

J. F. HANRAHAN & H. A. WENDE.

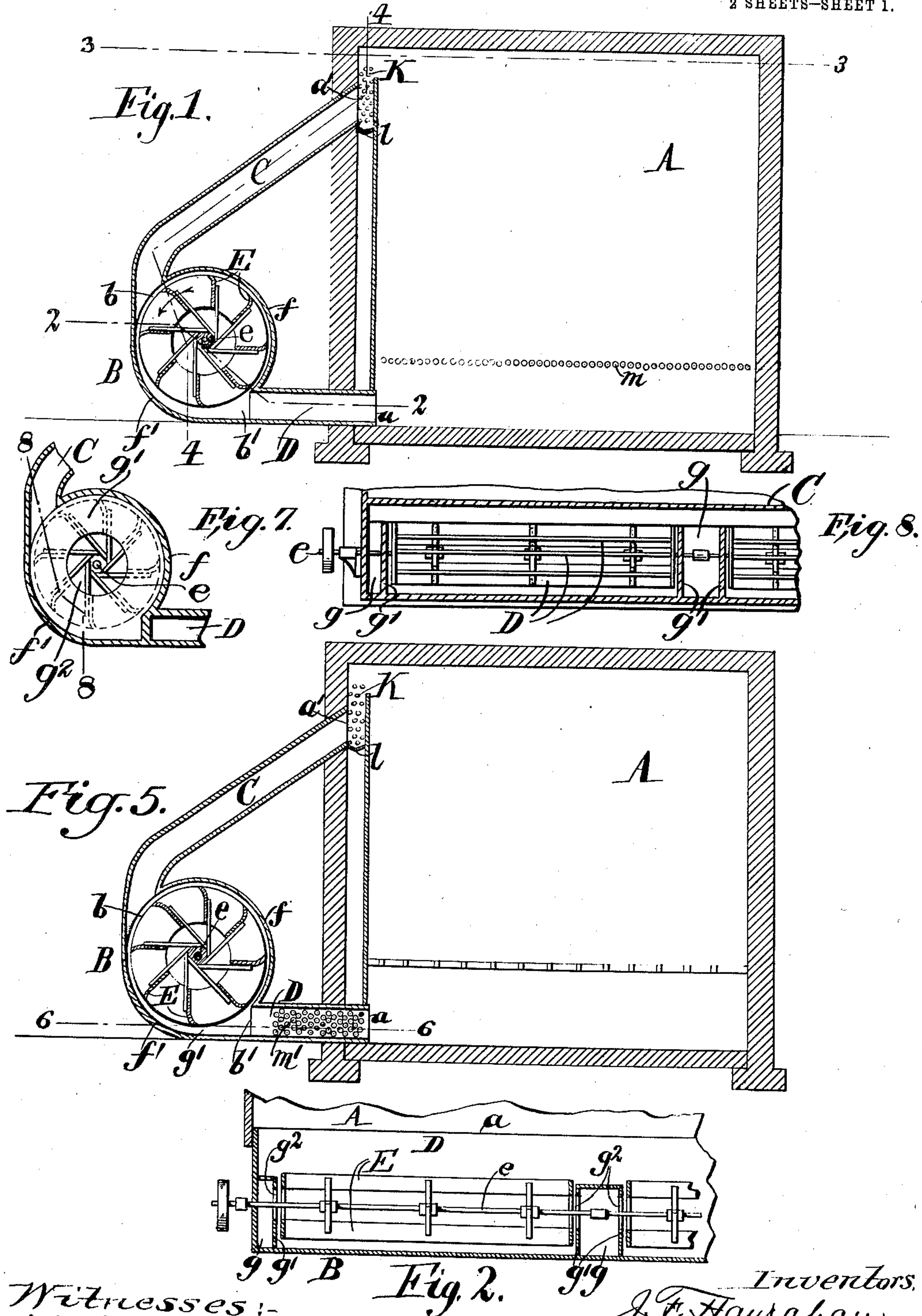
FAN.

APPLICATION FILED AUG. 13, 1909.

997,127.

Patented July 4, 1911.

