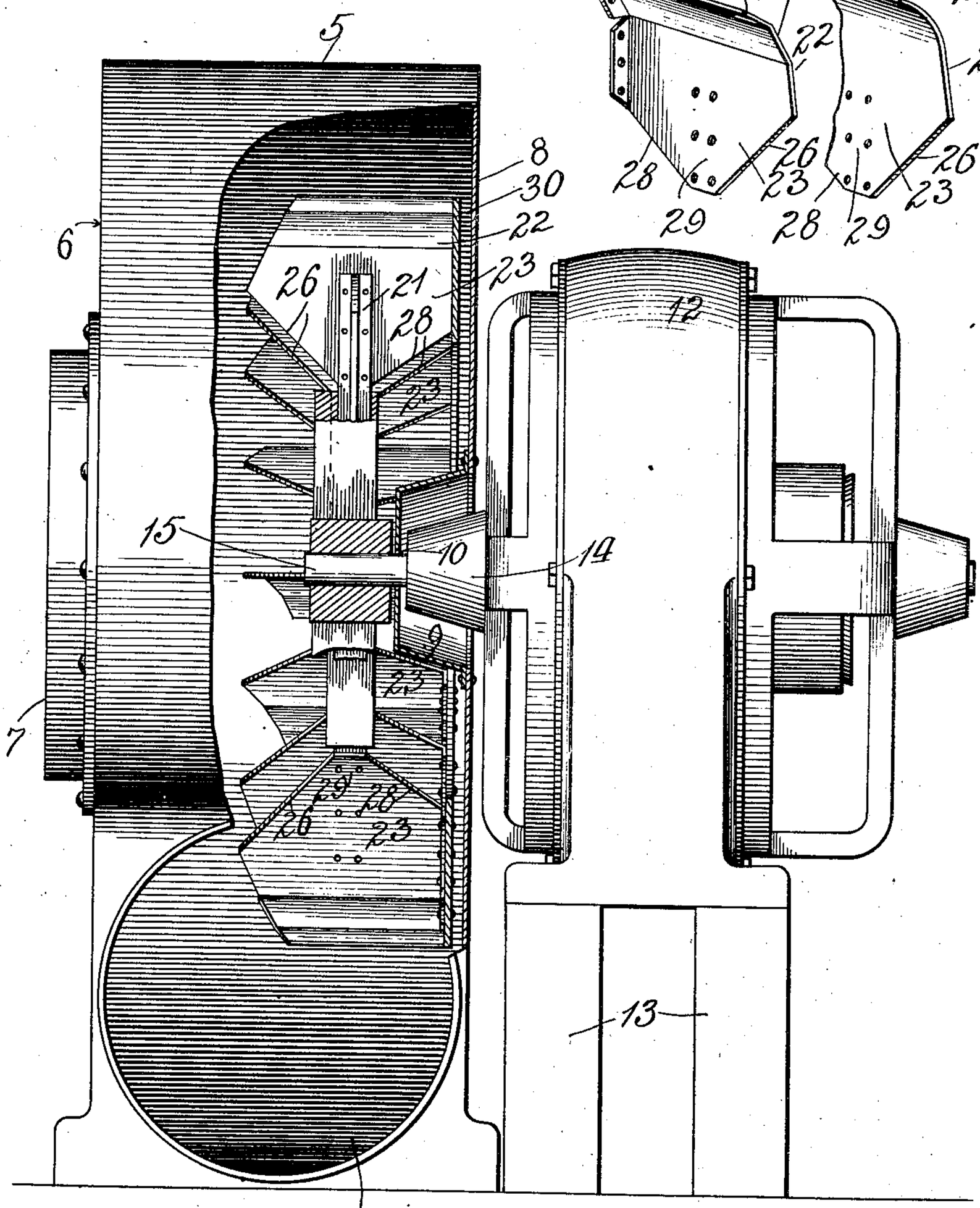

Fig. 3.

Fig. 4.

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UNITED STATES PATENT OFFICE.

WILLIAM E. ALLINGTON, OF SAGINAW, MICHIGAN.

