(No Model.)

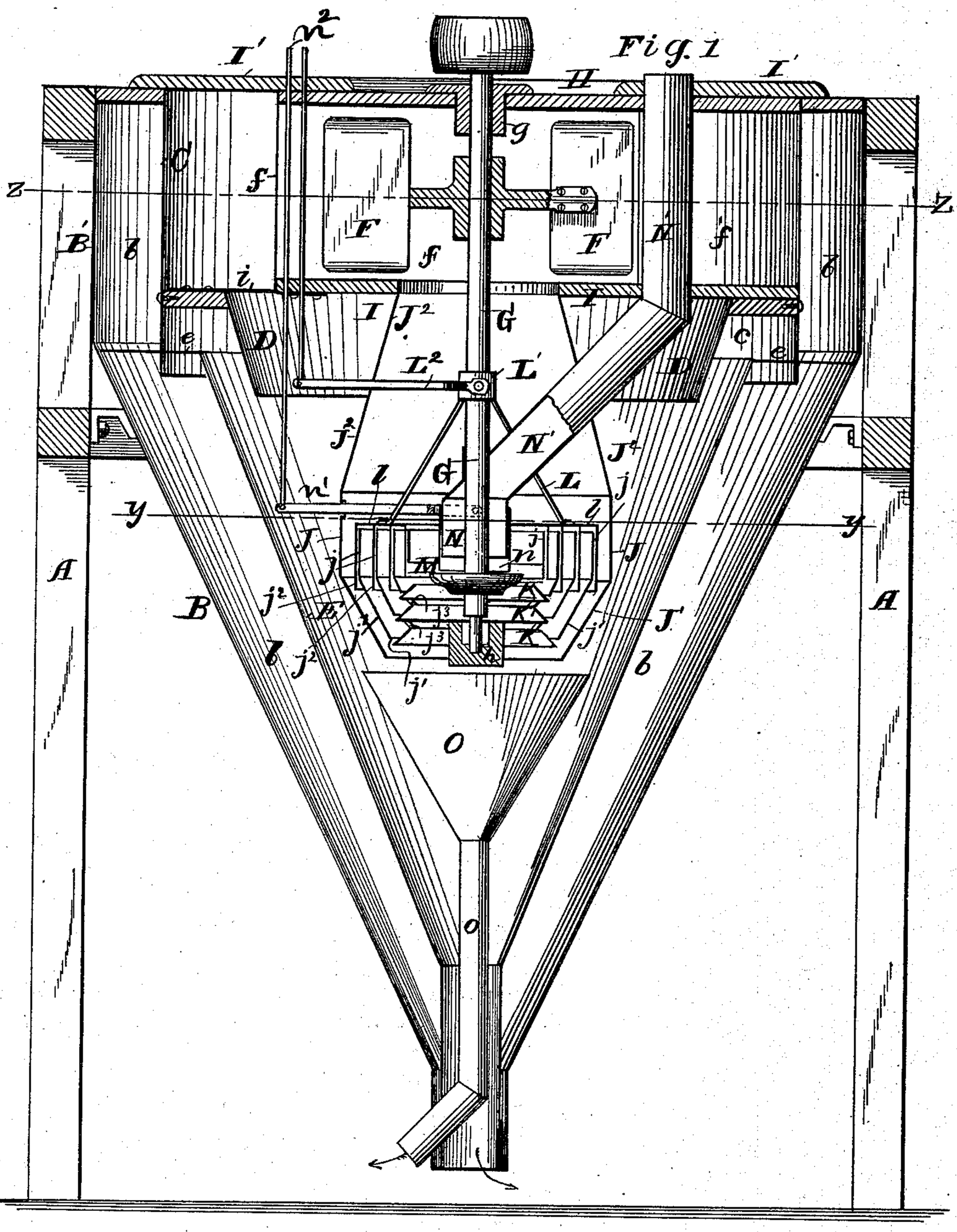
5 Sheets—Sheet 1.

N. W. HOLT.

SEPARATING MACHINE.

No. 384,950. Patented June 19, 1888.