2 SHEETS—SHEET 1.



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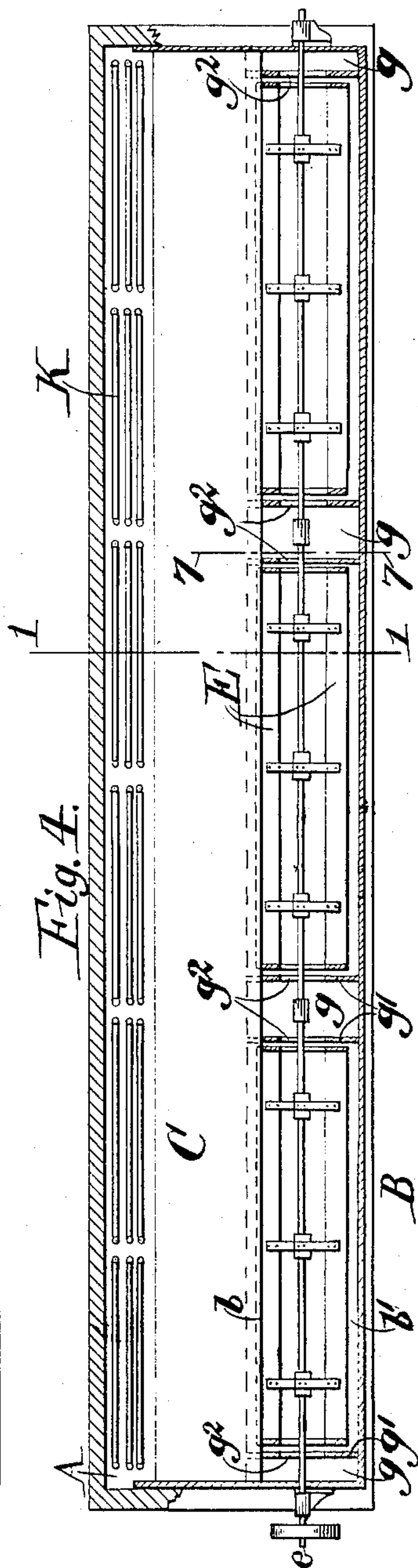
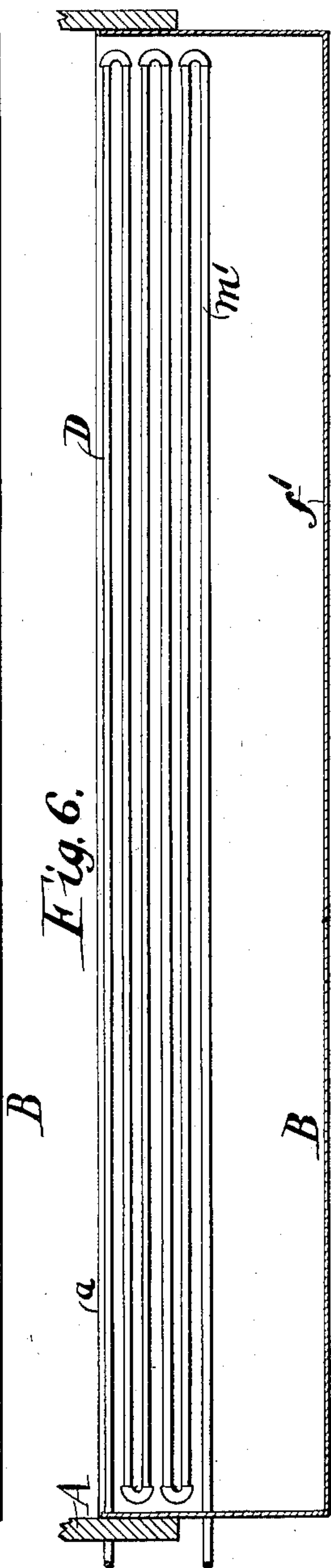
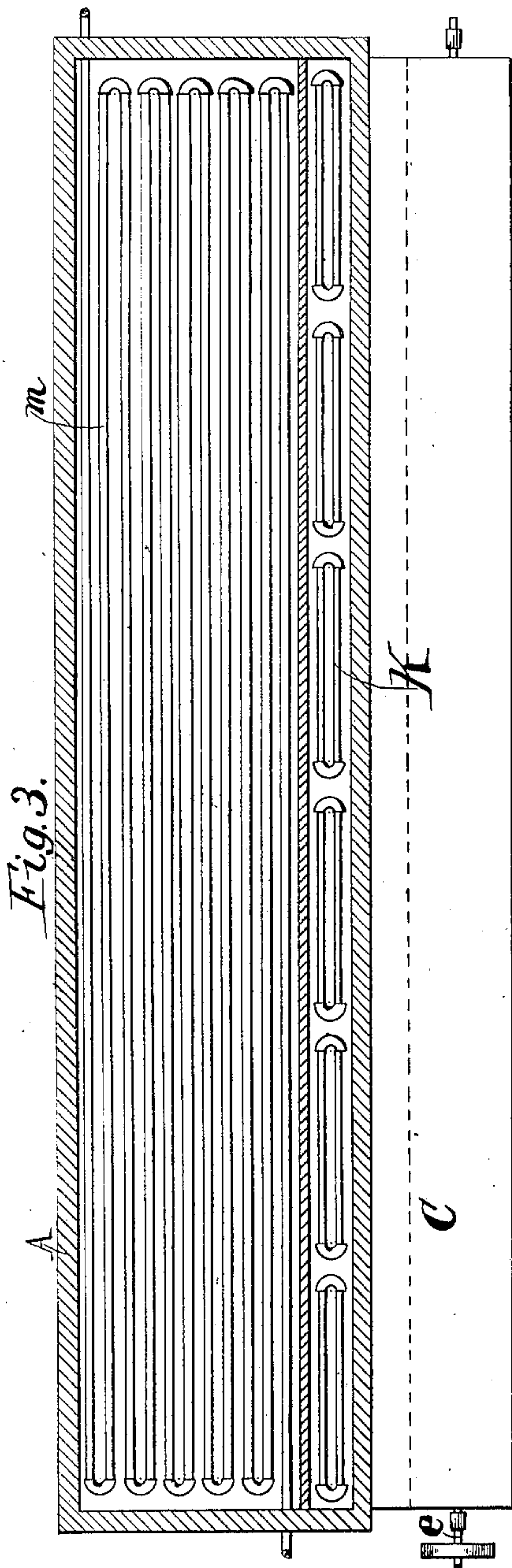
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UNITED STATES PATENT OFFICE.