CENTRIFUGAL FAN.

No. 865,962. Specification of Letters Patent. Patented Sept. 10, 1907.

Application filed June 18, 1906. Serial No. 322,225.

To all whom it may concern:

Be it known that I, WILLIAM E. ALLINGTON, a citizen of the United States, residing at Saginaw, in the county of Saginaw and State of Michigan, have invented certain new and useful Improvements in Centrifugal Fans, of which the following is a specification.

My invention relates to centrifugal fans, and particularly to fans of the general type illustrated in my prior application, Serial No. 243,204, filed January 30th, 1905.

The primary object of my invention is to provide an improved fan particularly adapted for the handling of material, such as the refuse from wood-working, milling and other manufactories.

One of the salient objects of my invention is to provide a material handling fan which will have relatively high efficiency to enable it to work against resistance, and yet will freely receive and deliver material to be handled.

Another object of my invention is to provide an improved wheel construction whereby the fan is adapted for service under widely varying conditions as to the character of material to be handled, and is adapted to withstand the shocks and strains incident to the handling of material of various qualities.

Yet a further object of my invention is to associate the fan wheel with driving means in such manner as to minimize the deleterious vibration of the fan wheel and driving means.

Other and further objects of my invention will become apparent to those skilled in the art from the following description taken in conjunction with the accompanying drawing, wherein:

Figure 1 is a side view, with the casing broken away, of a fan embodying my invention. Fig. 2 is an end elevation, with part of the casing and fan wheel broken away, of an embodiment of my invention. Figs. 3 and 4 are details of two forms of blade structure suitable for use in the embodiment of my invention.

Throughout the drawings like numerals of reference refer always to like parts.

In the drawings, 5 indicates in general a scroll-shaped fan casing, whereof 6 is the front side having therein an inlet 7; and 8 is the rear side having therein a recess 9, alining with the inlet 7, and having a central aperture 10 for the reception of the fan supporting shaft.

11 indicates the peripheral outlet, tangentially disposed.

12 indicates a driving means, illustrated as an electric motor, supported as on the bearing blocks 13 independently of the fan casing, and provided with a hub 14, as is usual in such motor devices, arranged to fit in the recess 9 of the fan casing, the motor being also provided with the usual protruding shaft 15, which projects through the aperture 10 in the wall of said recess 9 into the interior of the fan casing to support the fan wheel. This manner of mounting the motor I have found to be very advantageous, as it permits the use of standard motors without providing extra long shafts and the supporting of the motor independently of the fan casing prevents the long-wave vibration of the diaphragm-like sides of the fan casing from being communicated to the motor mechanism or the fan wheel on the motor shaft.

In referring to the fan wheel I will advert to the wheel in general as having a "front side" toward the inlet, a "rear side" away from the inlet, and to the various blades incorporated in the fan wheel as each having a "front face" which is the forward surface of the blade with reference to the direction of rotation of the wheel, and a "rear face", which is the opposite surface of the blade. It will also be understood that in referring to "radial" blade parts, or arms, I mean, approximately radial, as for convenience devices best arranged radially are sometimes in this art built at a slight angle to true radial position.

Referring to the wheel structure, 16 indicates the hub secured, as by set screws 17, to the motor shaft 15, and preferably having integrally cast therewith an annular disk 18, having a number of ribs 19, equal to the number of blades of the wheel, formed thereon, and having at intervals, on its front face only, radially-disposed, laterally-projecting ribs 20, which serve some of the functions of narrow blades, and which I will arbitrarily term "projector" ribs for distinction from the ribs 19.

