

No. 762,470.

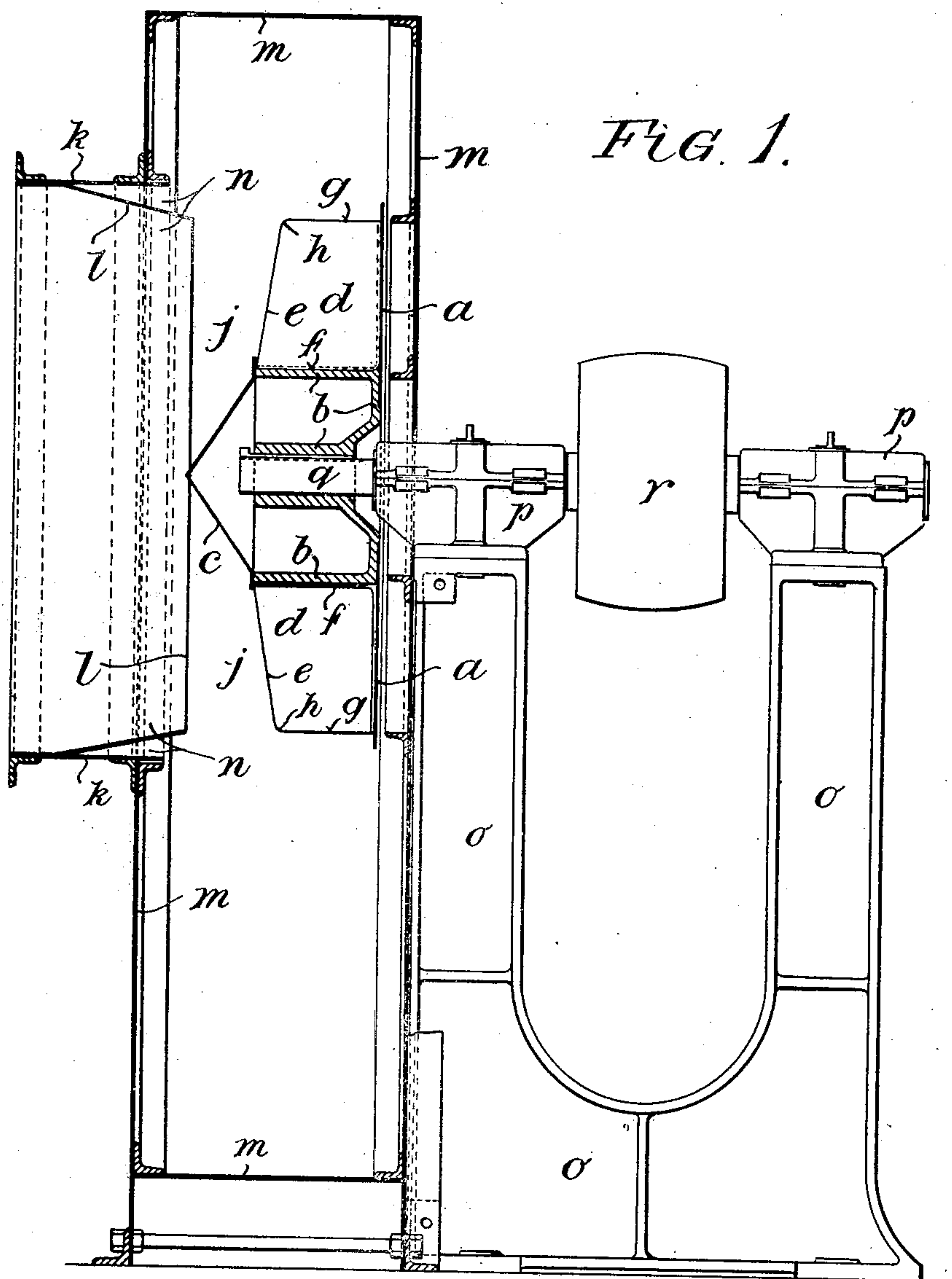
PATENTED JUNE 14, 1904.