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FAN.

997,127.

Specification of Letters Patent.

Patented July 4, 1911.

Application filed August 13, 1909. Serial No. 512,662.

To all whom it may concern:

Be it known that we, JOSEPH F. HANRAHAN, a citizen of Canada, and HERMANN A. WENDE, a citizen of the United States, and
5 residing at Buffalo, in the county of Erie and State of New York, have invented a new and useful Improvement in Fans, of which the following is a specification.

This invention relates to a fan which is
10 more particularly designed for use in circulating air through a drier or evaporator but which may also be used for other purposes.

The object of this invention is to produce
15 a fan for this purpose whereby a large volume of air is positively and uniformly propelled through a conduit or passage of considerable length in the direction of the axis of the fan, as for instance, the air supply
20 passage of a drying chamber which is equal in length to the entire length of said chamber.

In the accompanying drawings consisting of two sheets: Figure 1 is a vertical cross section of an evaporator taken in line 1—1, Fig. 4 and showing one application of our invention. Fig. 2 is a fragmentary horizontal section thereof on a reduced scale, in line 2—2, Fig. 1. Fig. 3 is a horizontal section, on a reduced scale in line 3—3, Fig. 1. Fig. 4 is a vertical longitudinal section in line 4—4, Fig. 1. Fig. 5 is a vertical cross section showing another application of our invention. Fig. 6 is a fragmentary horizontal section, on a reduced scale, in line 6—6, Fig. 5. Fig. 7 is a fragmentary vertical section taken in line 7—7, Fig. 4. Fig. 8 is a vertical section taken in line 8—8, Fig. 7.

Similar letters of reference indicate corresponding parts throughout the several views.

A represents the drying chamber which receives the products or articles to be dried and which may be of any suitable form or
45 construction. One of the longitudinal walls of this chamber is provided adjacent to the bottom of the chamber with an air inlet thereto *a* and adjacent to the top thereof with an air outlet therefrom *a*¹ said inlet and outlet of the chamber extending horizontally the full length of the chamber or substantially so, as shown in Figs. 3, 4 and 6.

B represents the case of a fan which is preferably arranged outside of the wall of
55 the chamber containing the air inlet and

outlet and extending the full length of the chamber, or substantially so, and parallel therewith. On the upper outer part of the periphery of the fan case the same is provided with a tangential air inlet *b* which is
60 connected by an upper inclined air conduit or pipe C with the upper air outlet of the drying chamber. On the lower inner part of the periphery of the fan case the same is provided with a tangential air outlet *b*¹
65 which is connected by a lower horizontal air conduit or pipe D with the lower air inlet of the drying chamber. The upper and lower conduits C, D are of the same length as the fan case and drying chamber,
70 as shown in Figs. 3 and 4.

Within the fan case are arranged a plurality of fan blades E which rotate vertically and are mounted on a horizontal shaft *e* arranged lengthwise in the fan case
75 and driven in any suitable manner.

