(No Model.) 5 Sheets—Sheet 1.

H. McCORNACK.

CENTRIFUGAL SEPARATOR.

No. 584,231. Patented June 8, 1897.

FIG. 1.

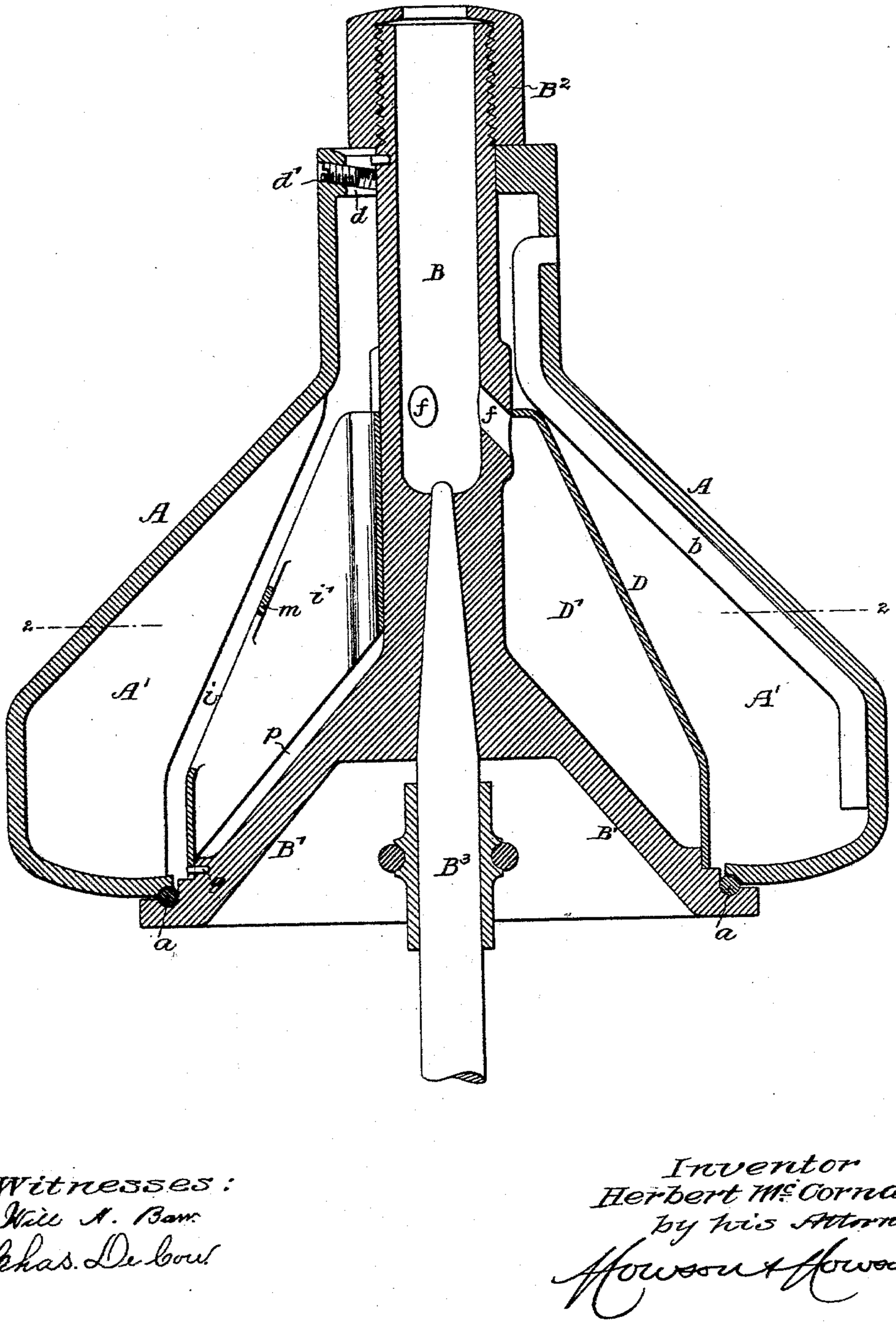

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FIG. 2.