S. C. DAVIDSON.
CENTRIFUGAL FAN.

APPLICATION FILED APR. 11, 1903.

NO MODEL.

2 SHEETS—SHEET 1.



WITNESSES:

Irel White
Thomas Wallace

INVENTOR:

Samuel Cleland Davidson,

By his Attorneys,

Arthur C. Fraser & Co.

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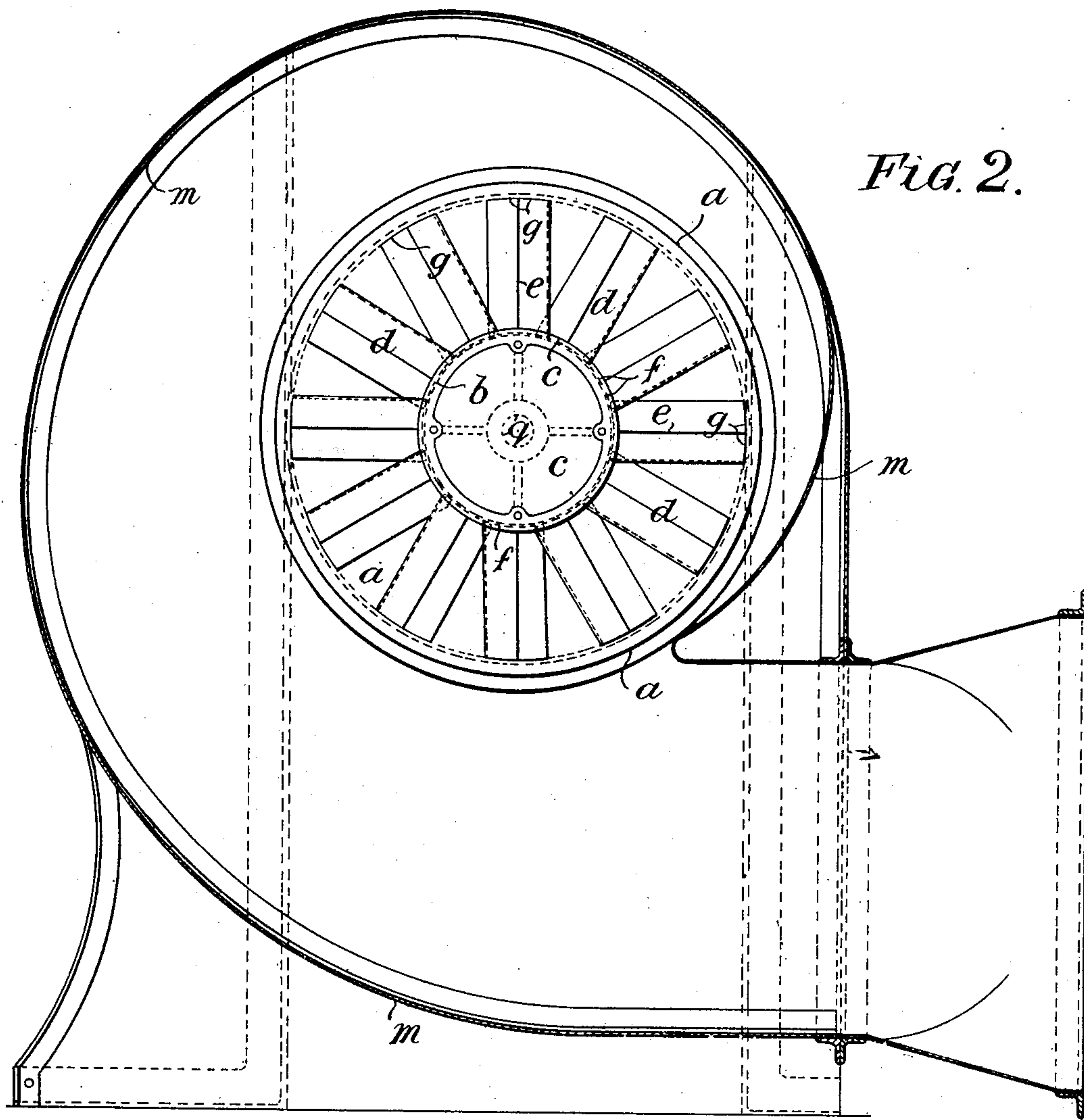
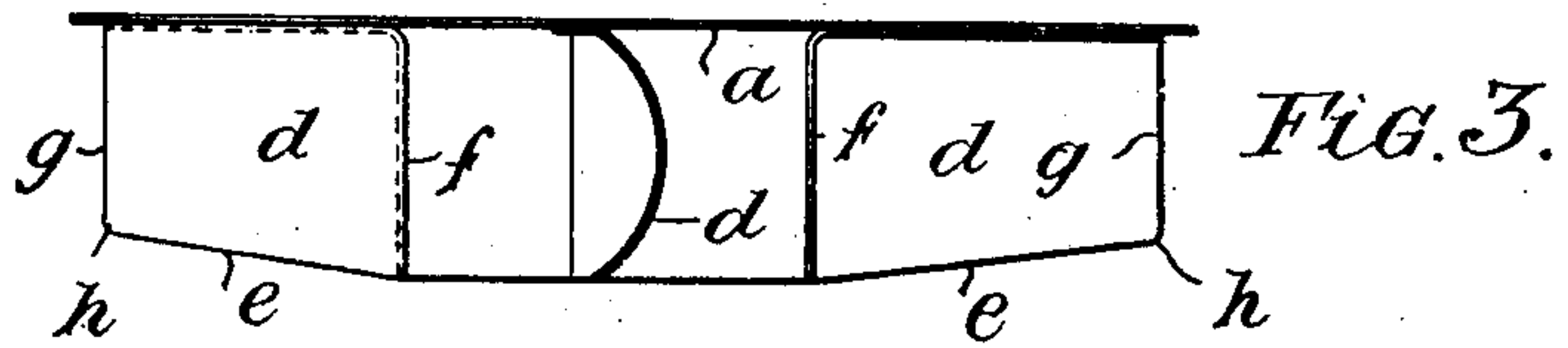
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UNITED STATES PATENT OFFICE.

