No. 662,395. Patented Nov. 27, 1900.

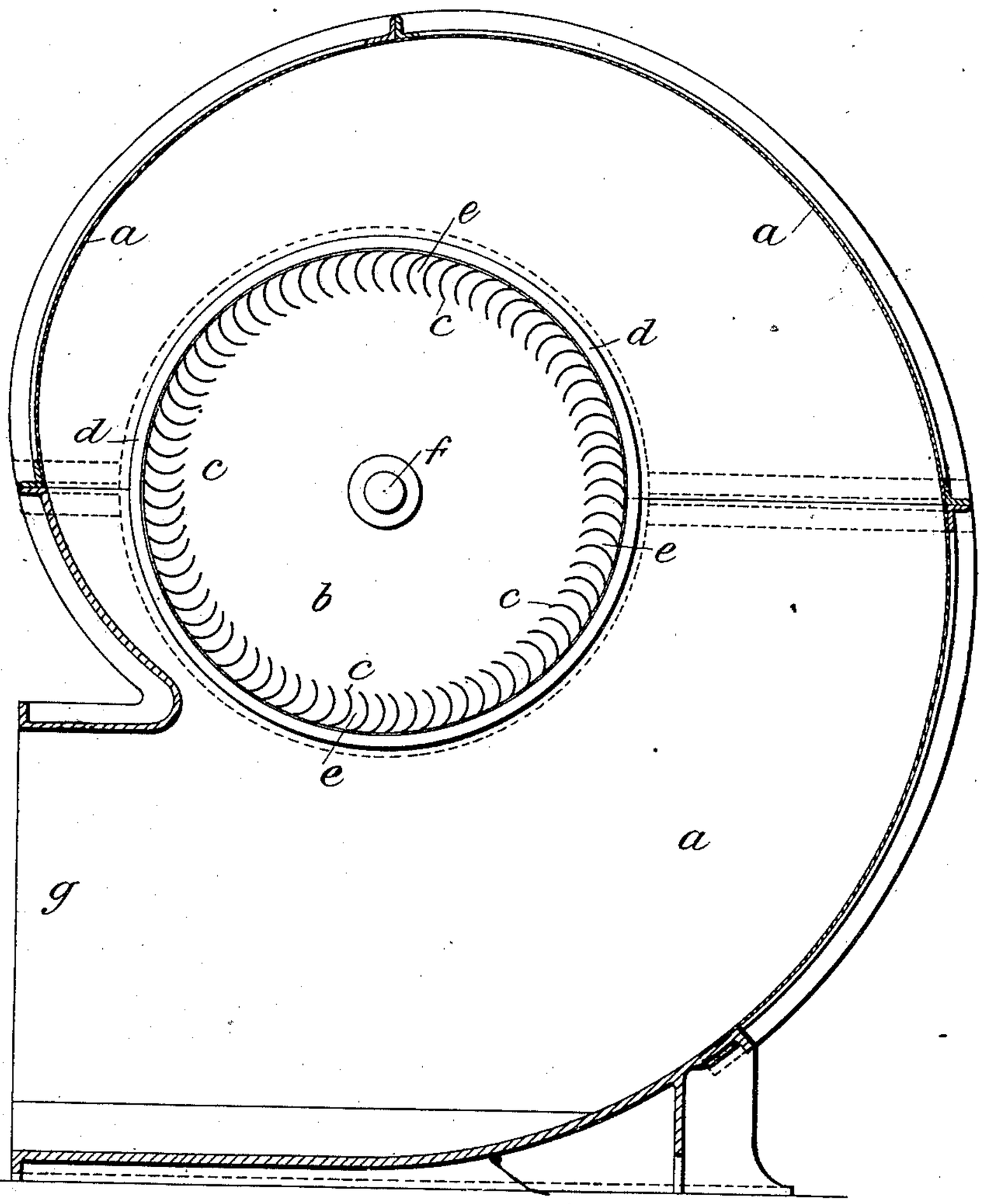
S. C. DAVIDSON.

CENTRIFUGAL FAN OR PUMP.

(Application filed Sept. 21, 1898.)

(No Model.) 11 Sheets—Sheet 1.

Fig. 1.



WITNESSES:

Fred Whitg

Thomas F. Wallace

INVENTOR:

Samuel Cleland Davidson,

By his Attorneys:

Wilkinson Fraser & Co.

No. 662,395. Patented Nov. 27, 1900.

S. C. DAVIDSON.

CENTRIFUGAL FAN OR PUMP.

(Application filed Sept. 21, 1898.)

(No Model.) 11 Sheets—Sheet 2.

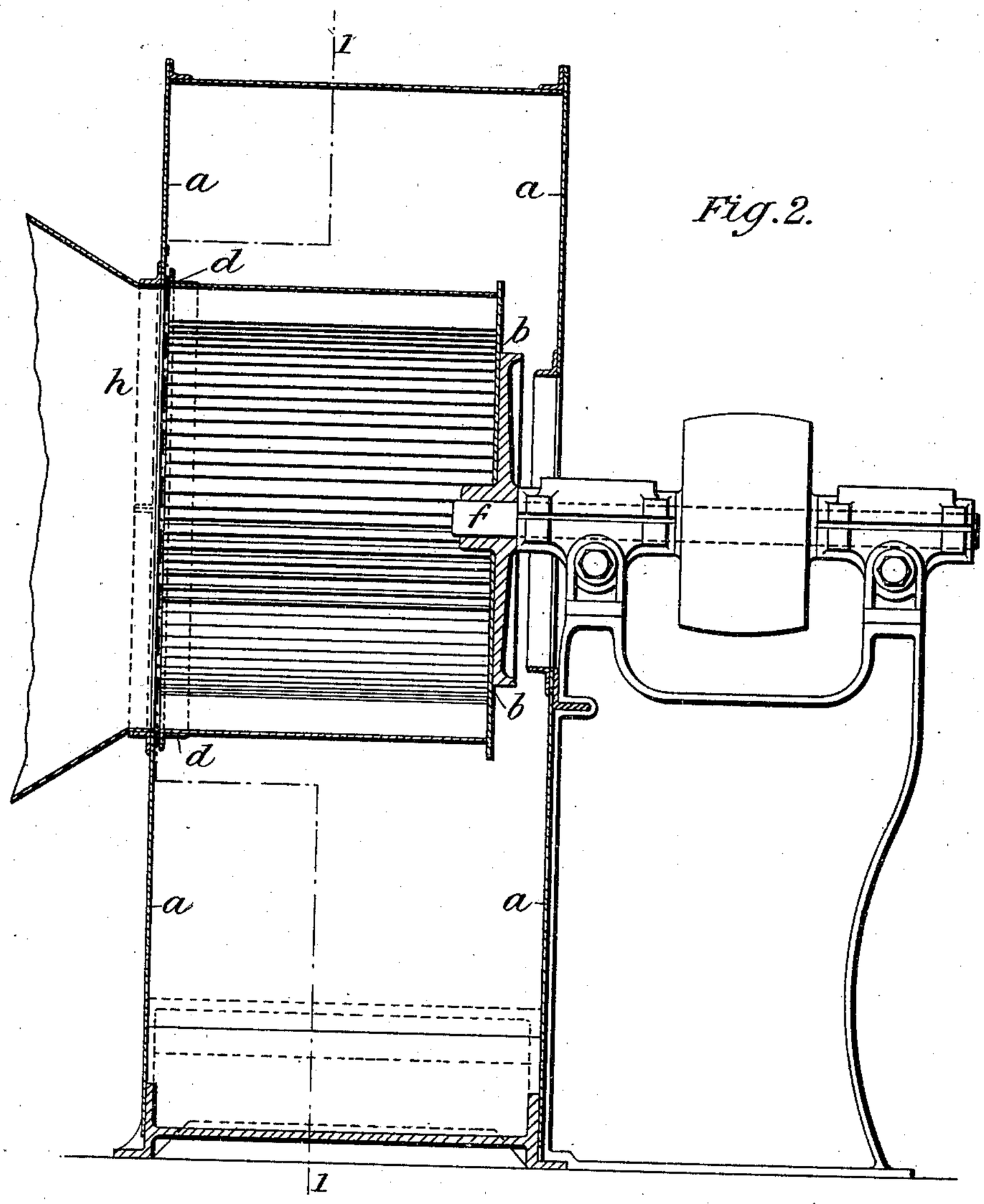


Fig. 2.

WITNESSES:

Fred White

Thomas F. Wallace

INVENTOR

Samuel Cleland Davidson,

By his Attorneys:

Wilkinson & Fraser & Co

No. 662,395. Patented Nov. 27, 1900.

S. C. DAVIDSON.

CENTRIFUGAL FAN OR PUMP.

(Application filed Sept. 21, 1898.)

(No Model.) 11 Sheets—Sheet 3.

Fig. 3.