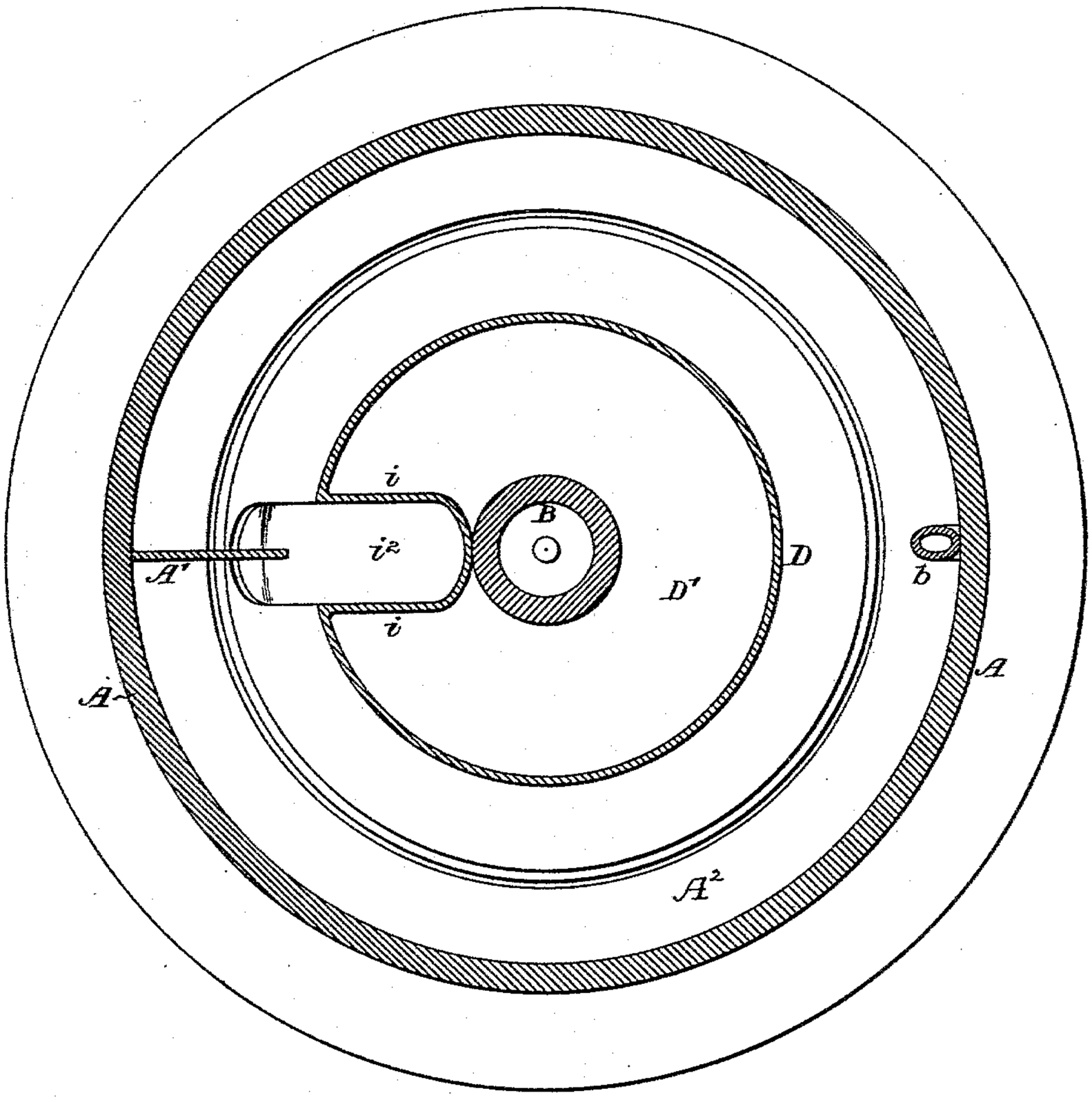
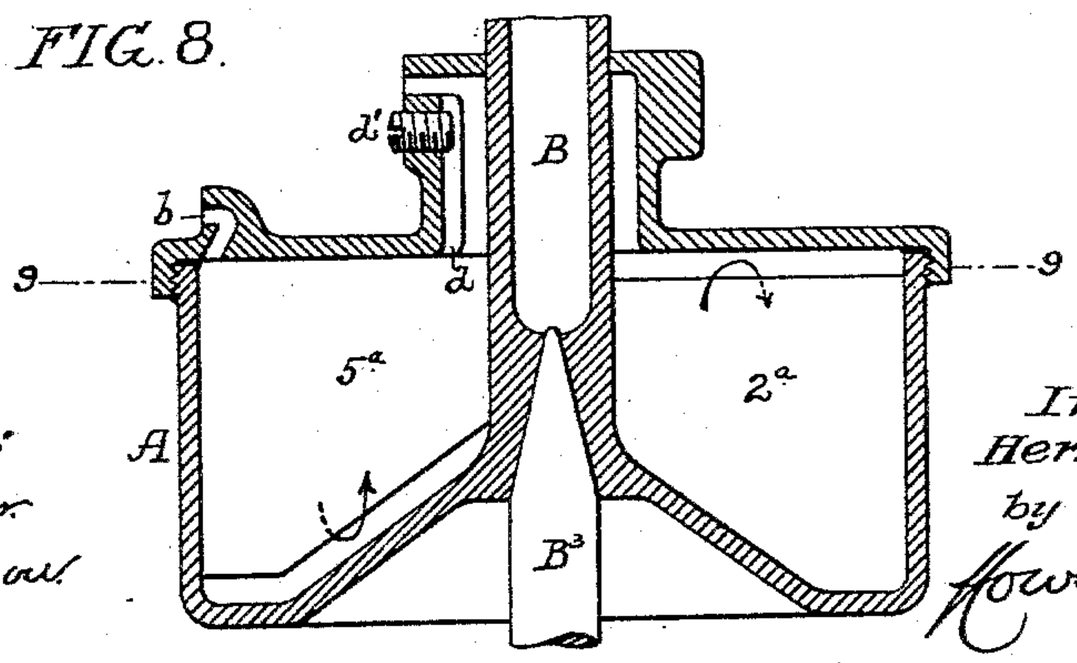