SAMUEL CLELAND DAVIDSON, OF BELFAST, IRELAND.

CENTRIFUGAL FAN.

SPECIFICATION forming part of Letters Patent No. 762,470, dated June 14, 1904.

Application filed April 11, 1903. Serial No. 152,144. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL CLELAND DAVIDSON, merchant, of Sirocco Engineering Works, Belfast, Ireland, have invented certain new and useful Improvements in Centrifugal Fans, of which the following is a specification.

My improvements relate more particularly to centrifugal fans when employed for the removal of shavings, straw, rags, and other substances of a stringy nature (hereinafter called the "material") from workshops by drawing same first through suction pipes or ducts connected to the inlet-opening to the fan, thence through the fan itself, and then propelling same from the fan discharge-nozzle through a pipe to wherever the material may require to be delivered.

My invention provides also a new fan specially adapted for conveying by a blast of air and through the fan a great variety of materials—such, for example, as are now handled by pneumatic stackers and the like.

In the ordinary construction of said centrifugal fans the inflowing current of air in which the material is carried (hereinafter called the "air-current") is admitted to a space within the inner edges of the blades constituting an intake-chamber within the fan itself which is practically a continuation of the inlet-opening in the fan-casing and of substantially equal diameter therewith, and in some forms of said fans the lateral ends of the blades are connected together and sometimes entirely closed by a ring or annulus. A serious difficulty hitherto pertaining to the employment of such fans for duty of the above-described nature is that stringy substances—such as shavings, straw, rags, &c.—on entering the fan get, as it were, astride of the inner edges of the fan-blades, so that the fan itself soon becomes completely choked up therewith, thus necessitating its being frequently stopped to be cleaned out; and the object of my improvements is to so construct the fan that it is impossible for the material passing through it to effect any lodgment on the edge of the blades.