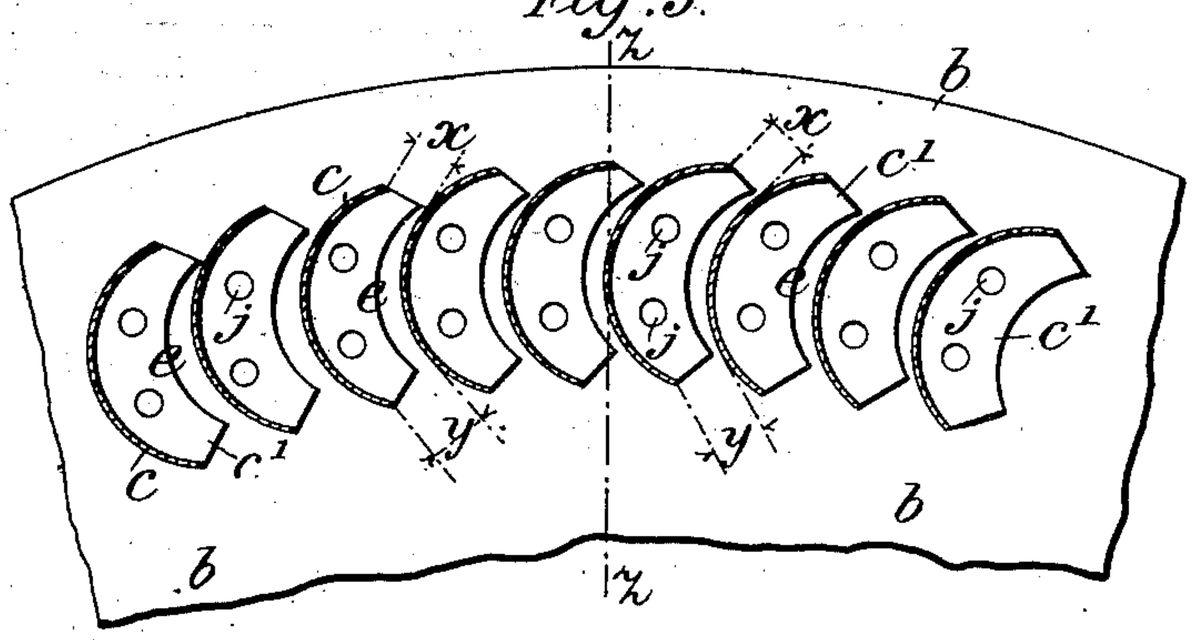


Fig. 4.

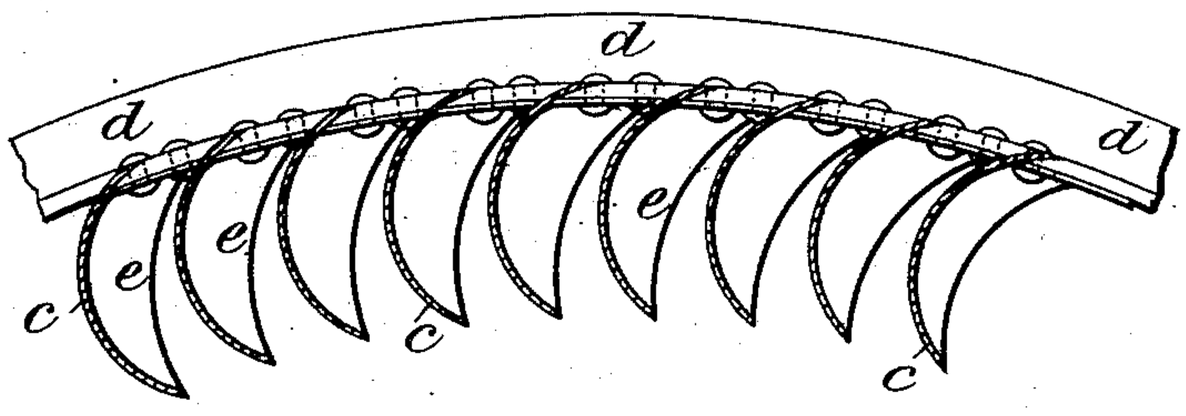
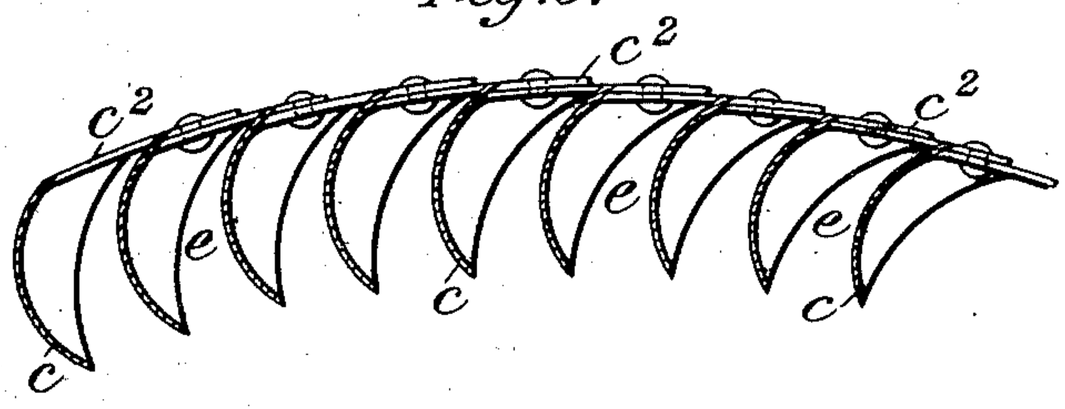


Fig. 5.



WITNESSES:

Fred Whitg

Thomas F. Wallace

INVENTOR:

Samuel Cleland Davidson,

By his Attorneys:

Albert G. Davis & Co

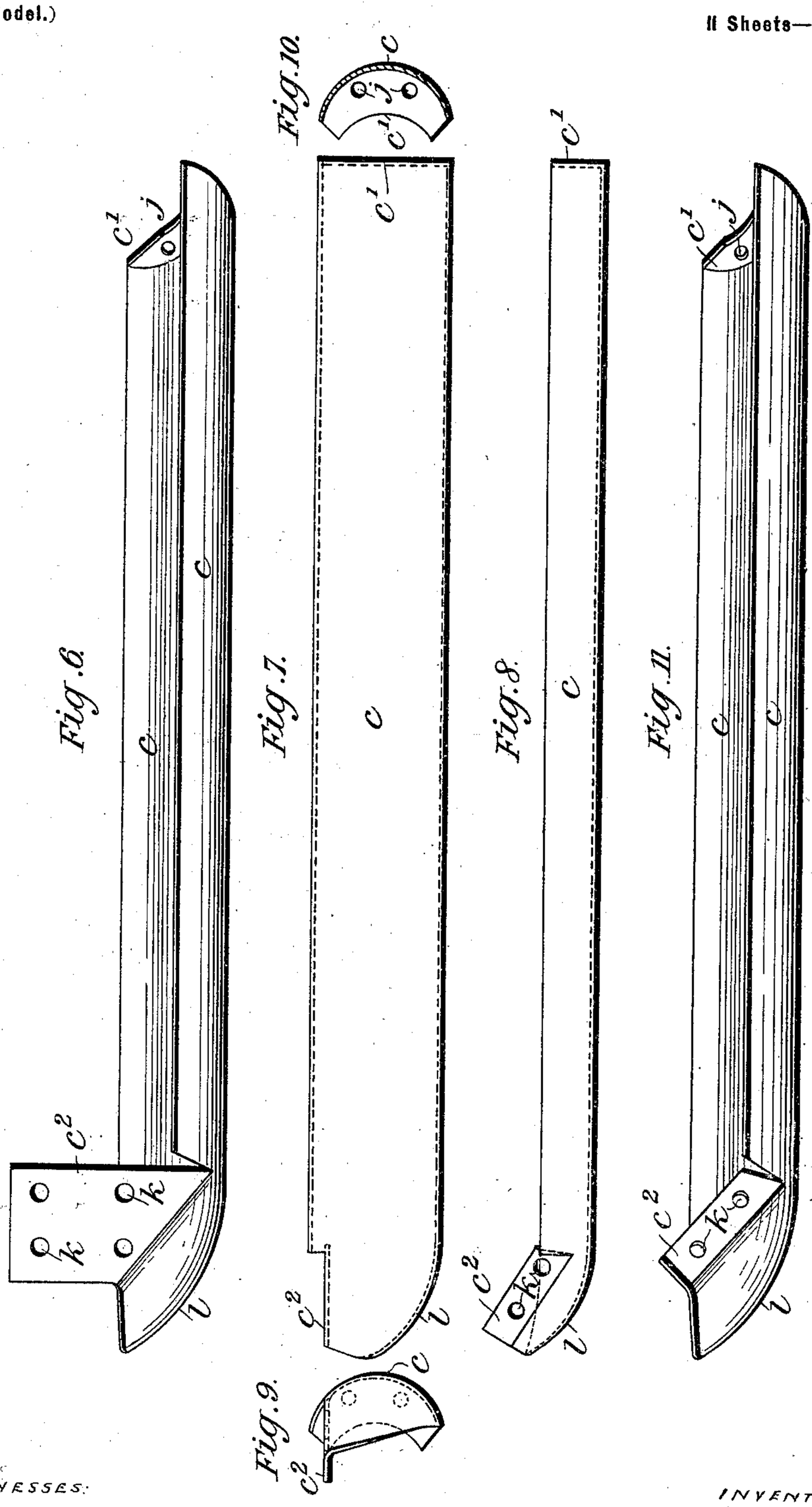
No. 662,395. Patented Nov. 27, 1900.

S. C. DAVIDSON.

CENTRIFUGAL FAN OR PUMP.

(Application filed Sept. 21, 1898.)

(No Model.) 11 Sheets—Sheet 4.



WITNESSES:

Fred. White

Thomas F. Wallace

INVENTOR:

Samuel Cleland Davidson

By his Attorneys

Fraser & Co.

No. 662,395. Patented Nov. 27, 1900.

S. C. DAVIDSON.

CENTRIFUGAL FAN OR PUMP.

(Application filed Sept. 21, 1898.)

(No Model.) 11 Sheets—Sheet 5.