FIG. 8.



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CENTRIFUGAL SEPARATOR.

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FIG. 3.

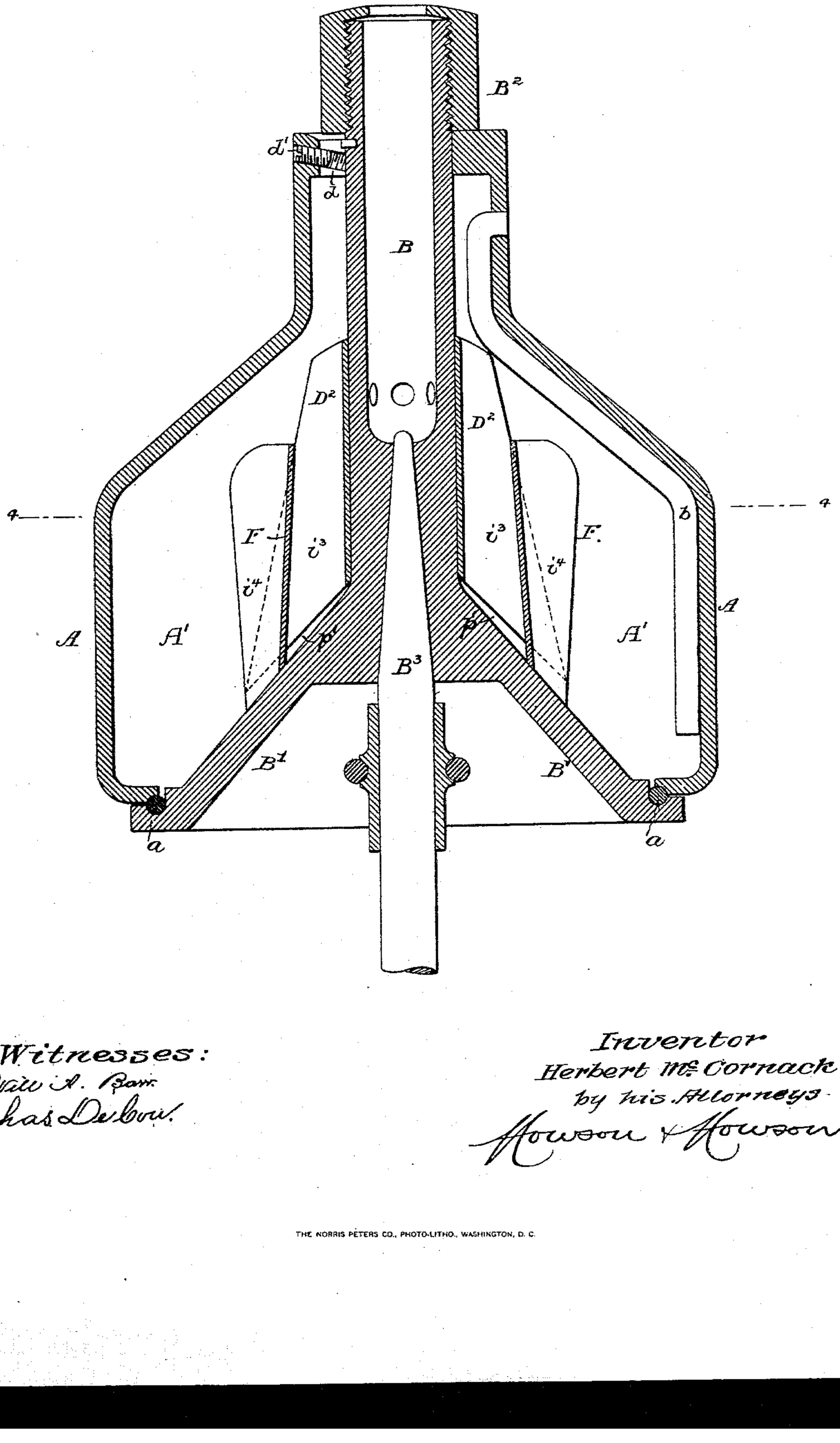

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FIG. 4.