According to this invention the edges of the fan-blades which face the inlet are so formed

and their axial edges so assembled that no edges are exposed which will overhang or obstruct the path which the material will travel through the fan—from inlet to discharge, for instance. I entirely close the inner edges of the blades throughout their entire length by mounting and attaching same upon a central cylindrical hub or by fitting them with a central shield, so that said inner edges of the blades are thus entirely sheltered from material lodging upon or passing through between them, while the lateral ends of the blades toward the inlet-openings of the fan are left entirely open and unconnected with one another and have no projection axially beyond the terminal end of the inner edges of the blades toward the inlet-opening but preferably are in the same plane or recede therefrom in the direction of the center of the tips of the blades. By this means no surfaces are exposed upon which the material can lodge or be retained by centrifugal tendency under the action of the fan. The inlet-opening to said fan I preferably make of a diameter at least as great as, and preferably substantially greater than, that of the circle in which the inner edges of the blades rotate, and which inlet-opening communicates directly with the spaces between the blades through between the lateral ends thereof, and as there is absolutely no radial flow of air from the center of the fan through between the inner edges of the blades the entire flow of air takes place axially over and past the lateral edges of said blades into the spaces between same. The size of the inlet-opening facilitates also the assembling of the fan in the casing.

In my preferred construction or form of the fan I make the lateral edges of the blades toward the inlet-opening into the fan-casing substantially radial from the fan-shaft or with a slight taper toward the center of their tip edges, so that any material which may get astride of said lateral edges when entering the fan through the inlet-opening in the fan-casing will slide along said lateral edges up to and be thrown off the tips of the fan-blades by centrifugal force—that is to say, the inner ends of said lateral edges extend toward the fan-inlet at least as far as, and preferably beyond, the outer ends thereof—and, further,

in order that this material when it comes through the fan-inlets in lumps or clusters, as is frequently the case with rags or shavings (an armful of which at a time is often thrown
5 into the suction-pipes leading up to the fan-inlet) or with blocks of wood which may accompany the shavings and which are too large to enter the space between the blades, and consequently only strike against their lateral
10 edges, may nevertheless pass with the air-current through the fan without "jamming" between the blades and the sides of the fan-casing facing same, I make the axial width of the fan-casing sufficiently larger than the greatest
15 axial width of the blades to provide a passage-way for said material to pass from the inlet-opening to the circumference of the fan-casing without having to enter the spaces between the blades. In practice I have found
20 that the provision of this space does not to any material extent detract from either the suction or discharge pressure of the fan.

By tapering the blade edges as described the tip edges will be shorter than their inner
25 edges, while the radial edges of the blades form an obtuse angle with the axial direction of the inflowing air through the eye of the fan-casing to the blades, said radial edges being entirely open and unconnected with one
30 another, except at the hub, and with the corner between said radial and the tip edges of the blades preferably rounded to let any material which may get astride of the radial edges be thrown off same more freely.

35 The intermediate surface of the blades between their inner and tip edges may be formed as a plane, but are preferably with a concave curve in the direction of the fan's rotation, through a line parallel with the axis of the
40 fan, whereby not only is the strength of the blade greatly enhanced, (which is a very important matter for duty of this class when the fans are running at a high speed, as the edges of the blades then strike against the material
45 with much force,) but the action of the blades on the air is also improved as compared with what same would be if the blades were made with a flat surface between said radial edges thereof.

50 Reference to the accompanying drawings will more fully explain the nature of my invention and how same is carried into effect.

Figure 1 is a cross-sectional elevation; Fig. 2, a side elevation looking in the direction of
55 the inlet to the fan, and Fig. 3 a plan of the wheel or rotary member of one form of my improved fan for the purpose described. In the latter view for clearness of reference only three blades are indicated.