To the disk 18 and ribs 19, are suitably secured radial angle iron arms 21, in number corresponding to the number of blades, and each having riveted, or otherwise secured to its front flat face, a blade 22. For convenience the arms 21 are positioned in the mold, and the center casting cast around them, though other modes of attachment may be substituted. Each blade 22, independently supported on an arm 21, preferably lies wholly without the periphery of the disk 18, and provides a relatively deep radial portion 23, and a forwardly deflected portion terminating in a delivery lip, which projects sharply forward with reference to the direction of rotation of the wheel, to deliver air and material therefrom into the clearance space surrounding the wheel in a direction approximating parallelism at the point of delivery, to the direction of progress of the air and material in flow past such point in the clearance space. To this end the forwardly deflected portion, as illustrated in Fig. 3, may comprise an intermediate part 24 forming a very obtuse angle with the radial portion 23, and relatively shallow when compared with said radial portion, and a still shallower lip portion 25, projecting at an obtuse angle to the intermediate portion 24, so that its rear face meets at an acute angle a tangent drawn to the periphery of the wheel at the delivery edge

of the end of the lip; or the deflected portion may, as shown in Fig. 4, consist of a curved part 25′ terminating in a delivery lip, disposed at substantially the same angle as the lip portion 25 of the first described blade. The function of such a deflected structure is to form upon the blade a pocket for dead air, whereon the air in flow past the front face of the blade may form its own delivery curve, from radial to nearly tangential, so that the least possible resistance to the change of direction may be encountered, and that when delivered to the clearance space the air and material may be flowing in a direction generally parallel to the direction of flow in the clearance space. As a result back pressure in the fan is minimized, or conversely stated, efficiency of the fan is largely increased. I have found that the nearer to true tangential the arrangement of the delivery lip the greater the efficiency of air delivery, but in a material handling fan it is necessary, in order to prevent undue pocketing of material, to arrange the delivery lip at a slight angle to true tangential. This I have found may be done without negativing or destroying the beneficial action of the air pockets in the blades, but the particular angularity of the delivery lip to true tangential, which may be provided without material detriment to the action of the fan, is dependent somewhat on the speed at which the fan is designed to run, the higher the speed the greater being the latitude of angularity permissible.

The blades 22 are mounted to extend on both sides of the plane of the supporting arms 21, that is toward the front and rear sides of the casing, the radially inner edge of each blade on the side of the supporting arm toward the front of the casing being preferably cut away, as shown at 26, at such an angle to the horizontal as to permit stringy material, which may lodge thereon, to slide radially off of the cut-away edge under the influence of centrifugal force. The rear portion of the radially inner blade-edge is preferably also cut away somewhat, as shown at 28, so that the radially inner portion of the blade tapers toward the axis of rotation through an area as generally shown at 29.

To close the ends of the pockets formed by the deflected portion of the blades, adjacent the rear side of the casing, and further to prevent the passage of material radially through the wheel to the rear side of the casing, I provide an annular plate 30 extending radially outward to the ends of the delivery lips of the blades and radially inward a suitable distance, the central opening of the plate 30 being preferably not greatly larger than the diameter of the disk 18.

The width of the fan wheel, by which I mean its extent from its rear side to its front side, is preferably considerably less than the internal width of the casing, and the wheel is mounted with its rear side as close to the rear side 8 of the fan casing as good practice will permit, so that there is left a wide clearance space on the front or inlet side of the casing, such space in width being preferably at least one third of the total width of the fan casing.

In the operation of the fan, the wheel, set in rotation by its motor, entrains air and material through the inlet 7. Heavy pieces of material, such as blocks of wood and the like, (where the fan is used for instance to handlere fuse from a woodworking mill,) strike the solid disk 18, or the narrow heels of the blades adjacent such disk, which is so substantially built as to withstand without injury the impact of such material traveling at a relatively high velocity, and projector ribs 20 start such heavy articles in rotation and impart thereto an initial centrifugal action which relieves the work of the blades proper 22. By reason of the forward deflection of the blades, as heretofore described, the air and material, as delivered into the clearance space peripherally without the wheel, travel in a direction generally corresponding to the direction of travel of the air and material already in the clearance space, the pocket in the blade being of such configuration as to permit the air in flow past the blade to form its own delivery curve upon a body of substantially dead air carried in the pocket. The relation of the disk and back plate shown I have found effective in preventing material from passing through the wheel from its front side to its rear side in escape from the blade, as in seeking to effect such passage the material is always somewhat affected by centrifugal force, and I have found that as a result material always is thrown outward at such an angle that the inner edge of the back plate 30 may be somewhat more remote from the axis than the periphery of the disk.