Fig. 1



Witnesses:
J. B. Turner.
J. B. McGirr.

Inventor:
Noah W. Holt.
by Doubleday & Bliss
attys

(No Model.) 5 Sheets—Sheet 2.

N. W. HOLT.

SEPARATING MACHINE.

No. 384,950. Patented June 19, 1888.

Fig. 2

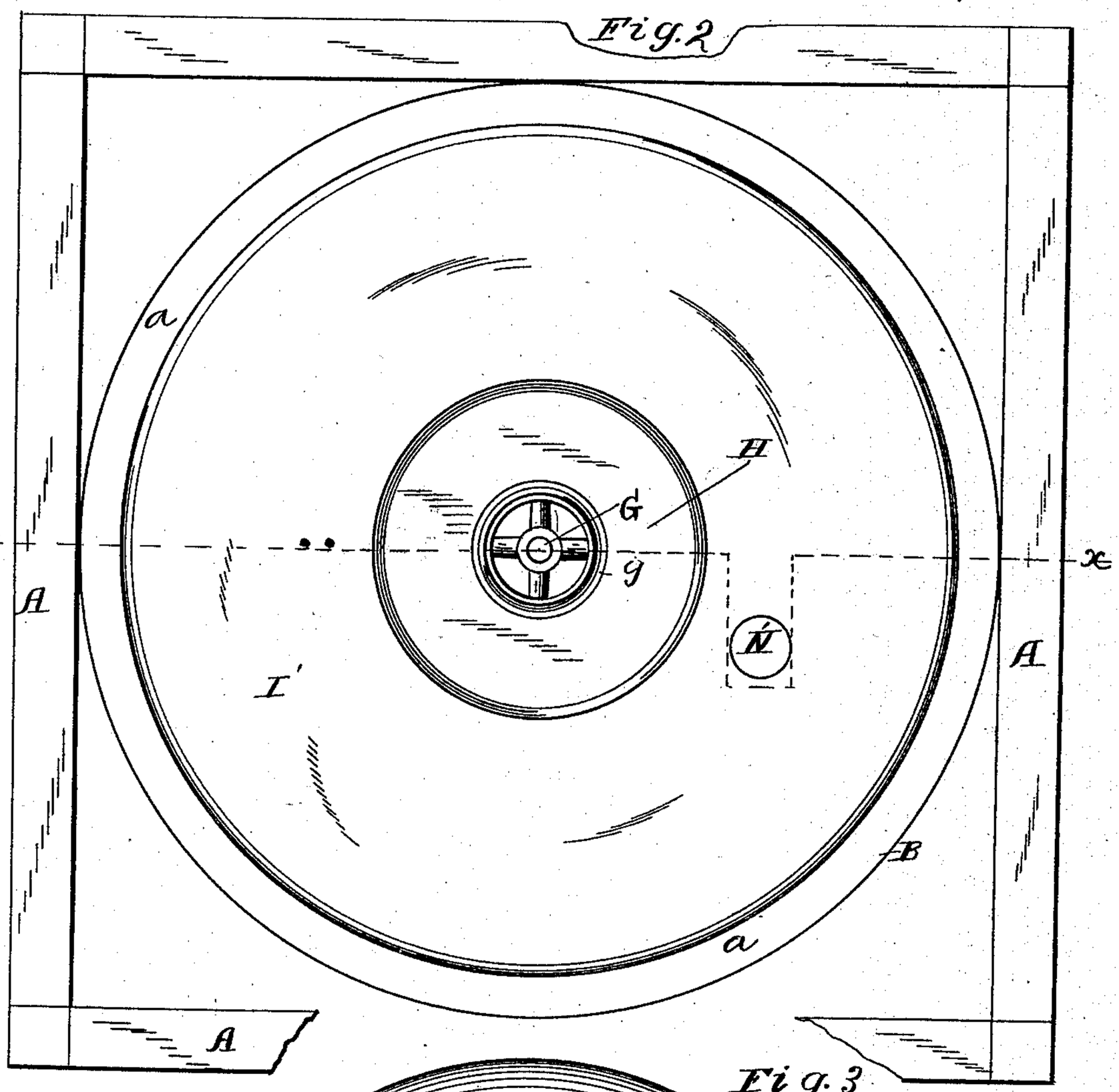
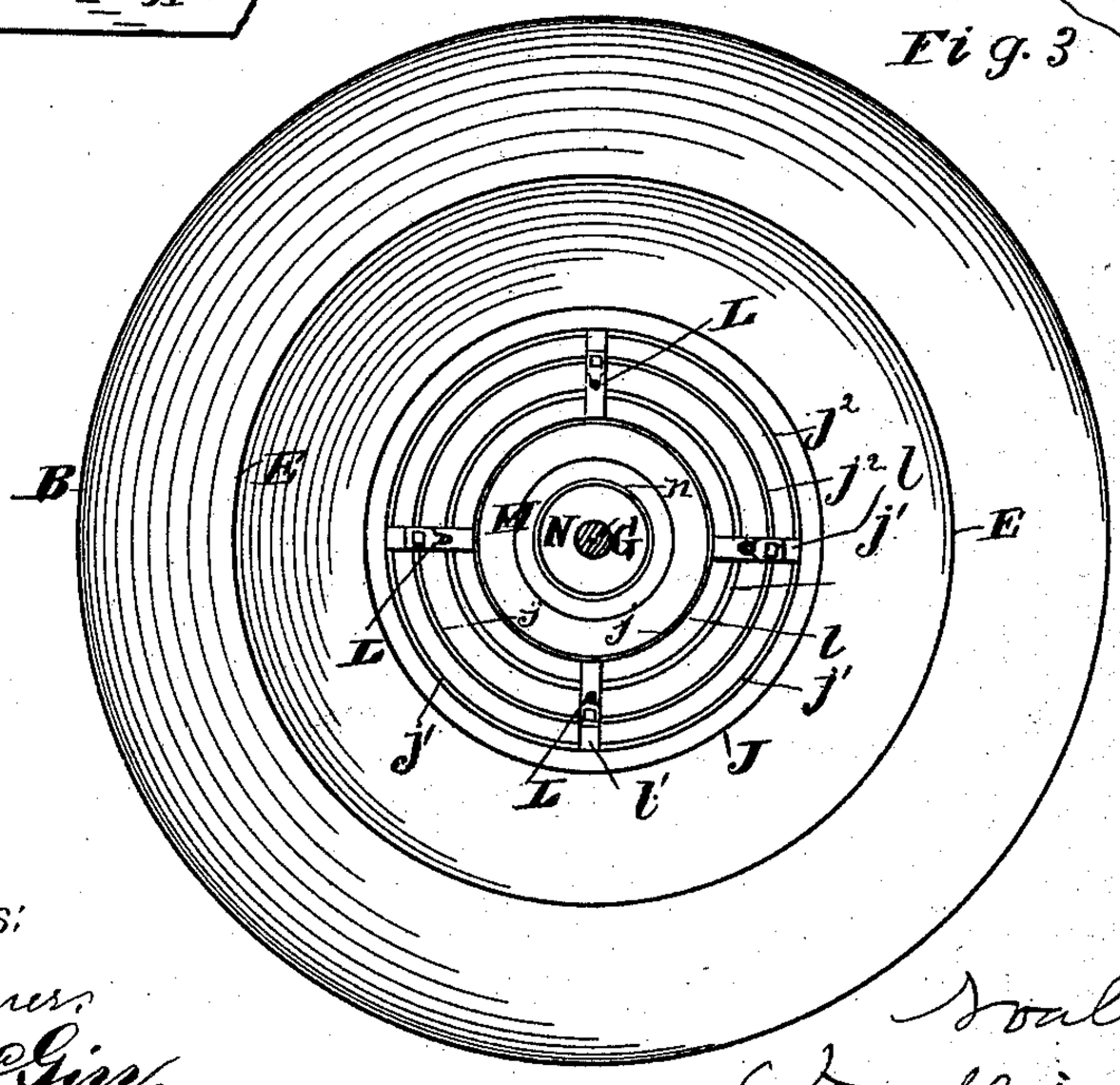


Fig. 3



Witnesses:
J. C. Turner.
J. B. McGinn.