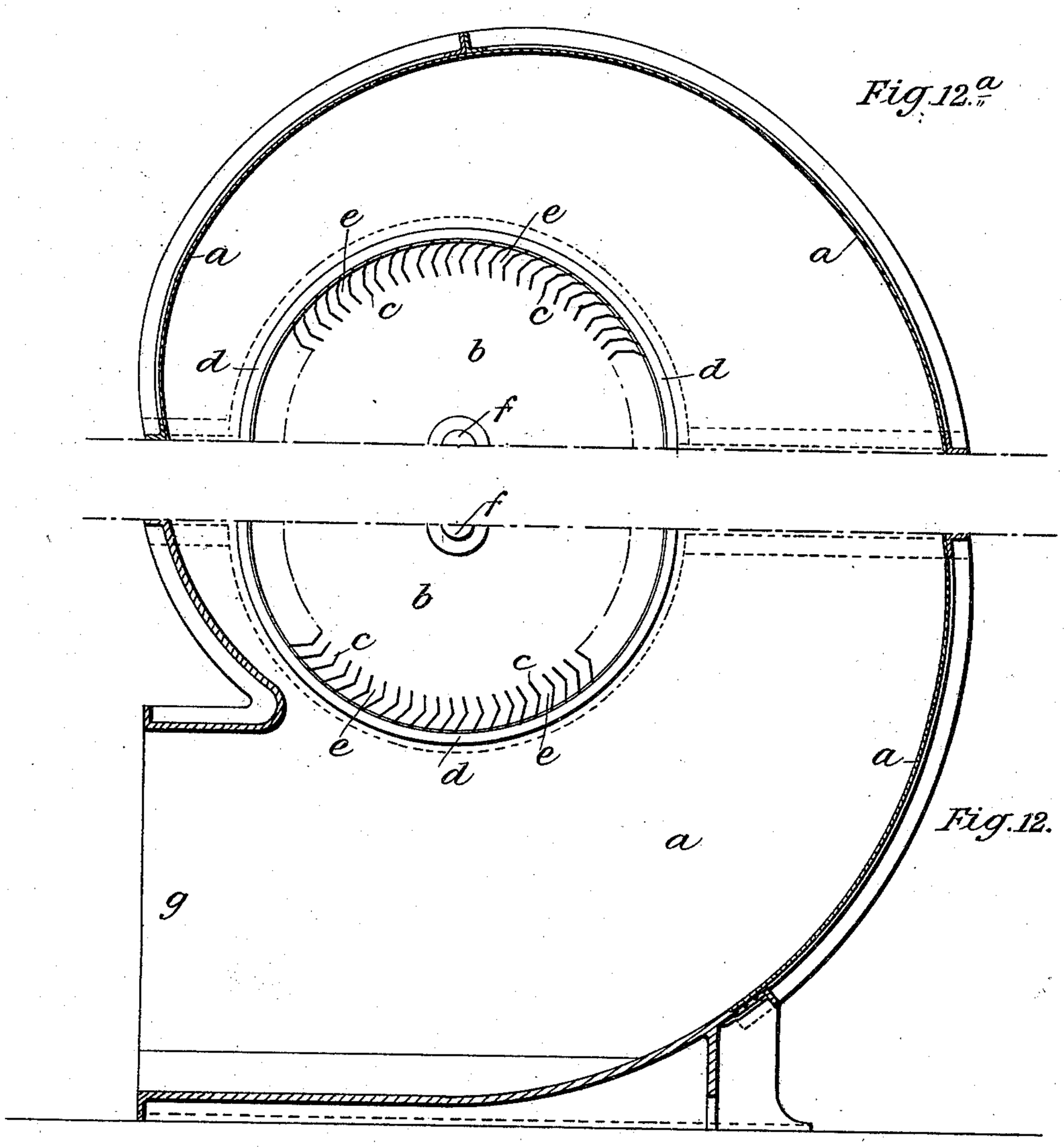


Fig. 12.a

Fig. 12.

WITNESSES:

Fred White

Thomas F. Wallace.

INVENTOR:

Samuel Cleland Davidson,

By his Attorneys

Arthur C. Fraser & Co.

No. 662,395. Patented Nov. 27, 1900.

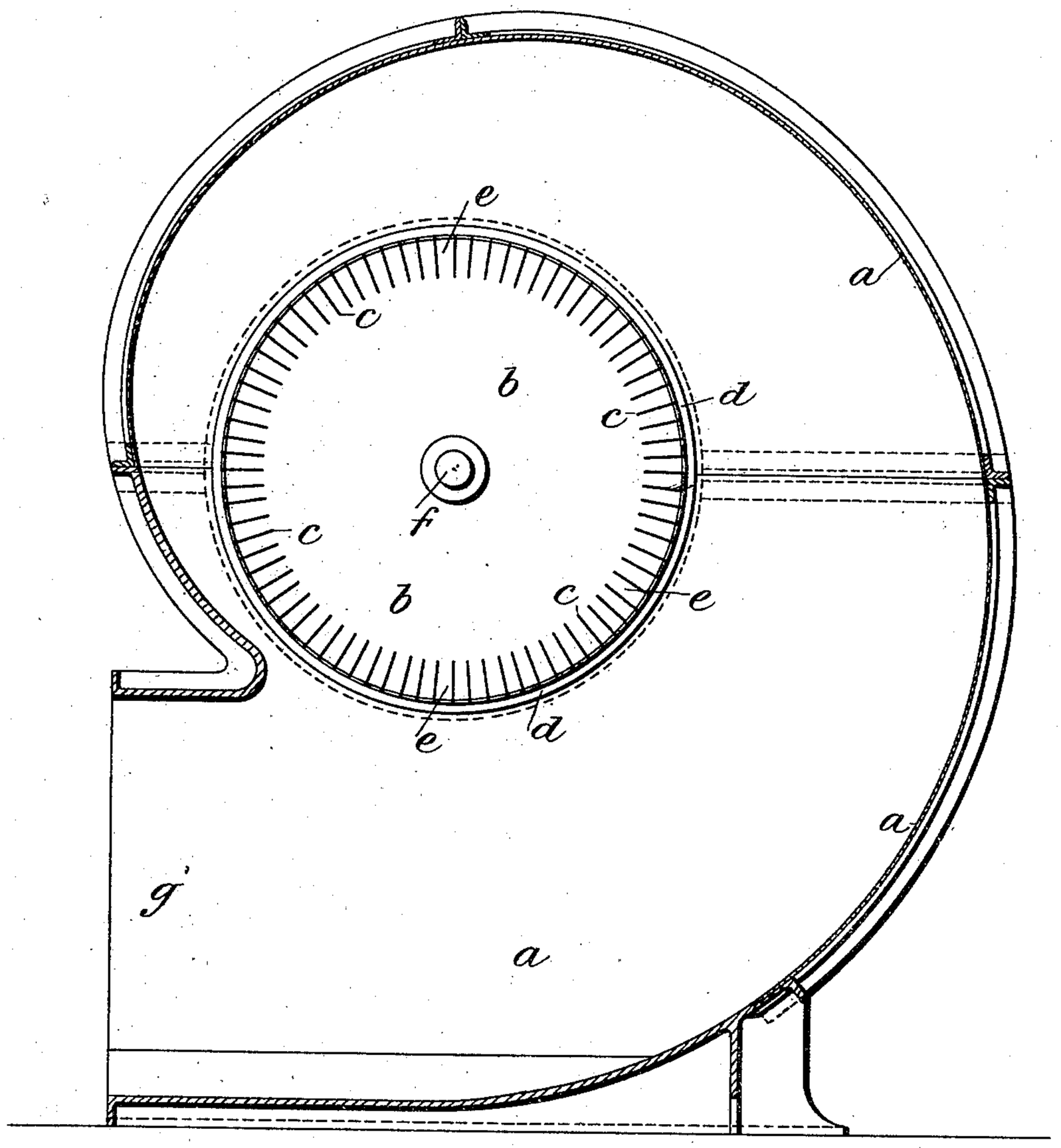
S. C. DAVIDSON.

CENTRIFUGAL FAN OR PUMP.

(Application filed Sept. 21, 1898.)

(No Model.) 11 Sheets—Sheet 6.

Fig. 13.



WITNESSES

Fred White

Thomas F. Wallace

INVENTOR:

Samuel Cleland Davidson

By his Attorneys:

Wilkinson Fraser & Co.

No. 662,395. Patented Nov. 27, 1900.

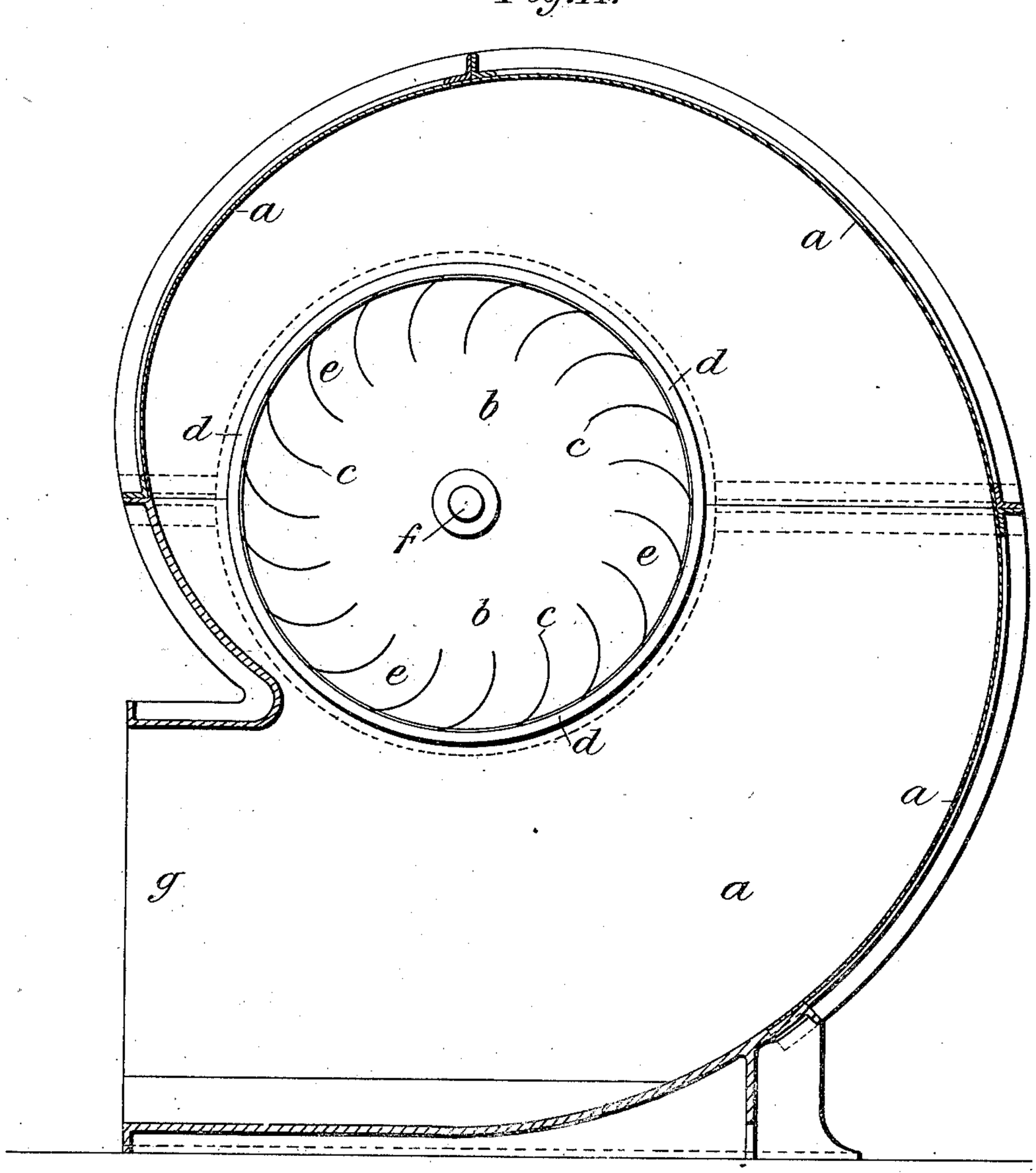
S. C. DAVIDSON.