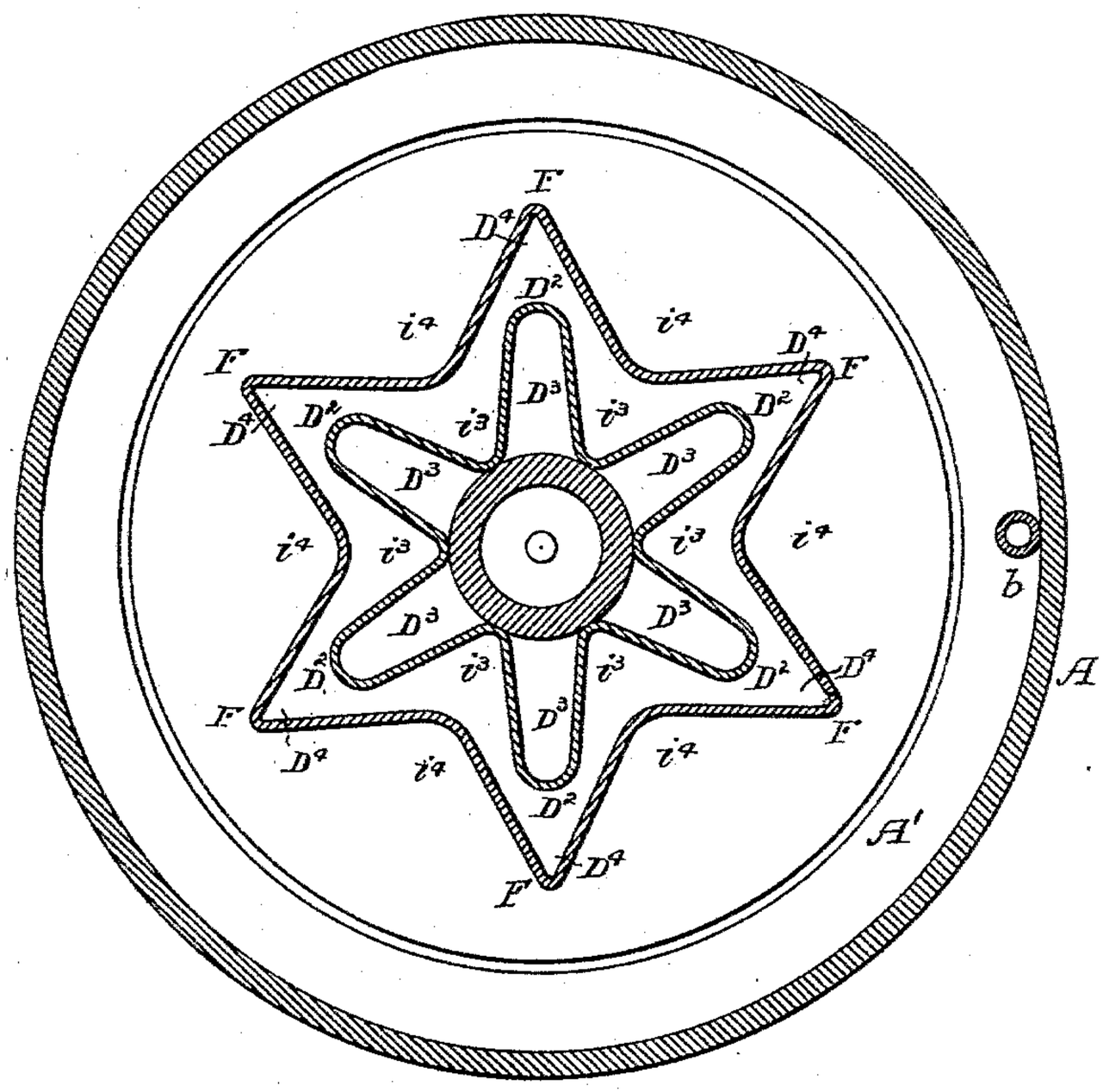
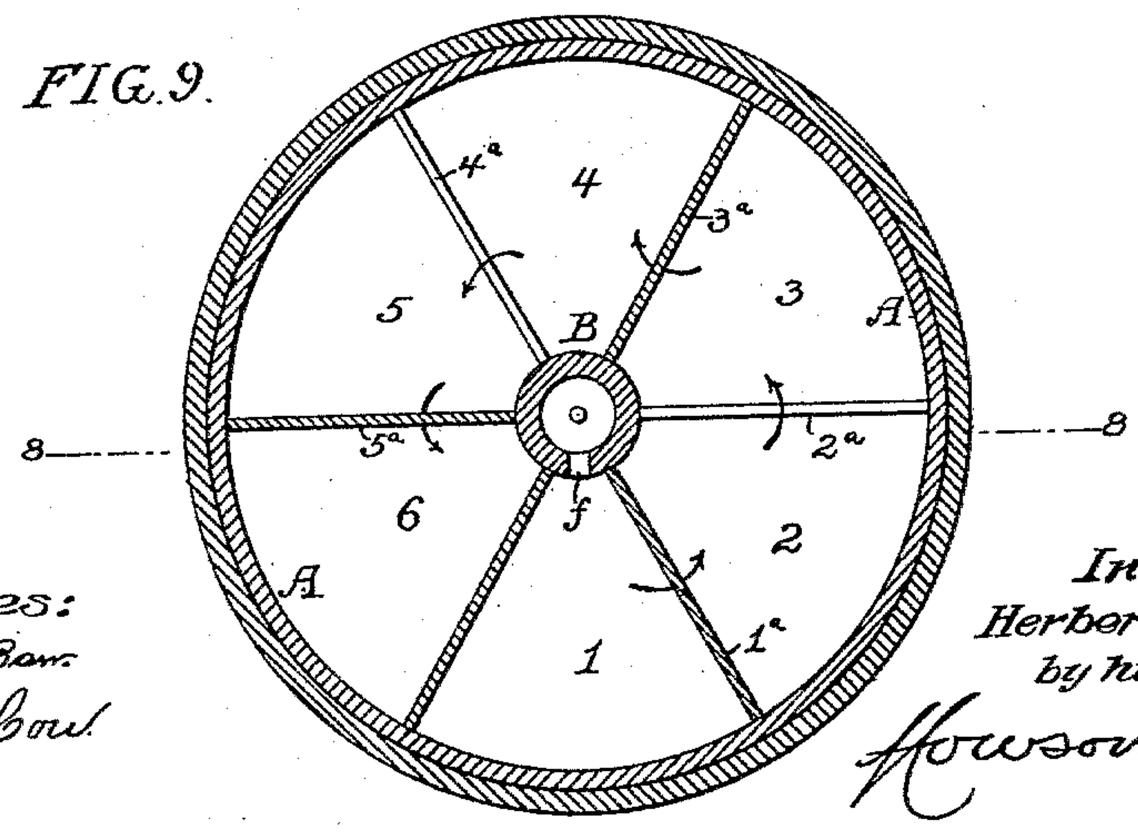