Inventor:
Noah W. Holt.
by Dowell & Dowell Attys

(No Model.) 5 Sheets—Sheet 3.

N. W. HOLT.

SEPARATING MACHINE.

No. 384,950. Patented June 19, 1888.

Fig 4

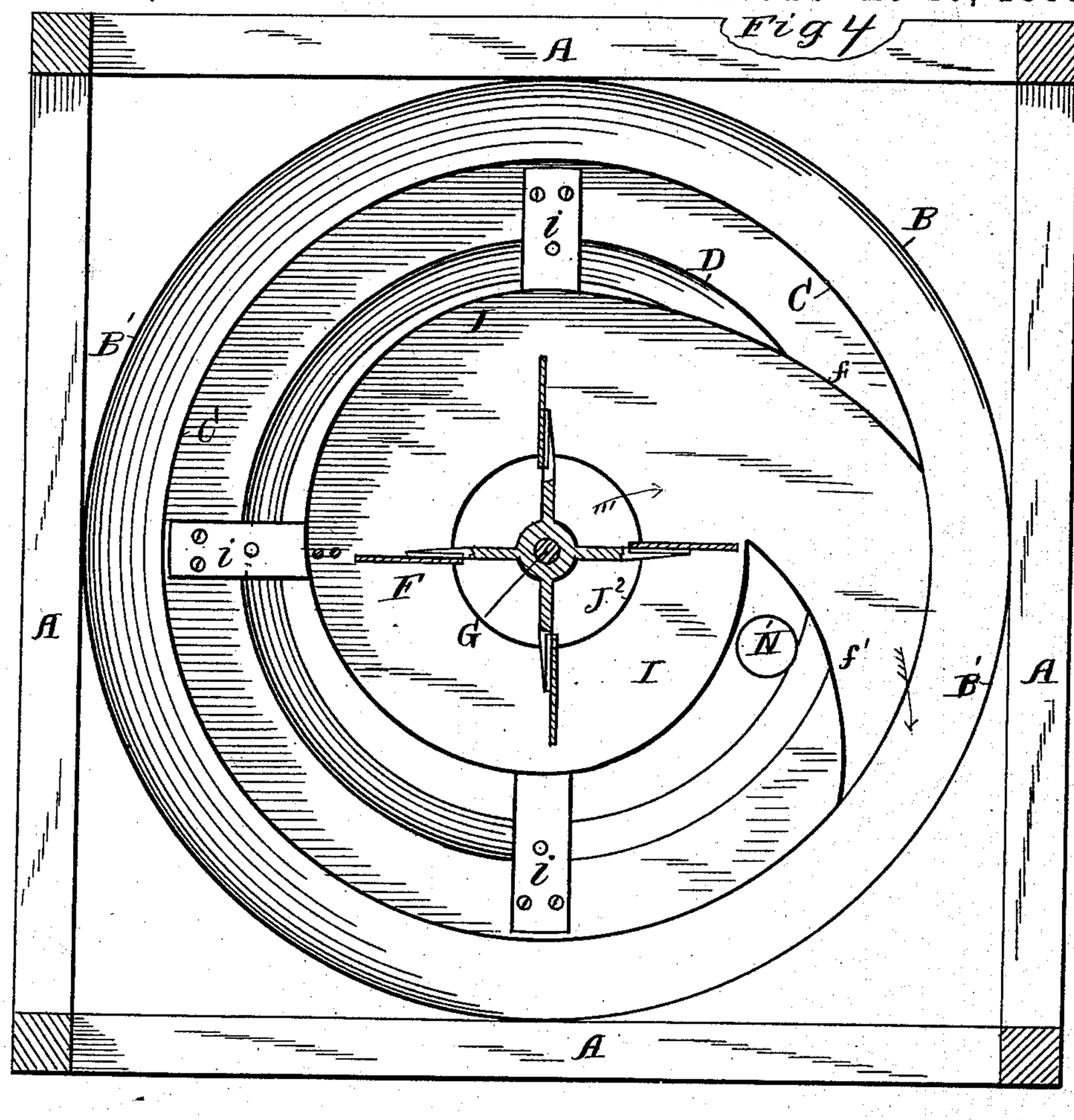


Fig. 5