CENTRIFUGAL FAN OR PUMP.

(Application filed Sept. 21, 1898.)

(No Model.) 11 Sheets—Sheet 7.

Fig. 14.



WITNESSES:

Fred White

Thomas F. Wallace

INVENTOR:

Samuel Cleland Davidson,

By his Attorneys

Arthur T. Fraser & Co.

No. 662,395. Patented Nov. 27, 1900.

S. C. DAVIDSON.

CENTRIFUGAL FAN OR PUMP.

(Application filed Sept. 21, 1898.)

(No Model.) 11 Sheets—Sheet 8.

Fig. 17.

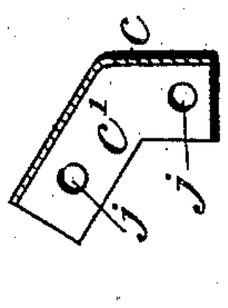


Fig. 15

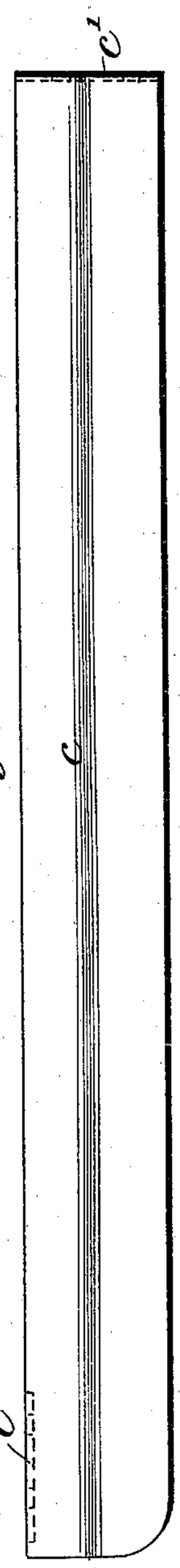


Fig. 16.

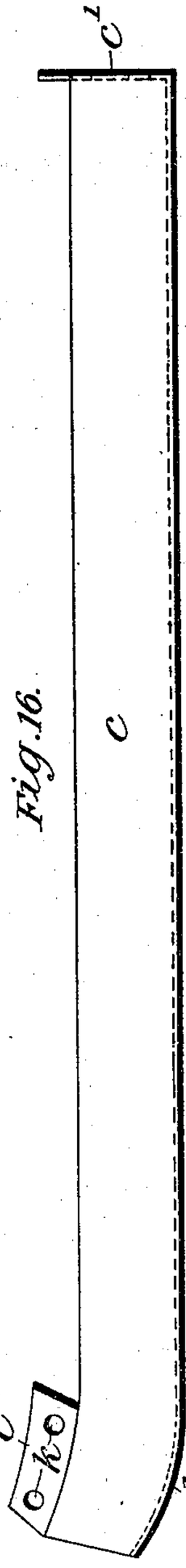


Fig. 20.

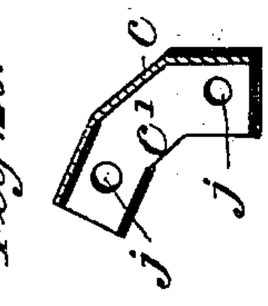


Fig. 18.

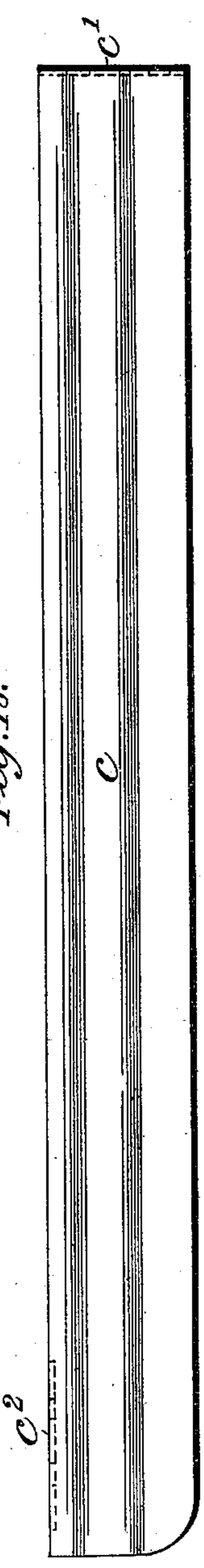
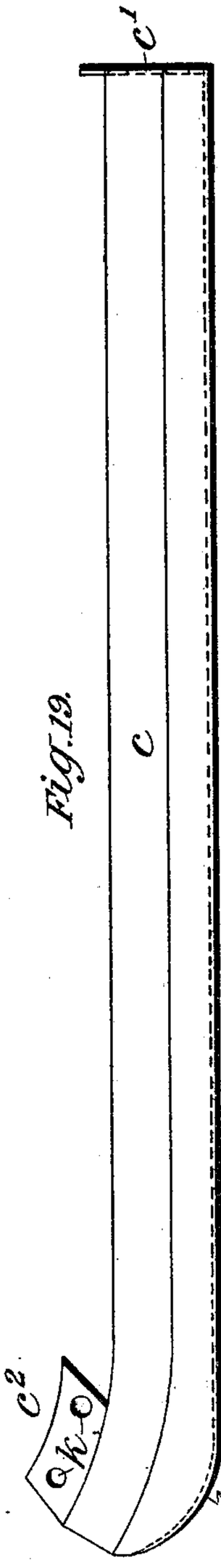


Fig. 19.



WITNESSES:

Fred White

Thomas F. Wallace

INVENTOR:

Samuel Cleland Davidson,

By his Attorneys:

Wilkinson, Fraser & Co

No. 662,395. Patented Nov. 27, 1900.

S. C. DAVIDSON.

CENTRIFUGAL FAN OR PUMP.

(Application filed Sept. 21, 1898.)

(No Model.) 11 Sheets—Sheet 9.

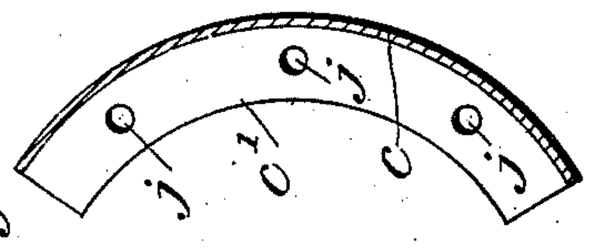


Fig. 23.

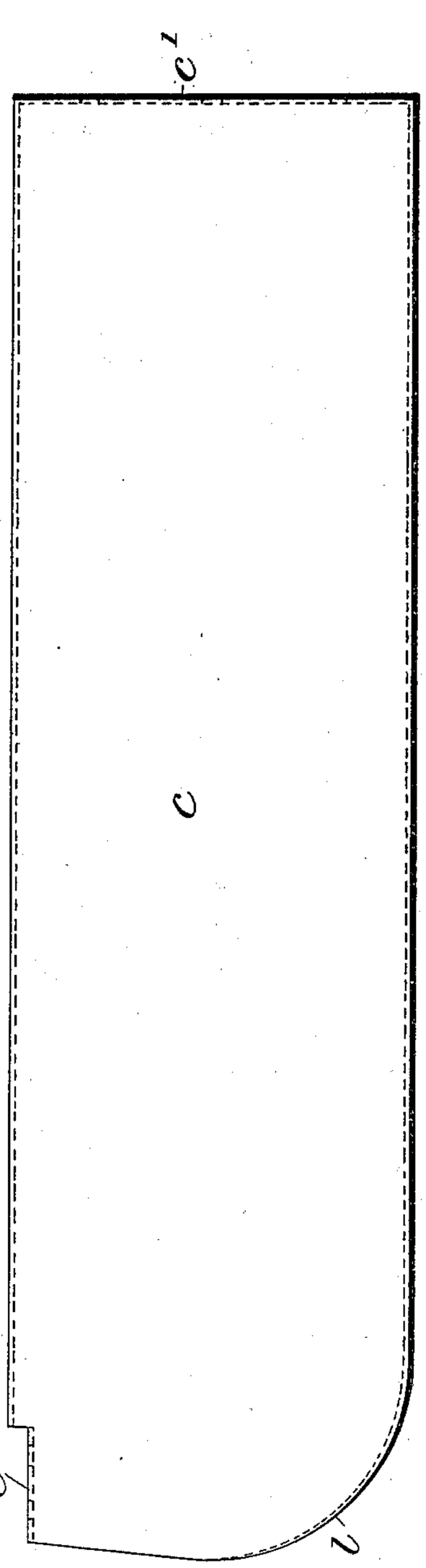


Fig. 21.