FIG. 9.



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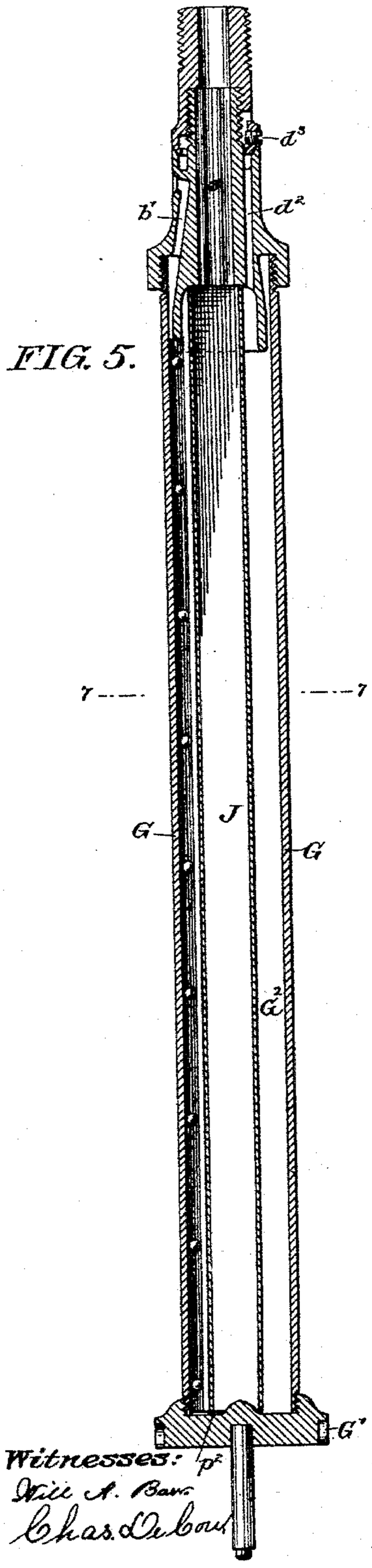

FIG. 5.