60 The letters indicating the various parts are the same in each figure and are as follows:

a is a disk to which is attached a central hollow cylindrical hub *b*, the opposite end of which from the disk is closed by preferably a
65 cone-shaped projection *c*, the apex of which

is toward the inlet-opening of the fan. Around the outer surface of said hub *b* the inner edges of the blades *d d* are mounted as close-fitting attachments and without any axial projection beyond the end of said cylindrical hub. The
70 radial edges of said blades which are next the disk are suitably flanged for attachment thereto, and the opposite radial edges, which are toward the inlet-opening in the fan-casing, are preferably made with a slight taper from the
75 hub outward toward the tips in the direction of the fan-disk, as shown at *e e*, so that their tip edges *g g* are shorter than their inner edges *f f*, and said radial edges *e e* and tip edges *g g* are open from disk to hub and without any in-
80 termediate connections from one blade to the other. The inner axial edges *f* are also flanged, as shown, so as to stiffen the curve by forming a sort of diaphragm across it to make a strong attachment and at the same time leave free the
85 spaces between the blades. When the blades are thus constructed, the centrifugal force developed when the fan is rotating causes any string like material which the inflowing air may drive against and place astride of the ra-
90 dial edges of the blades to slide along same to and be thrown clear off the tips, and as the material has thus no catchment-place of any sort on the edges of the blades and as there is sufficient space provided at *j* between the open
95 radial edges and the side of the fan-casing facing same for any material which gets astride of the radial edges of the blades to pass freely between same and the side of the casing without jamming, while the surfaces of
100 the blades and of the disk have no projections of any sort upon which the material passing through into the spaces between the blades could effect a lodgment, the air-current through the fan consequently carries the ma-
105 terial along with it at substantially its own velocity and discharges it through the discharge-nozzle from the fan-casing. The corner between said radial and tip edges of the blades is preferably rounded, as shown at *h h h*, to
110 let any of the material which may get astride of the radial edges be thrown off same more freely.

The above-described operation of my improved fan is so effective that after a long
115 period of work in discharging through it stringy material—such as long shavings, cotton-waste, ribbon-like rags, or cuttings of leather, &c.—the blades are found to be clean and free from any lodgment of such material
120 upon them.

k is an annular ring forming the inlet-opening to the fan and of greater diameter than the fan itself, to the inner side of which is fitted an inwardly-tapering ring *l*, which at its
125 inner end is preferably of slightly less diameter than that of the circle in which the tip edges of the blades revolve.

m is the fan-casing; *n*, the inlet-opening therein, within which the ring *k* and its con-
130

tained cone-ring *l* are detachably applied, so that on removal of these the rotary member of the fan can be inserted or withdrawn bodily through the inlet-opening *n* in the side of the casing.

o is the pedestal on which the bearings *p p* for driving shaft *q* are mounted, the latter being driven by the pulley *r*.

I do not limit myself to the particular construction and arrangement of the fan or fan-blades shown in these drawings, as it will be obvious that the fan itself may be constructed with an inlet on both sides and that the blades may be attached to said hub only without employment of any disk; but in my preferred construction of double-inlet fan I usually employ a disk with blades mounted on each side thereof, so that the two oppositely-entering currents of air are kept separate until their discharge from the periphery of the fan.

What I claim, and desire to secure by Letters Patent, is—

1. A centrifugal fan for the removal of shavings, straw, rags and other substances of a stringy nature, comprising the combination of a blade-carrying part, blades disposed radially of the axis with a lateral edge facing the air-inlet to the fan, the inner ends of said lateral edges extending toward the inlet beyond the outer ends thereof, thereby insuring that any material striking the blade edges will by its centrifugal tendency slide along the same and be duly delivered from the tips of the blades, substantially as and for the purpose set forth.

2. In a centrifugal fan for the removal of shavings, straw, rags and other substances of a stringy nature, the combination of a central hub mounted on the fan-shaft, fan-blades mounted upon said central hub, a disk disposed at right angles to and connected with said hub, means for attaching said blades to the disk whereby the blades are supported on that side as well as from the hub, the radial edges nearest the inlet being entirely open and unconnected with one another except at the hub and having their inner ends extending toward the inlet beyond their outer ends to insure that material striking the blade edges will by its centrifugal tendency slide along the same and be duly delivered from the tips of the blades, substantially as and for the purpose set forth.