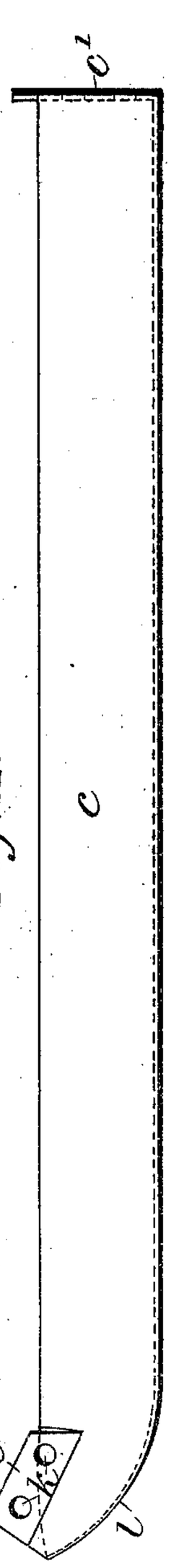


Fig. 22.

WITNESSES:
Fred Whitfe
Thomas F. Wallace

INVENTOR:
Samuel Cleland Davidson
By his Attorneys:
Arthur C. Fraser & Co

No. 662,395. Patented Nov. 27, 1900.

S. C. DAVIDSON.

CENTRIFUGAL FAN OR PUMP.

(Application filed Sept. 21, 1898.)

(No Model.) 11 Sheets—Sheet 10.

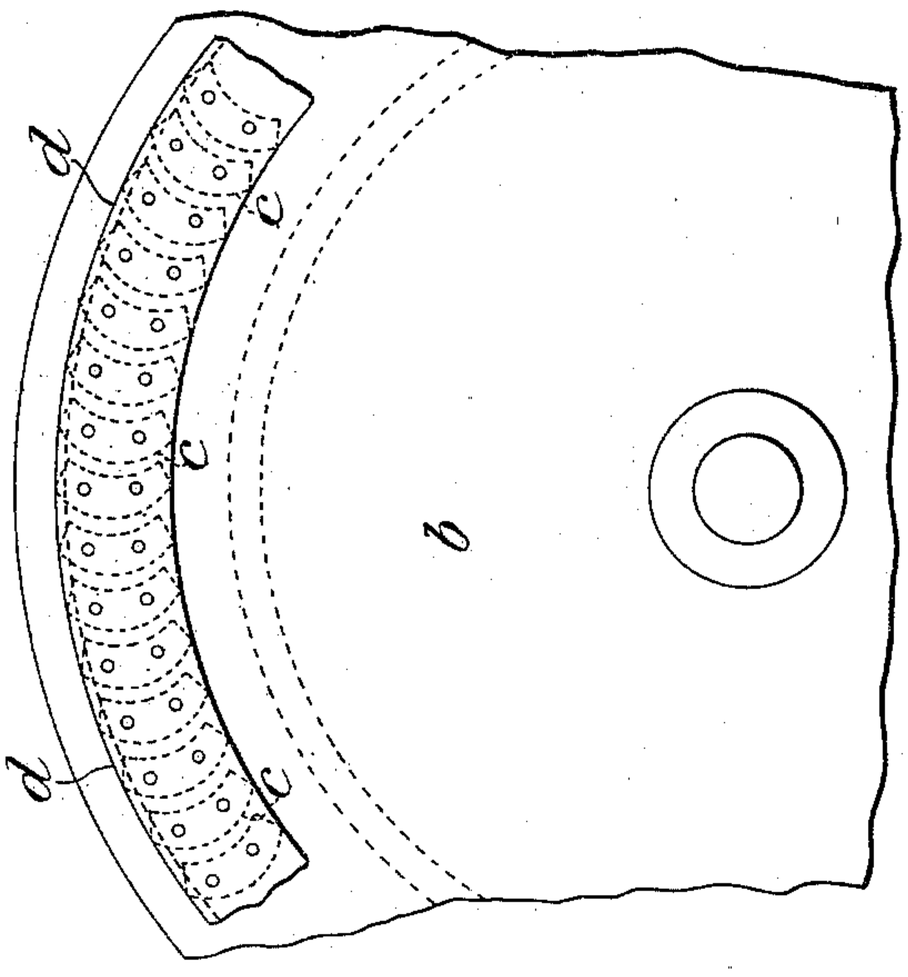


Fig. 25.

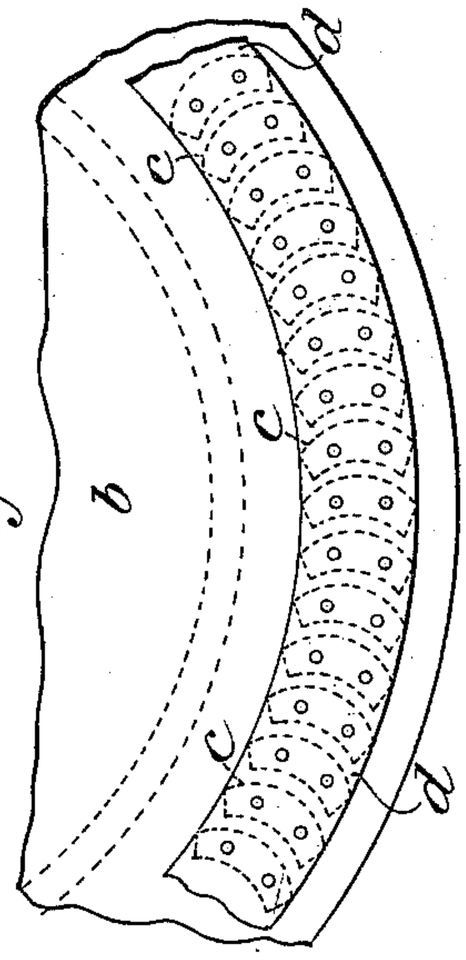


Fig. 27.

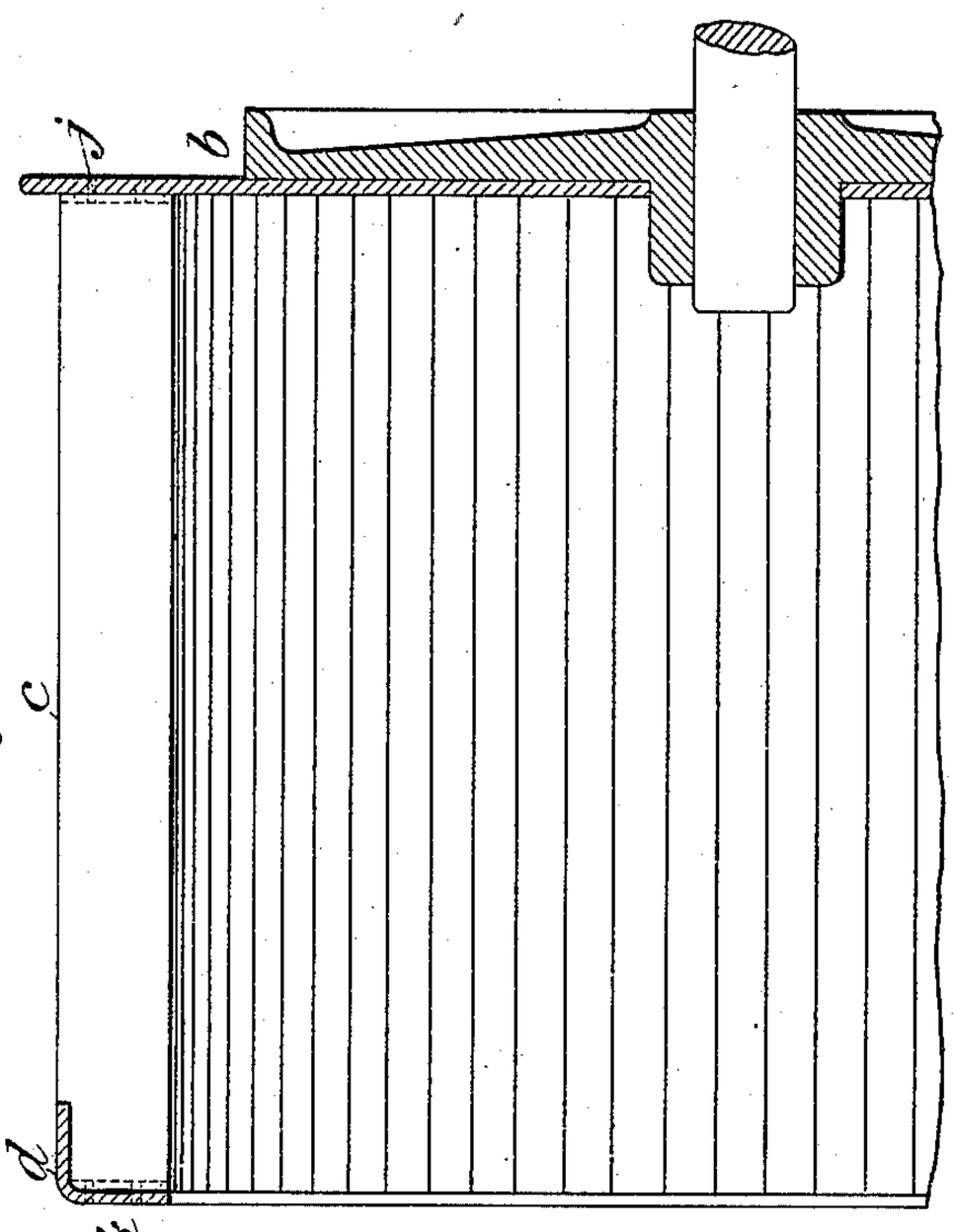


Fig. 24.