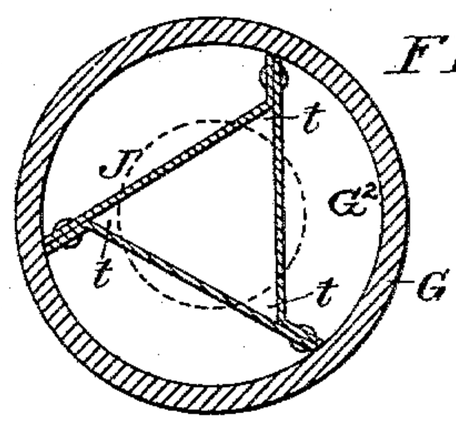

FIG. 7.

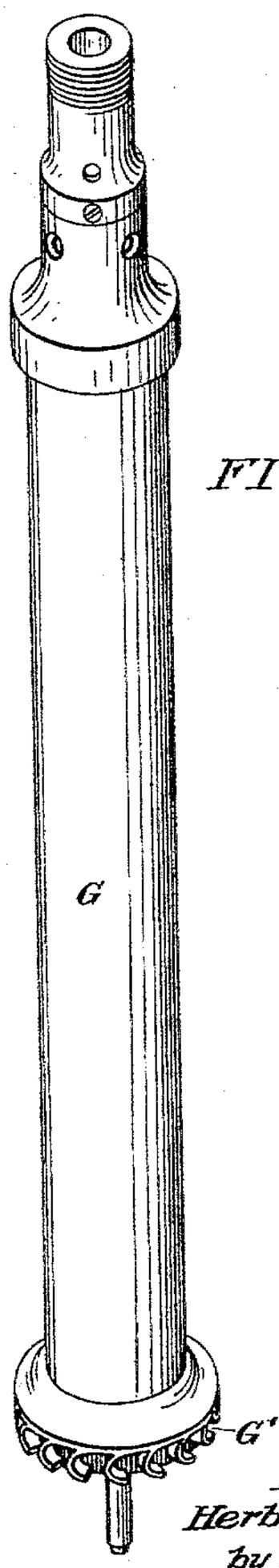

FIG. 6.

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UNITED STATES PATENT OFFICE.

HERBERT McCORNACK, OF WEST CHESTER, PENNSYLVANIA, ASSIGNOR TO PHILIP M. SHARPLES, OF SAME PLACE.

CENTRIFUGAL SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 584,231, dated June 8, 1897.

Application filed December 9, 1895. Serial No. 571,568. (No model.)

To all whom it may concern:

Be it known that I, HERBERT MCCORNACK, a citizen of the United States, and a resident of West Chester, Pennsylvania, have invented certain Improvements in Centrifugal Separators, of which the following is a specification.

My invention relates to that class of centrifugal separators which are employed for separating liquids of different densities, such as cream and milk, and in which the liquid mass in the rapidly-rotated bowl is divided by one or more partitions into different volumes, in each of which a partial separation takes place, the object of my present invention being to provide for communication between the different volumes of liquid in such a way that liquid may pass from one volume to another without any material disturbance of the natural stratification or lamination due to the action of centrifugal force upon the portions of different specific gravity which constitute the mass. This object I attain by providing for free communication between the mass of liquid on one side of the partition and that on the other side of the same on lines concentric with the axis of rotation of the bowl, so that corresponding strata or laminæ in each volume are in constant communication with each other on the lines in which they naturally dispose themselves under centrifugal action, and hence the concentration of the cream or lighter portion of the liquid mass upon the inner wall of the same and the flow of the skim-milk or heavier portion of the mass to the outer portion of the bowl are not attended with any material disturbance of the various strata or laminæ.

In the accompanying drawings, Figure 1 is a vertical section of an ordinary form of centrifugal cream-separator, illustrating the application of my invention thereto. Fig. 2 is a sectional plan view on the line 2 2, Fig. 1. Fig. 3 is a vertical section similar to Fig. 1, but illustrating a modified form of partition structure. Fig. 4 is a sectional plan view taken on the line 4 4, Fig. 3. Fig. 5 is a vertical section of another form of centrifugal separator embodying my invention. Fig. 6 is a perspective view of the same on a smaller scale. Fig. 7 is a sectional plan view on the line 7 7, Fig. 5, but on a larger scale than said figure. Fig. 8 is a vertical sectional view of still another form of separator, illustrating my invention; and Fig. 9 is a sectional plan view on the line 9 9, Fig. 8.