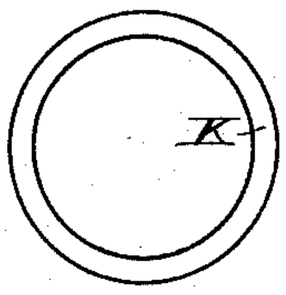


Fig. 6

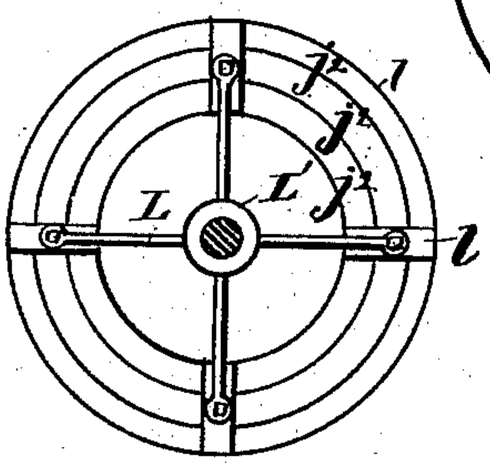
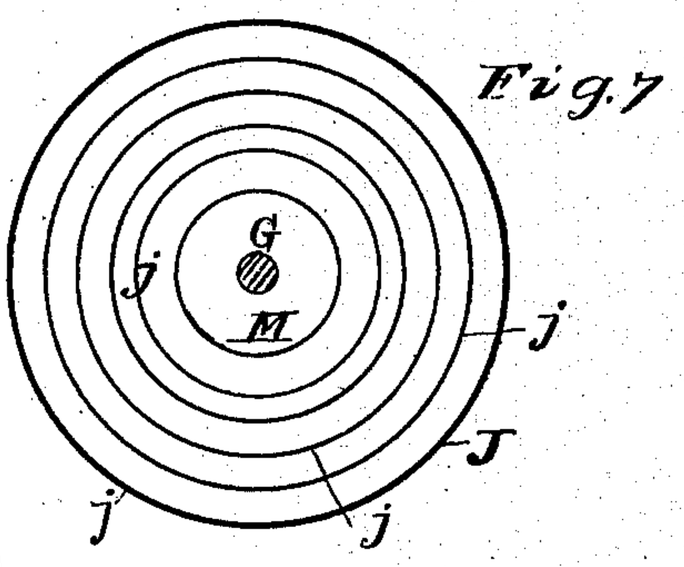


Fig. 7



Witnesses:
J. L. Turner
J. B. McGinn.

Inventor:
Noah W. Holt
by Dunlevy & Blinn Atty's

(No Model.)