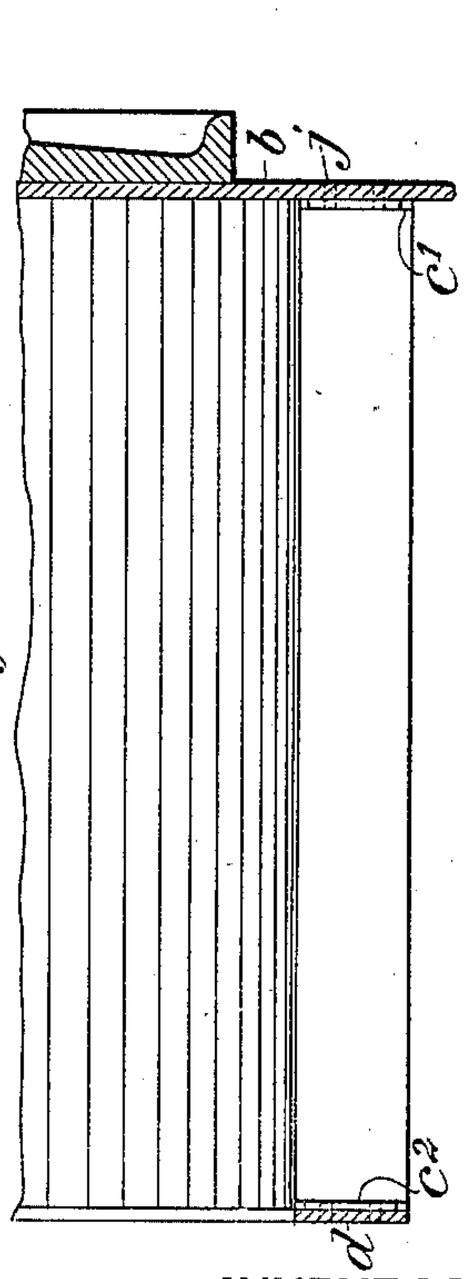


Fig. 26.

WITNESSES:

Fred Whitg.

Thomas F. Wallace

INVENTOR:

Samuel Cleland Davidson,

By his Attorneys,

Arthur G. Fraser & Co

No. 662,395. Patented Nov. 27, 1900.

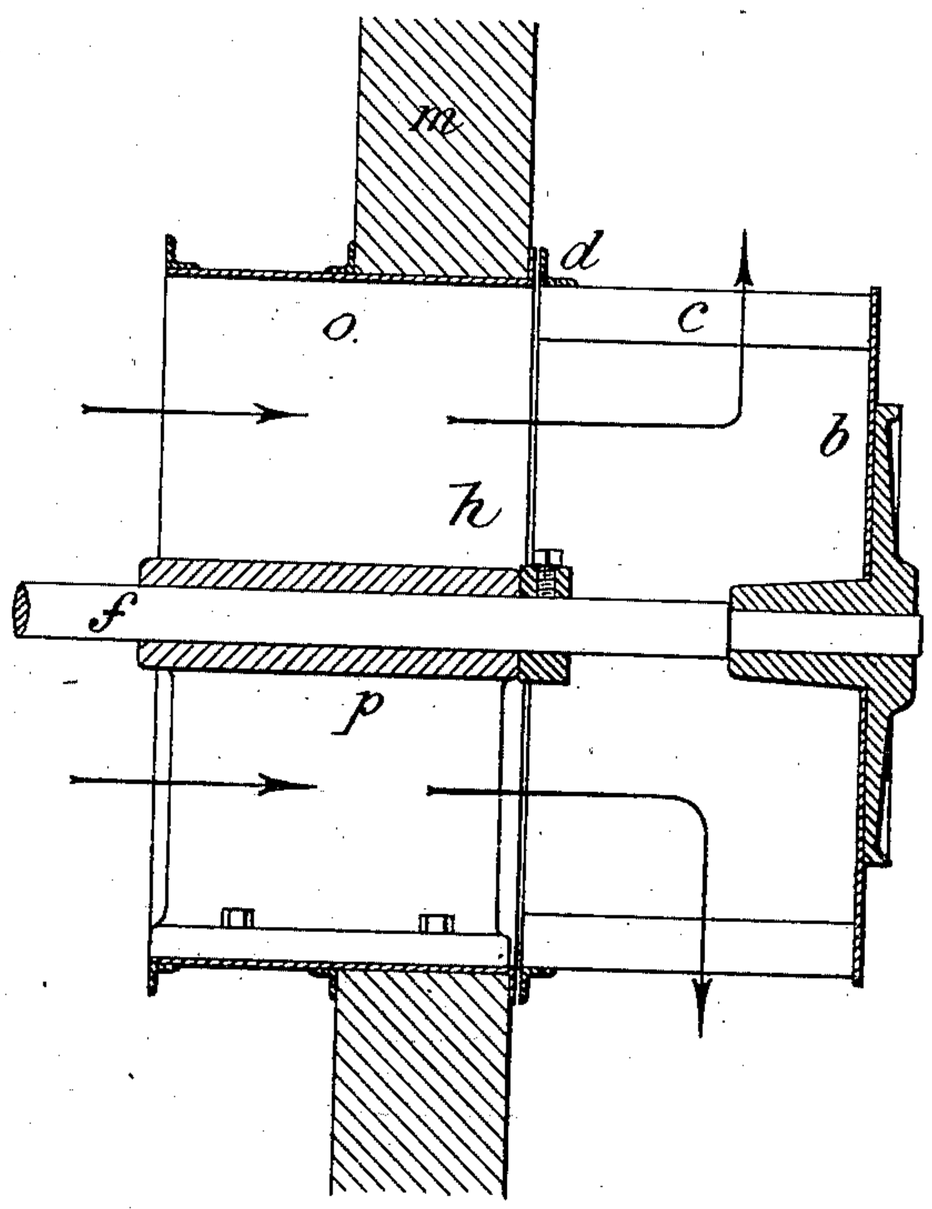
S. C. DAVIDSON.

CENTRIFUGAL-FAN OR PUMP.

(Application filed Sept. 21, 1898.)

(No Model.) 11 Sheets—Sheet 11.

Fig. 28.



WITNESSES:
Fred White
Thomas F. Wallace

INVENTOR:
Samuel Cleland Davidson,

By Attorneys,
Arthur G. O'Brien & Co

UNITED STATES PATENT OFFICE.

SAMUEL C. DAVIDSON, OF BELFAST, IRELAND.

CENTRIFUGAL FAN OR PUMP.

SPECIFICATION forming part of Letters Patent No. 662,395, dated November 27, 1900.

Application filed September 21, 1898. Serial No. 691,495. (No model.)

To all whom it may concern:

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

My invention has reference to rotary fans or pumps in which the fluid operated on is taken in axially and discharged circumferentially; and it relates to centrifugal fans or pumps in which the blades carry the fluid with them in their rotation, and thereby throw it outward by centrifugal force, as distinguished from propeller fans or pumps in which the blades act upon the fluid with a wedging action, pushing it from them without materially rotating it.

The object of this invention is to improve the efficiency of such centrifugal fans or pumps by increasing the volume and pressure of the fluid drawn into and discharged therefrom relatively to their diameter and speed of rotation.

In this specification the word "fan" is understood as including a pump. The word "axially" means in a direction coincident with or parallel with the axis of rotation. The word "blades" is used to indicate the vanes or wings which impart motion to the fluid. The expression "intake-chamber" is employed to indicate a chamber or space inclosed within the series of blades. The word "eye" is used to designate the inlet-opening in the casing or stationary member of the fan, through which opening the fluid enters the intake-chamber. By the "intake" end of the blades or ports is understood that end which is nearest the eye. The "depth" of the blades is their width measured radially from the inner to the outer edge, the "length" of the blades is their axial measurement, and the "ports" are the intervening spaces between the blades.

According to my invention the rotary member of the fan is constructed with numerous thin elongated blades arranged in substantially drum form, being extended in approximately axial direction, so as to inclose within them a relatively large and practically-unobstructed intake-chamber, and said blades in transverse section being arranged relatively to the axis and direction of rotation to carry the fluid with them rotatively and discharge it tangentially, and said rotary member is so mounted as to permit the tangential escape of the fluid discharged from its blades. The blades are best made of sheet metal and are elongated—that is to say, their length approximates at the least three times their depth and being preferably as much as nine or more times their depth—it being preferable to make them as narrow or shallow as practicable consistent with strength of construction. Preferably their inner and outer edges are substantially parallel to each other. The blades must be so shaped relatively to the axis and direction of rotation as to carry the fluid with them in their rotation in order to throw it outward by centrifugal force, whereby it is discharged tangentially. To this end the blades may be formed with a plane surface and arranged in radial planes or they may be made in two or more planes at an angle to each other with their outer edges turned or inclined forward—that is, in the direction of rotation—or they may be formed as curved plates with their outer edges turned forward, so that the concave of said curve is on the forward or advancing side, this latter construction being preferred. The blades are so numerous as to follow each other in close succession, being spaced apart preferably a distance approximating two-thirds of their radial depth, or it may be as much as twice the full depth of the blades. The drum-like arrangement of the blades is such as to inclose within them an intake-chamber, which preferably is approximately cylindrical and which is of large dimensions as compared with fans heretofore existing—that is to say, its diameter approximates at the least to four times the radial depth of the individual blades, and in the preferred proportions is five-sixths of the external diameter of the series of blades, and its length or axial dimension approximates at least three times the depth of the individual blades and in the preferred proportions is approximately nine times such depth.

When I employ angled or curved blades, I mount them so that while their concave faces are toward the direction of rotation their outer edges are tilted forward slightly, so that they have a lead in the direction of rotation relatively to their inner edges, whereby the clear

width of the ports between the blades at their outer edges is narrower and consequently less in area than at their inner edges.

The drum-like series of blades is supported in any suitable manner upon a shaft or spindle revolving in suitable bearings. A convenient supporting means consists of a disk mounted on the spindle, to which disk the blades are attached at their ends remote from the intake ends. A ring or annular support is preferably provided for the opposite or intake ends of the blades.