The arrangement of the blades, in large number, not less than twelve, I have found advantageous for the reason among others, that the increased efficiency, due to the pocket structure of the blades is lost in greater or less degree as the number of blades is decreased, and I have found it to be practically impossible to obtain any material advantage by the use of a pocket construction of blade where the blades number less than twelve to the wheel, and in practice I prefer to employ sixteen or more blades. Further the arrangement of the blades upon independent supports has advantage, aside to the strength and rigidity imparted to the wheel, in that it enables me to dispense with any sort of connection between the blades on the front side of the wheel, so that the inclined inner edges 26, of the blades join with the free front edges of said blades and facilitate the escape of stringy materials which may mass or bunch upon the blades upon their entrance into the wheel. I have also found by experiment that the clearance between the periphery of the wheel and the surrounding casing may be reduced, if compensating increase in area be provided in the casing by widening said casing, relative to the wheel, and for this reason I provide a casing much wider in relation to the width of the wheel than the present customary practice would dictate, as I find that thereby I am enabled to use a deeper wheel, or one of greater diameter in connection with a casing of any given depth or diameter without deleteriously effecting the action of the fan.

While I have herein described in some detail a specific embodiment of my invention, which in actual practice I have found to be satisfactory in its operation, it will be understood that I do not intend to limit my invention to the specific details shown and described further than as specified in the claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent of the United States, is:

1. In a centrifugal fan for handling material, the combination with a fan casing, having an eye in its side, of a

wheel, comprising a hub, twelve or more blades each free throughout its edge adjacent the inlet, a back plate connecting the back edges of the blades, and a separate supporting arm for each blade connected with the radial mid-portion of the blade and connected with the hub.

2. In a centrifugal fan for handling material, the combination with a fan casing having an eye in its side, of a wheel comprising a hub, a plurality of blades each free throughout its edge adjacent the inlet, and providing a relatively deep radial portion and a forwardly deflected lip portion, arranged to form when the wheel is rotated a pocket for substantially dead air whereon the air in flow past the blade may form its own delivery curve, a back part connecting the blades and closing one side of the pocket of each blade, and a separate supporting arm for each blade connected with the radial mid-portion of the blade and connected with the hub.

3. In a centrifugal fan for handling material, the combination with a casing providing an axial inlet and a peripheral outlet, of a wheel providing a central flat disk alining with the inlet to receive the impact of material entrained through the inlet, radial ribs upon the face of said disk adjacent the inlet, and blades arranged wholly beyond the disk.

4. In a centrifugal material handling fan, a casing, a wheel open throughout on its front side, and comprising a plurality of supporting arms equal in number to the blades, a blade secured to each supporting arm, the radially inner edge of each of said blades being inclined, from its point of juncture with the supporting arm toward the front of the casing, to permit the centrifugal delivery of stringy material encountering the edge of the blade toward the open front side of the wheel.

5. In a material handling fan, a wheel comprising blades, each having a relatively deep radial portion, a forwardly deflected pocket portion adapted to contain a body of substantially dead air whereon the air in flow past the blade may form its own curve from radial entry to approximately tangential delivery, each blade being free at its front side and shaped to provide a portion closest to the inlet intermediate the tip and heel of the blade, the front edge of the blade being inclined rearwardly from such point to its tip, means for closing the rear sides of the pockets in the blades, and means for supporting the blades.

6. In combination, a suitable support, a motor thereon having a projecting shaft, a fan wheel mounted on the shaft, a fan casing surrounding the said wheel providing a rear wall of relatively large area, having an aperture therein for the shaft, wherethrough said shaft projects out of contact with the wall, the middle area of said wall, susceptible to vibration due to the action of the fan wheel, being out of contact with the motor and its support, whereby the motor and fan wheel are not affected by the long-wave vibrations of the rear wall of the fan casing.

In testimony whereof I hereunto set my hand in the presence of two witnesses.

WILLIAM E. ALLINGTON.

In the presence of—
MARY F. ALLEN,
GEORGE T. MAY, Jr.