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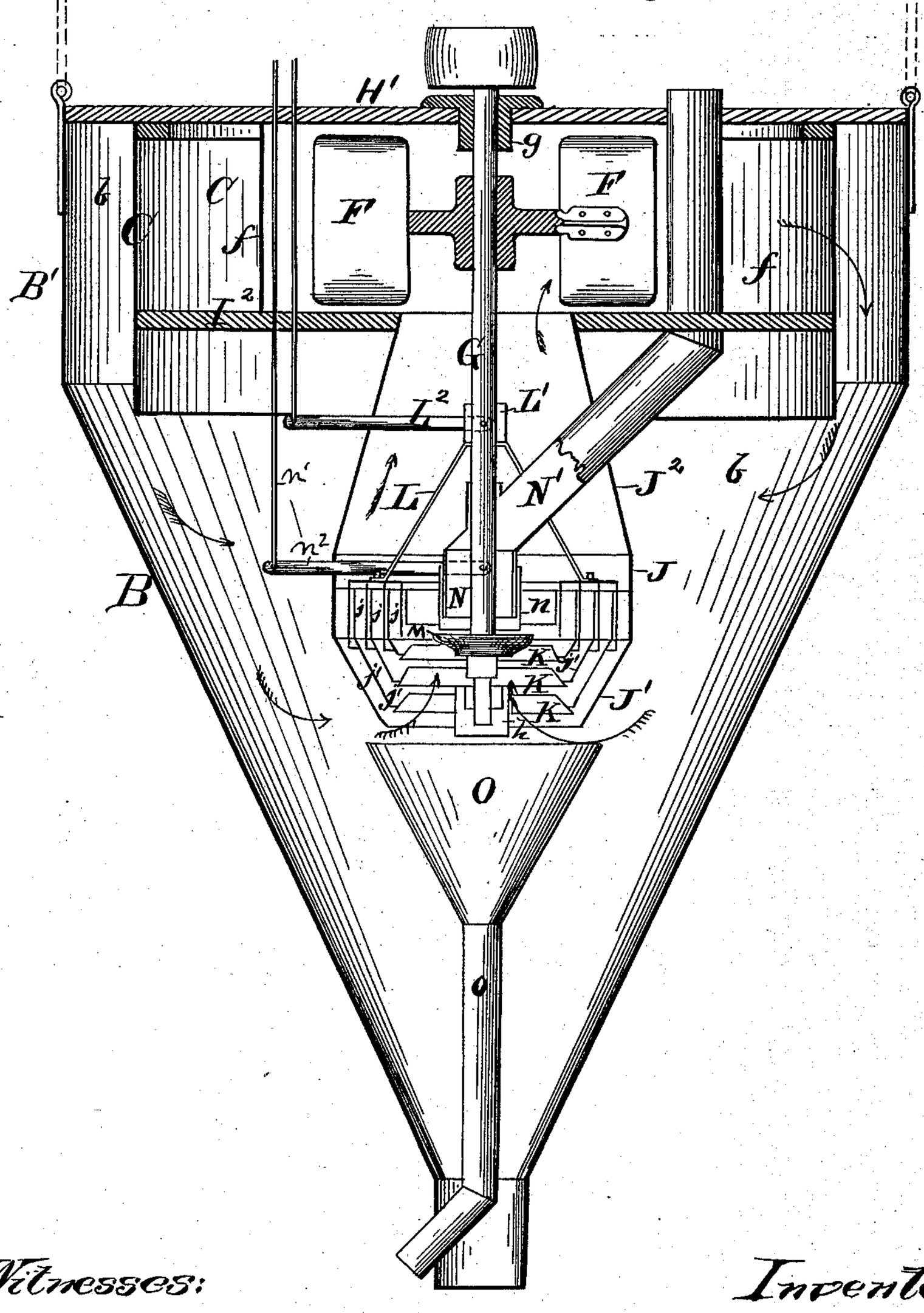
N. W. HOLT.

SEPARATING MACHINE.

No. 384,950. Patented June 19, 1888.

Fig. 8.



Witnesses:
J. C. Turner
J. B. McGinn.

Inventor.
Noah W. Holt.
by Dowlleday & Bliss
Atty

(No Model.)