The rotary member of the fan is suitably mounted to permit the tangential escape of the fluid discharged from its blades. If not incased, this fluid can freely escape from it in all directions. If inclosed in a casing, the latter must be so constructed as to permit the tangential escape of the fluid—as, for example, by forming the casing of the usual snail shape with a tangential outlet beyond the periphery of the rotary member.

In the operation of my new fan the fluid flows in axial direction into the intake-chamber, in which it expands without perceptibly revolving until it is caught by the blades and drawn into the ports between them, whereby the fluid in these ports is converted into a whirling shell of fluid, whereby it is thrown outward by centrifugal force and discharges from the outer sides of the ports as a whirling and expanding shell of fluid, the individual particles of which move in tangential direction. The blades are so narrow and so close together that no eddy-currents are caused in the ports between them, thus avoiding the loss of efficiency and the whirring or beating noise accompanying the operation of centrifugal fans as heretofore made.

In my preferred construction the intake ends of the blades are open to the inflowing fluid, so that the fluid may flow axially into the intake ends of the ports. In this case I make the eye or intake opening in the casing leading to the fan of a diameter equal, or approximately so, to the full outer diameter of the drum-shaped series of blades, whereby the volume of fluid which will be propelled through the fan for a given diameter and speed of revolution is proportionately increased without loss of velocity in the flow of the fluid.

My improved fans or pumps when constructed as herein described may be employed with any fluids, either gaseous or liquid—as, for instance, with air or water.

In the accompanying drawings, Figure 1 is a sectional elevation on the line 1 1 of Fig. 2, illustrating the preferred embodiment of my invention. Fig. 2 is a cross-sectional elevation thereof. Fig. 3 is a fragmentary detail view, showing a portion of the blades shown in Fig. 1 on a larger scale. Fig. 4 is a detail cross-section taken at the intake ends of the blades, showing the method of attaching their outer edges to the connecting-ring. Fig. 5 is a similar detail view to Fig. 4, showing the attachment of the outer edges of the intake ends of the blades to each other by means of projecting lips or flanges extending from each blade to the next. Fig. 6 is a perspective view of a curved blade having a spoon-shaped intake end and a projecting lip or flange for attaching it to the next in the manner shown in Fig. 5. Figs. 7, 8, 9, 10, and 11 are detail views of the curved blades shown in Figs. 1 and 2 with spoon-shaped intake end, Fig. 7 being a rear elevation, Fig. 8 an outer edge view, Fig. 9 an end view, Fig. 10 a cross-section, and Fig. 11 a perspective view. Figs. 12 and 12ª are sectional elevations, respectively, of the lower and upper half of the fan with two forms of angle-blades. Fig. 13 is a sectional elevation of the fan with flat blades in radial planes. Fig. 14 is a sectional elevation of the fan with curved blades in a modified proportion. Figs. 15, 16, and 17 are detail views, on a larger scale, of a blade formed in two planes, as in Fig. 12. Figs. 18, 19, and 20 are similar views of a blade formed in three planes, as in Fig. 12ª. Figs. 21, 22, and 23 are similar views of a curved blade, as in Fig. 14, with spoon-shaped ends. Figs. 24 and 26 are fragmentary sectional elevations corresponding to portions of Fig. 2 and illustrating two modified constructions for supporting the intake ends of the blades, Fig. 25 being a fragmentary end view of Fig. 24 and Fig. 27 a similar end view of Fig. 26. Fig. 28 is a vertical axial section of a modification, showing an uncased fan or exhauster.

Referring to the drawings, *a* in Figs. 1, 2, 12, 13, and 14 designates a casing in which the rotary member of the fan is inclosed. It has an eye *h*, Fig. 2, through which the supply of fluid is drawn, and is shown with a discharging-mouthpiece *g*. The rotary member comprises blades *c c*, suitably supported upon a revolving shaft or spindle *f*. The support shown comprises a disk *b*, to which the blades are attached at one end, and an annular support for the opposite or intake ends of the blades. In Figs. 1, 2, 4, and 14 this support is formed by a ring *d*, to which the intake ends are riveted. The blades *c c* have at one end flanges *c'*, by which they are attached to the disk *b*, *j j* being holes in said flanges to give passage to the rivets or attaching devices. At the intake ends of the blades they may have flanges c^2, by which they are attached to the ring *d* in the manner shown in Fig. 4, or by prolonging the flanges c^2, as shown in Fig. 6, they may be riveted or attached to each other in the manner shown in Fig. 5. The flanges c^2 have holes *k k* to give passage to the rivets or attaching devices. The forwardly-tilted spoon-shaped intake ends of the blades are designated at *l*.

The ports or intervening spaces between the blades are lettered *e e*. In Fig. 3 it will be noticed that the width of these ports at *x*, near the outer edges of the blades, is somewhat less than at *y*, their inner edges, owing to said

outer edges of the blades, being tilted slightly forward relatively to the radial line *z*. By thus turning forward the outer edges of the blades the outer or discharging area of the ports is reduced to less than their inner or inlet area. The same result may be attained with angle-blades, as shown, for example, in Fig. 12ª.

In proportioning the parts I make the length of the blades such that the aggregate open area of the ports around the periphery of the fan shall be about equal to the area of the inlet-opening when the maximum volume of intake and discharge is required; but the length of the blades may be reduced to suit any special requirements.

The preferred proportions of my fan are shown in Figs. 1 and 2, where the radial depth of the blades is one-twelfth of the diameter of the fan and the length of the blades slightly exceeds nine times their depth. This construction affords a large intake-chamber of approximately cylindrical form, the diameter of which is ten times the depth of the individual blades, while its length, equaling that of the blades, is about nine times this dimension.

The provision of a relatively large intake-chamber in connection with shallow blades following each other at frequent intervals is a distinctive feature of my invention. In fans as ordinarily constructed, employing blades of great radial measurement, supplementary vibrations and eddies are set up, which reduce the efficiency of the fan. In those fans also in which the blades are extended inwardly to or near the axis the best efficiency is not obtained. I have discovered that by providing a relatively large intake-chamber practically unobstructed by the projection into it of blades or other parts and by employing blades which extend as short a distance from the periphery of the fan inward as is consistent with strength of construction the said supplementary vibrations and eddies are minimized and the velocity and volume of fluid discharged for a given speed of revolution are greatly increased.

The blades may be flat and in radial planes, as shown in Fig. 13, or they may be bent angularly into two or more planes, as shown in Figs. 12 and 12ª, or they may be curved, as shown in Figs. 1 and 3, the curved form being preferable. The depth of the blades may be increased to the extent shown in Fig. 14, where the intake-chamber is reduced to a diameter four times the depth of the individual blades.

It has hitherto been considered impossible to get pressure or partial exhaust with centrifugal fans unless the blades are inclosed on the sides and the eye or opening is of not greater diameter than about one-half the diameter of the fan. With my present invention, however, the eye may be of equal diameter to that of the fan periphery. This is clearly shown in Fig. 2. This is made possible by making the intake ends of the blades open or unobstructed, so as to form open-ended ports between them. To support and strengthen the intake ends of the blades, I prefer to make them laterally curved or spoon-shaped or concavo-convex, as shown at *l* in Figs. 6 to 11.

When greater strength of construction is required, as when the fan or pump has to be driven at a very high velocity or when it has to be employed for pumping a heavy medium, as a liquid, the intake ends of the blades may be closed in the manner shown in Figs. 24 to 27, inclusive. In the modification shown in Figs. 24 and 25 the intake ends of the blades are closed by projecting the flange of the encircling ring *d* inward. In the modification shown in Figs. 26 and 27 the intake ends are closed by a flat connecting-ring, to which they are attached in the same manner as they are attached to the disk *b* at their opposite ends.

It is obvious that in the fan or pump shown in Figs. 1 and 2 and also in others (shown, respectively, in Figs. 12, 12ª, 13, and 14 and in those shown in Figs. 24 to 27, inclusive) the casing *a* may project inward over the edges of the blades *c c*, but the inlet-opening or eye to the fan should not be thereby reduced to less than five-sixths of the diameter of the fan.

In all the modifications thus far described the fan is within a casing. It will, however, be readily understood that a casing is not necessary in all instances—as, for instance, when the inflowing fluid is led to the eye of the fan by a pipe or when the fan projects through an orifice in a wall, so as to revolve, say, outside a house with the eye of the fan facing the bearings in which the spindle revolves. The fan when driven would then draw the air through that orifice and discharge it freely all around into the open air. This modification is shown in Fig. 28, where *o* is a pipe leading to the eye *h* of the fan, and *m* is the wall of a building, through which this pipe passes to lead the air to the rotary member of the fan, the driving-shaft *f* being supported in a bearing *p*.

It is essential to my invention that the fan-blades shall be adapted to carry the fluid with them rotatively, so that it shall be thrown outward by centrifugal force and be discharged tangentially, in contradistinction to merely exerting a wedge-like action upon the fluid, tending to thrust it outward in radial direction unaccompanied by any material rotation or whirling of the fluid. In a true centrifugal fan it is almost solely the rear surface of the blade which acts upon the fluid, drawing it around by suction, whereas in blades which thrust the fluid outward by a wedge-like action it is the front or advancing side of the blade which is the active face. Blades of the latter kind require to be inclined or curved rearwardly to a considerable angle, so that the outer edge follows behind the middle or major portion of the blade. I

use the expression "in transverse section arranged, relatively to the axis and direction of rotation, to carry the fluid with them rotatively and discharge it tangentially" to exclude such rearwardly-inclined or wedging blades and include generically any form of blade adapted to act upon the air by rotating or whirling it, thus including blades which are substantially radial, as well as those which incline forwardly, and either flat, curved, or angled.