That side *f* of the periphery of the fan case between the inner angles of the tangential inlet and outlet is arranged concentrically with the axes of the fan blades and
80 case and the opposite side *f*¹ of the periphery of the case between the outer angles of the tangential inlet and outlet of the fan case is of scroll form or arranged eccentrically to the axes of the fan case and blades being of
85 gradually increasing radii from the tangential inlet to the tangential outlet of the fan case, as shown in Fig. 1. The direction of rotation of the fan blades is such that when passing the eccentric side of the periphery
90 of the fan case they move from the shorter to the longer radii thereof. By this means the air carried around by the fan blades within the concentric part of the periphery of the case is confined against outward radial
95 movement under the centrifugal action of the fan blades but when the latter pass the eccentric part of the periphery of the case the air at this time is permitted to move radially outward a limited extent and produce a downward suction of the air from
100 the upper part of the drying chamber through the upper air conduit and into the fan case from which latter it is again forcibly expelled through the lower air pipe into
105 the lower part of the drying chamber wherein it again rises to the top, being forcibly and continuously circulated in this manner so long as the fan is in operation.

In the absence of any provision to prevent 110

it the rarefication of the air at the axis of the rotary fans due to the centrifugal action of the latter would cause a conflict of air currents at this place which would interfere with the propelling effect of the fan blades on the air for withdrawing the same from the top of the drying chamber and returning the same to the bottom thereof. To avoid this, means are provided whereby sufficient air is diverted from the air inlet of the fan case to the axis of the blades to compensate for the air which is withdrawn from this location by the centrifugal action of the fan blades. The preferred means for accomplishing this result consists in dividing the fan blades into a plurality of groups or sections, each group containing a circumferential row of blades and the several groups being arranged lengthwise side by side on the fan shaft, as shown in Fig. 4, and providing auxiliary air supply conduits g which are arranged adjacent to the ends of the groups of the fan blades and each of which extends from the air inlet of the fan case to the axis of the blades. These auxiliary air conduits are formed by vertical partitions or diaphragms g^1 arranged in the fan case between the groups of blades and extending from the inlet to the outlet thereof and having air inlet eyes g^2 in line with the axis of the blades. As the fan blades rotate that part of the air which is forced outwardly from the center of the same by the centrifugal action of the blades is replenished by the air supplied through the auxiliary air conduits g , thereby preventing any back pressure or clashing of the air currents and enabling a large volume of air to be propelled by the fan with the expenditure of comparatively little power.

By means of this fan a uniform draft of air into the upper air conduit and a uniform blast of air from the lower air conduit is produced throughout the entire length of these conduits which causes a current of air of equal uniformity to rise from the lower to the upper part of the drying chamber and thereby operate alike on the products in all parts of this chamber, thereby avoiding the necessity of redrying of part of the products in a charge as has been customary heretofore with consequent loss of efficiency in the apparatus and loss of uniformity in the product put out.

The vapors which are taken up by the air in passing the products to be dried are condensed by intercepting the air by means of a condenser on its way to the fan which condenser preferably consists of water conducting coils K which are arranged in front of

the upper air outlet of the chamber and from which the water of condensation drips upon a gutter or pan l leading to a sewer or receptacle.

The air freed from vapors upon being returned to the lower part of the drying chamber is preferably heated so as to increase its vapor absorbing capacity. The means for this purpose may consist of heating coils or pipes m arranged in a horizontal row in the lower part of the drying chamber, as shown in Figs. 1 and 3, or similar pipes or coils m^1 may be arranged in the lower air conduit, as shown in Figs. 5 and 6. The coils m , m^1 may be heated by circulating a suitable heating agent through the same such as steam or hot water.

It is of course understood that the propelling effect of the fan is aided by the natural tendency of the cool column of air in the upper and lower air conduit and fan case to descend by gravity and the hot or warm air in the drying chamber to rise. When, however, the article or product to be dried requires treatment under comparatively low temperatures, as is the case in drying of glue and similar material, the thermal action of the air, if solely depended on, would produce a comparatively slow circulation of the air which would prolong the period of drying in the same measure. By the use of the fan, however, the movement of the air is accelerated and the drying operation expedited, thereby materially increasing the output of the evaporator and reducing the cost of operation.

We claim as our invention:

A fan comprising a circular case composed of a plurality of sections arranged axially in line, an air inlet conduit connected tangentially with the peripheries of said several case sections on one side thereof, an air outlet conduit connected with the peripheries of said several case sections on the opposite side thereof, auxiliary air conduits arranged at the ends of the several case sections and extending from said inlet conduit to said case sections at the axes thereof, fan blades rotatable in each of said case sections, and a shaft for driving said blades extending lengthwise through said case sections and auxiliary conduits.

Witness our hands this 12th day of August, 1909.

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Witnesses:

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