In Figs. 1 to 4, A represents a centrifugal separator-bowl of well-known form, this bowl comprising a lower cylindrical portion, above which is a conical portion surmounted by a contracted cylindrical portion or neck, this bowl being mounted upon an expanded conical base B′, which forms part of a central tube B. The bowl is confined to the base by a nut B^2 on the tubular shaft, which nut bears upon the top of the contracted neck of the bowl, and a packing-ring *a* is interposed between the bowl and the base B′ in order to form a tight joint. The base B′ of the bowl has a central depending supporting and driving spindle B^3.

Within the bowl is the usual pipe *b*, communicating with the outer portion of the bowl and leading thence upward to and through the contracted neck, said pipe serving for the discharge of the skim-milk, and in the top of the contracted neck is a contracted radial slot *d*, into which projects a set-screw *d′*, the inner end of which determines the point at which the cream discharges from the bowl, so that by turning the screw in one direction or the other the cream-discharge line can be varied as desired.

The tubular shaft B serves as the milk-inlet, the full milk being introduced thereinto through an opening in the top of the nut B^2 and being discharged therefrom through suitable radial openings *f*.

Within the bowl is a conical partition D, which fits snugly at its lower end to the enlarged base B′ of the bowl and is caused to rotate therewith in any suitable manner, as, for instance, by means of a pin *g*, carried by the base and projecting into a slot or notch in the lower portion of the partition, as shown in Fig. 1.

The bowl A has the usual inwardly-projecting blade or vane A′ for insuring the rotation of the liquid mass therewith, and the partition D has a hollow rib *i* projecting inwardly from the outer shell of the partition to a point inwardly beyond the line of the cream-dis-

charge, as shown in Figs. 1 and 2, this hollow rib insuring the rotation of the liquid mass contained within the partition.

The chamber i' within the hollow rib is in free communication with the interior of the bowl A, the mouth of the rib being crossed only by a narrow bridge-piece m, serving as a brace or stiffener. Hence the volume of liquid within the chamber i' is to be regarded as a part of that contained within the outer separating-chamber A^2—that is to say, the chamber between the partition D and the outer shell of the bowl.

The side walls of the hollow rib i do not extend completely downward to the base B′ of the bowl. Hence a flow-passage p is formed between said base B′ and the lower edges of the side walls of the hollow rib, this flow-passage extending from the outer shell of the partition to the inner end or base of the rib, or at least to a point close to or inside of the line of cream-discharge and serving to provide free communication between the liquid mass contained in the chamber D′ within the partition and the mass contained in the chamber i' of the hollow rib.

In the operation of the device the full milk is discharged from the tubular shaft or spindle B through the openings f into the chamber D′ within the partition D, and thence flows through the channels p into the chamber i' of the hollow rib and thence into the bowl.

When the bowl is rotated, the centrifugal action causes separation of the mass of full milk into various concentric strata or laminæ of different specific gravity, the heaviest strata being outermost and the lightest innermost.

The use of the partition D is for the purpose of causing a primary or partial separation and a secondary separation, the primary separation taking place in the chamber D′ within the partition and the secondary separation being accomplished in the chamber A^2 of the bowl outside of said partition.

By providing the partition with a hollow rib which is in free communication with the mass of liquid in the bowl and is also in free communication with the mass of liquid in the chamber D′ within the partition on lines concentric with the axis of rotation of the bowl perfect communication of the two masses is effected, since the stratification or lamination of the mass within the chamber i' of the hollow rib must be precisely the same as that of the mass within the chamber D′, and the strata in one chamber can communicate freely on concentric lines with the strata in the other chamber. Hence there is no commingling or disturbance of the different strata by compelling one to force its way radially through another in order to find a means of escape.

In Figs. 1 and 2 I have illustrated the partition D as having but a single hollow rib; but it will be apparent that the number of these hollow ribs may be increased to any desired extent without departing from the essential purpose or principle of my invention.

In Figs. 3 and 4 I have shown an instance of an extreme embodiment of the idea of multiple ribs. In this case the shell which constitutes the equivalent of the partition-shell D of Fig. 1 is in the form of a series of radiating fingers D^2, flaring outwardly from top to bottom, as shown in Fig. 3, and each inclosing a chamber D^3, this series of chambers D^3 constituting the equivalent of the single chamber D′ of Fig. 1, in that the primary or partial separation is effected therein. The spaces i^3 between the fingers D^2 constitute the equivalents of the chamber within the hollow rib i of the structure shown in Fig. 1, and these chambers i^3 communicate with the chambers D^3 through flow-passages p' at the base of the structure in substantially the same manner and for the same purpose as the communication is established between the chambers i' and D′ of Fig. 1 by means of the flow-passage p. In these views of the drawings I have also illustrated, in connection with the winged partition structure D^2, an outer and similarly winged supplementary partition structure F, which surrounds the partition structure D^2, extends part way throughout the height of the same, and flares outwardly from bottom to top, the chambers D^4 within the hollow wings F serving as separating-chambers and communicating over the top of said partition structure F with the chambers i^4, formed between the wings of said structure F. In this case provision is made for a primary or partial separation in the chambers D^3, for a secondary or further separation in the chambers D^4, and for a third or final separation in the chamber A′ within the bowl, and this multiplication of separating actions may be carried to any desired extent without departing from my invention.