The operation of my fan when propelling air is accompanied by the existence of a thin shell or film of rapidly-whirling air immediately surrounding the drum-like series of blades, which air is apparently compressed, and outside of this shell the air discharging from the fan escapes tangentially. Whether the fan is provided with a casing or not the construction must be such as to permit the whirling fluid discharged from the blades to escape tangentially therefrom in outward direction.

To realize the full advantages of my invention, it is practically essential that the inflow of fluid to the intake-chamber be unobstructed and that the inlet-opening be of the full diameter of said chamber, as any throttling of this opening results in a proportionate diminution of volumetric efficiency. It is also practically essential that the whirling fluid discharged from the fan-blades shall be permitted to escape tangentially outward therefrom, as any attempt to divert the revolving fluid inwardly results in a rapid diminution of efficiency; but the whirling fluid can be collected in a casing, and if the outlet from this casing be arranged beyond the radius of the circle described by the outer edges of the blades the fluid will freely escape through said outlet, its whirling motion being thereby resolved into a direct motion, after which it can be led through a suitable conduit in any desired direction.

The fan provided by my present invention is distinguished from that shown in Fig. 7 of my United States Patent No. 544,758, wherein the blades are triangular and project into the central hub, that in my present form the blades are extended approximately parallel to the axis of rotation, being arranged in drum form, so as to inclose within them an approximately cylindrical intake-chamber which is practically unobstructed by blades or other parts.

The modification shown in Fig. 13, wherein the blades are flat and radial, is not specifically claimed in my present application, but is so claimed in my application, Serial No. 740,399, filed December 15, 1899, as a division of my present application, nor is the modification shown in Fig. 28, wherein the rotary member is uninclosed by any casing, so that the fluid discharged from the blades may freely escape tangentially in all directions, specifically claimed in my present application, this feature being so claimed in my application, Serial No. 17,366, filed May 21, 1900, which also is a division of my present application.

I claim as my invention the following-defined novel features, substantially as hereinbefore specified, namely:

1. A centrifugal fan or pump, comprising a rotary member having numerous elongated blades arranged lengthwise in approximately axial direction, and in substantially drum form, so as to inclose within them a relatively large and practically-unobstructed intake-chamber, and in transverse section arranged, relatively to the axis and direction of rotation, to carry the fluid with them rotatively and discharge it tangentially, and a means for so mounting said rotary member as to permit the tangential escape of the fluid discharged from said blades.

2. A centrifugal fan or pump, comprising a rotary member having numerous thin elongated blades arranged lengthwise in approximately axial direction, and in substantially drum form, so as to inclose within them a relatively large and practically-unobstructed intake-chamber, and in transverse section arranged, relatively to the axis and direction of rotation, to carry the fluid with them rotatively and discharge it tangentially, and spaced apart a distance no greater than twice their radial depth, and a means for so mounting said rotary member as to permit the tangential escape of the fluid discharged from said blades.

3. A centrifugal fan or pump, comprising a rotary member having numerous elongated blades arranged lengthwise in approximately axial direction, and in substantially drum form, so as to inclose within them a relatively large and practically-unobstructed intake-chamber having a diameter equal to at least four times, and an axial length exceeding three times, the radial depth of the individual blades, and said blades in transverse section arranged, relatively to the axis and direction of rotation, to carry the fluid with them rotatively and discharge it tangentially, and a means for so mounting said rotary member as to permit the tangential escape of the fluid discharged from said blades.

4. A centrifugal fan or pump, comprising a rotary member having numerous elongated blades of a length approximating nine or more times their radial depth, said blades arranged lengthwise in approximately axial direction, and in substantially drum form, so as to inclose within them a relatively large and practically-unobstructed intake-chamber of a diameter approximating ten times the radial depth of the individual blades, and in transverse section arranged, relatively to the axis and direction of rotation, to carry the fluid with them rotatively and discharge it tangentially, and a means for so mounting said rotary member as to permit the tangential escape of the fluid discharged from said blades.

5. A centrifugal fan or pump, comprising a

rotary member having numerous elongated thin blades arranged lengthwise in approximately axial direction, and in substantially drum form, so as to inclose within them a relatively large and practically-unobstructed intake-chamber, and in transverse section having their outer edges inclined forwardly, in the direction of rotation, whereby to carry the fluid with them rotatively and discharge it tangentially.

6. A centrifugal fan or pump, comprising a rotary member having numerous elongated blades arranged lengthwise in approximately axial direction, and in substantially drum form, so as to inclose within them a relatively large and practically-unobstructed intake-chamber, and in transverse section having their outer edges inclined forwardly, in the direction of rotation, to such effect that the outer or discharging area of the ports is less than their interior or inlet area, whereby to carry the fluid with them rotatively and discharge it tangentially.

7. A centrifugal fan or pump, comprising a rotary member having numerous thin elongated blades arranged lengthwise in approximately axial direction, and in substantially drum form, so as to inclose within them a relatively large and practically-unobstructed intake-chamber, and in transverse section curved in the direction of rotation, whereby to carry the fluid with them rotatively and discharge it tangentially.

8. A centrifugal fan or pump, comprising a rotary member having numerous elongated blades arranged lengthwise in approximately axial direction, and in substantially drum form, so as to inclose within them a relatively large and practically-unobstructed intake-chamber, and said blades formed as curved plates having their outer and inner edges turned forward in the direction of rotation so that the blades are concave on their advancing sides.

9. A centrifugal fan or pump, comprising a rotary member having numerous elongated blades arranged lengthwise in approximately axial direction, and in substantially drum form, so as to inclose within them a relatively large and practically-unobstructed intake-chamber, and said blades formed as curved plates having their outer edges turned forward in the direction of rotation, and arranged with a forward angle or lead, with their outer edges in advance of their inner edges, so that the outer or discharging area of the ports is less than their interior or inlet area.

10. A centrifugal fan or pump, comprising a rotary member having numerous thin elongated blades arranged lengthwise in approximately axial direction, and in substantially drum form, so as to inclose within them a relatively large and practically-unobstructed intake-chamber, and in transverse section arranged, relatively to the axis and direction of rotation, to carry the fluid with them rotatively and discharge it tangentially, a disk on which said blades are mounted at one end, and an annular support for the opposite ends of said blades, and a means for so mounting said rotary member as to permit the tangential escape of the fluid discharged from said blades.

11. A centrifugal fan or pump comprising stationary and rotary members, the rotary member having numerous thin elongated blades arranged lengthwise in approximately axial direction, and in substantially drum form, so as to inclose within them a relatively large and practically-unobstructed intake-chamber, and in transverse section arranged, relatively to the axis and direction of rotation, to carry the fluid with them rotatively and discharge it tangentially, and the stationary member having an eye through which the fluid is drawn coincident with said intake-chamber and of a diameter substantially equal to that of said chamber, and having means for so mounting said rotary member as to permit the tangential escape of the fluid discharged from said blades.

12. A centrifugal fan or pump comprising stationary and rotary members, the rotary member having numerous elongated blades arranged lengthwise in approximately axial direction, and in substantially drum form, so as to inclose within them a relatively large and practically-unobstructed intake-chamber, and in transverse section arranged, relatively to the axis and direction of rotation, to carry the fluid with them rotatively and discharge it tangentially, and the stationary member having an eye through which the fluid is drawn coincident with said intake-chamber and of a diameter substantially equal to that of said chamber, and having means for so mounting said rotary member as to permit the tangential escape of the fluid discharged from said blades, and the aggregate effective area of the ports between the blades of said rotary member approximately equal to the area of said eye.

13. A centrifugal fan or pump comprising stationary and rotary members, the rotary member having numerous elongated blades arranged lengthwise in approximately axial direction, and in substantially drum form, so as to inclose within them a relatively large and practically-unobstructed intake-chamber, and in transverse section arranged, relatively to the axis and direction of rotation, to carry the fluid with them rotatively and discharge it tangentially, and the stationary member comprising a casing adapted to permit the tangential escape of the fluid discharged from said blades.

14. A centrifugal fan or pump, comprising a rotary member having numerous elongated blades arranged lengthwise in approximately axial direction, and in substantially drum form, so as to inclose within them a relatively large and practically-unobstructed intake-chamber, and in transverse section arranged,

relatively to the axis and direction of rotation, to carry the fluid with them rotatively and discharge it tangentially, the ports between said blades being open at their intake ends, and having an inlet-opening to said chamber of diameter approximately equal to the external diameter of the series of blades, so as to admit the inflowing fluid into the open ends of said ports.

15. A centrifugal fan or pump, comprising a rotary member having numerous elongated blades arranged lengthwise in approximately axial direction, and in substantially drum form, so as to inclose within them a relatively large and practically-unobstructed intake-chamber, and in transverse section arranged, relatively to the axis and direction of rotation, to carry the fluid with them rotatively and discharge it tangentially, the ports between said blades being open at their intake ends, and an annular support for the intake ends of the blades, such support engaging the outer edges thereof.

16. A centrifugal fan or pump, comprising a rotary member having numerous elongated blades arranged lengthwise in approximately axial direction, and in substantially drum form, so as to inclose within them a relatively large and practically-unobstructed intake-chamber, and in transverse section arranged, relatively to the axis and direction of rotation, to carry the fluid with them rotatively and discharge it tangentially, the ports between said blades being open at their intake ends, and the blades being curved transversely at their intake ends to stiffen them.

17. A centrifugal fan or pump comprising stationary and rotary members, the rotary member having numerous elongated blades arranged lengthwise in approximately axial direction, and in substantially drum form, so as to inclose within them a relatively large and practically-unobstructed intake-chamber, and in transverse section arranged, relatively to the axis and direction of rotation, to carry the fluid with them rotatively and discharge it tangentially, the ports between said blades being open at their intake ends and the stationary member having an eye through which the fluid is drawn concentric with said intake chamber and of a diameter approximately equal to the external diameter of the series of blades, so as to admit the inflowing fluid into the open ends of said ports.

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

SAMUEL C. DAVIDSON.

Witnesses:
GEORGE GOOLD WARD,
HUGH TAYLOR COULTER.