3. In a centrifugal fan for the removal of shavings, straw, rags and other substances of a stringy nature, the combination of a central hub, radial fan-blades mounted with the entire length of their inner axial edges upon said hub, the lateral edges of said blades facing the fan-inlet being entirely open and unconnected with one another except at the hub, an inclosing casing for said fan-blades, the parts being arranged to provide a space between said lateral edges of the blade and the side of the inclosing casing of the fan facing same, and said space being of sufficient dimensions to provide a passage-way by which

the material may pass through the fan without of necessity entering between the blades, substantially as and for the purpose set forth.

4. In a centrifugal fan for the removal of shavings, straw, rags and other substances of a stringy nature, the combination of fan-blades mounted with the entire length of their inner axial edges as a close attachment upon a central cylindrical hub carried upon the shaft of the fan, the plane in which the radial edges of the blades rotate being, on the inlet side, inclined away from the axis toward the tip edges of the blades so that such plane forms an obtuse angle with the axial direction of the inflowing air through the eye of the fan-casing to the blades, said radial edges being entirely open and unconnected with one another except at the hub, and an inclosing casing for said fan-blades, said casing and fan arranged to form a free space between said radial edges of the blades on the inlet side and the side of the inclosing casing of the fan facing same, substantially as set forth.

5. In a centrifugal fan for the removal of shavings, straw, rags and other substances of a stringy nature, the combination of a central cylindrical hub mounted on the fan-shaft, fan-blades mounted with the entire length of their inner axial edges as a close attachment upon said central cylindrical hub, a disk disposed at right angles to and connected with said hub, flanges on the radial edges of the blades which are farthest from the air-inlet, means for attaching said flanges to the disk whereby the blades are supported on that side as well as from the hub while the other opposite radial edges of said blades are entirely open and unconnected with one another except at the hub, the said edges of the blades being inclined away from the inlet toward the tip edges so that such edges form an obtuse angle with the axial direction of the inflowing air from the eye of the fan-casing to the blades, and an inclosing casing for said fan, said casing and fan arranged to form a free space between said radial edges of the blades and the side of the inclosing casing of the fan facing same, substantially as set forth.

6. In a centrifugal fan for the removal of shavings, straw, rags and other substances of a stringy nature, a fan-shaft, fan-blades disposed radially of the axis with a lateral edge facing the inlet which is axial, the inner ends of said lateral edges extending toward the inlet beyond the outer ends thereof, and a hub on said shaft for receiving and holding said blades, the end of the hub which faces the inlet having its edge approximately flush with the edges of the fan-blades on that side, substantially as and for the purpose set forth.

7. In a centrifugal fan for the removal of shavings, straw, rags and other substances of a stringy nature, the combination of a fan-shaft, fan-blades disposed radially of the axis with one lateral edge facing the inlet which is

axial, the inner ends of said lateral edges extending toward the inlet beyond the outer ends thereof, a hub on said shaft for receiving and holding said blades, the end of said hub which
5 faces the inlet being free and coned with its base approximately flush with the edges of the fan-blades on that side and its apex projecting beyond said blade edges, substantially as and for the purpose set forth.

10 8. In a centrifugal fan for the removal of shavings, straw, rags and other substances of a stringy nature, the combination of a shaft, a hub on said shaft, concave radial blades fixed to said hub and formed with a lateral edge
15 facing the air-inlet and the concavity facing

the direction of rotation, the inner ends of said lateral edges extending toward the inlet beyond the outer ends thereof, thereby insuring that any material striking the blade edges will by its centrifugal tendency slide along the
20 same and be duly delivered from the tips of the blades, substantially as and for the purpose set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing
25 witnesses.

SAMUEL CLELAND DAVIDSON.

Witnesses:

GEORGE G. WARD,
HUGH T. COULTER.