In Figs. 5, 6, and 7 I have illustrated an embodiment of my invention in which the separator consists of a simple upright tube or cylinder G, rotated by means of a jet of motive fluid acting on an impact-wheel G′ or in any other available manner, and having at the top a skim-milk outlet b' and a cream-outlet d^2, controlled by a set-screw d^3. In the cap of the cylinder is also formed a central channel or passage s for the inflow of the full milk, and within the cylinder is a partition structure J, consisting of three plates so disposed in respect to each other as to form a triangular structure with projecting flanges at the angles, which flanges bear upon the walls of the cylinder G, and are riveted or otherwise suitably secured together. This triangular structure is of such dimensions that the cream-discharge line, which is represented by the dotted circle in Fig. 7, falls within the angles of the structure, these portions of the chamber within the partition being in free communication with the chamber surrounding the partition and within the cylinder G through flow-passages p^2 at the base

of the separator. When the full milk is introduced into the structure J, primary or partial separation takes place in each of the chambers *l* within the angles of the structure and outside of the cream-line, and these separating-chambers have free communication on lines concentric with the axis of rotation with the secondary separating-chamber G^2, surrounding the partition, so that there is in this machine, as in the machines previously described, constant communication of the strata in the preliminary separating-chambers with the corresponding strata in the secondary separating-chamber, with the same attendant good results.

Where the partition structure is a flaring one, the flow passage or passages between the successive separating-chambers is preferably at that portion of the partition structure having the greatest diameter. Thus it is at the bottom of the partitions D D^2 and at the top of the partition F. Where the partition is of uniform diameter or dimensions throughout, the flow-passage may be at either end, but it should by preference be at the end opposite that which receives the full milk—for instance, in the structure shown in Fig. 5 the partition structure receives the full milk at the top and the communicating passages are at the bottom.

In all of the machines previously described the secondary separating-chamber surrounds the primary separating-chamber, but this construction is not necessary to the proper carrying out of my invention, as the latter is equally applicable to separators in which the successive separating-chambers are side by side.

In Figs. 8 and 9 I have shown a separator in which the separating-chambers are thus arranged and are separated from each other by partitions having flow-passages at top or bottom providing for communication between the successive separating-chambers on concentric lines. Thus 1 is the inlet-chamber and 6 the outlet-chamber of the separator, the chamber 1 communicating through a flow-passage beneath the partition 1^a with the chamber 2 and the latter communicating through a flow-passage above the partition 2^a with the chamber 3, which communicates through a flow-passage beneath the partition 3^a with the chamber 4, and so on, the chamber 5 communicating through a flow-passage beneath the partition 5^a with the outlet-chamber 6, which has a skim-milk outlet b^2 and a cream-discharge groove d^4 with adjusting-screw d^5.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. A centrifugal separator having a separating-bowl with one or more internal partitions disposed as described to provide successive separating-chambers and form one or more flow-passages extending from the cream-wall at the inner portion of the chamber bounded by the partition to the outer portion of said chamber, and providing for communication on lines concentric with the axis of rotation between the masses of liquid in the successive separating-chambers.

2. A centrifugal separator having a separating-bowl with an internal partition disposed as described to provide for primary and secondary separation of the liquid mass, said partition having one or more hollow ribs each forming a flow-passage extending from the cream-wall at the inner portion of the chamber bounded by the partition to the outer portion of said chamber, and providing for communication on lines concentric with the axis of rotation between the masses of liquid in the primary and secondary chambers.

3. A centrifugal separator having a separating-bowl with an internal flaring partition disposed therein as described so as to cause primary and secondary separation of the liquid mass, and forming one or more flow-passages located at the wide end of the partition and extending from the cream-wall at the inner portion of the chamber bounded by said partition to the outer portion of said chamber and serving to afford communication on lines concentric with the axis of rotation between the separating-chamber within the partition and that outside of the same.

4. A centrifugal separator having a separating-bowl with a series of partitions disposed therein as described to form successive separating-chambers side by side, and flow-passages extending from the cream-wall at the inner portion of the chambers bounded by said partitions to the outer portion of said chambers, and providing for communication on lines concentric with the axis of rotation between the masses of liquid in the successive separating-chambers.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HERBERT McCORNACK.

Witnesses:
WILLIAM S. WINDLE,
A. E. WORRALL.