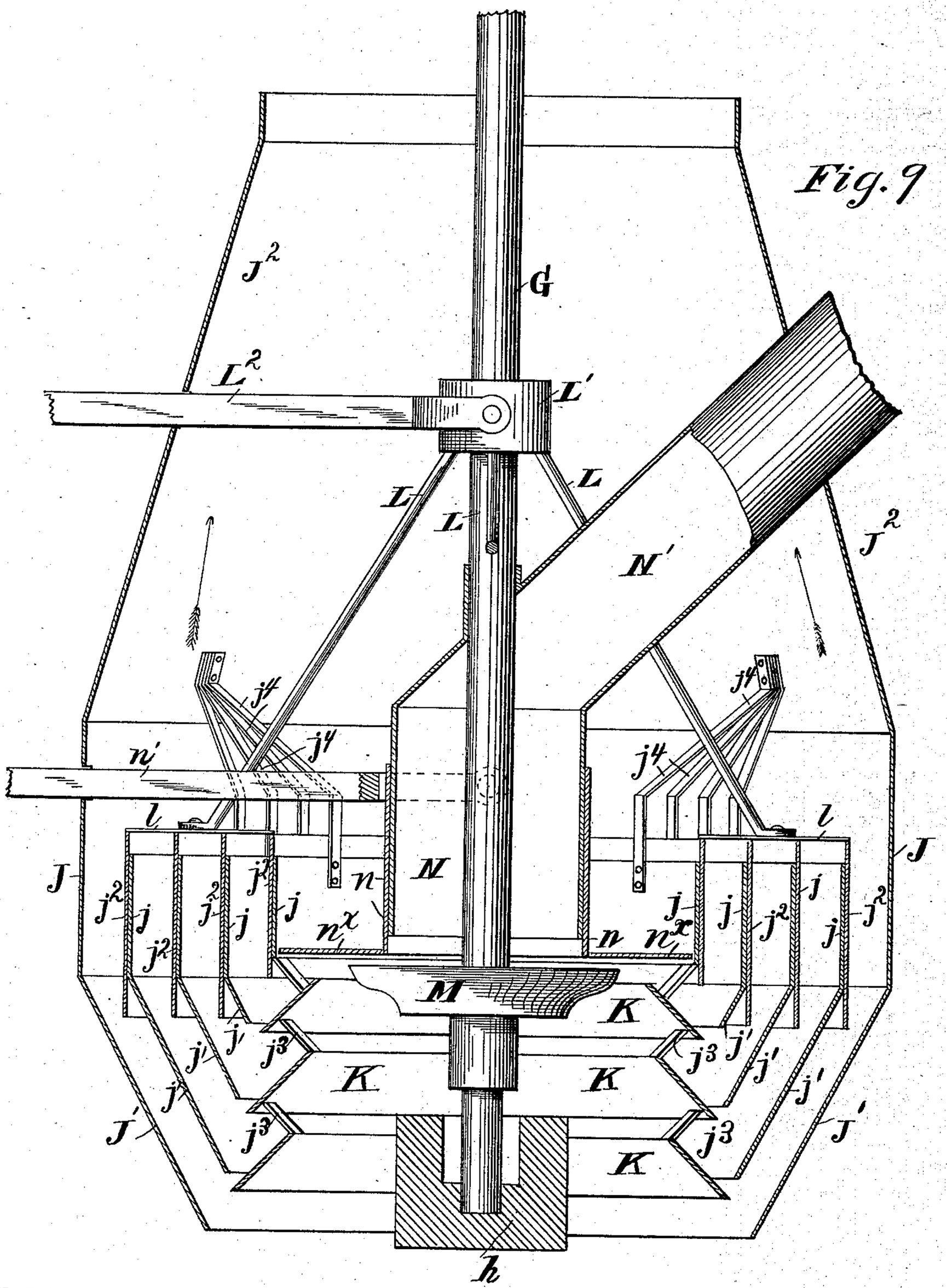
5 Sheets—Sheet 5.

N. W. HOLT.

SEPARATING MACHINE.

No. 384,950. Patented June 19, 1888.

Fig. 9



Witnesses:
J. C. Turner.
B. F. Sommers.

Inventor:
Noah W. Holt.
by Dowlesday & Bliss
attys.

UNITED STATES PATENT OFFICE.

NOAH W. HOLT, OF MANCHESTER, MICHIGAN.

SEPARATING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 384,950, dated June 19, 1888.

Application filed March 9, 1888. Serial No. 266,715. (No model.) Patented in Canada April 4, 1888, No. 28,807.

To all whom it may concern:

Be it known that I, NOAH W. HOLT, a citizen of the United States, residing at Manchester, in the county of Washtenaw and State of Michigan, have invented certain new and useful Improvements in Separating-Machines, (for which on April 4, 1888, I obtained a patent, No. 28,807, in the Dominion of Canada,) of which the following is a specification, reference being had therein to the accompanying drawings.

Figure 1 is a central vertical section of a machine containing my invention, taken on line *x x*, Fig. 2. Fig. 2 is a top or plan view. Fig. 3 is a horizontal section on line *y y*, Fig. 1. Fig. 4 is a horizontal section on line *z z*, Fig. 1. Figs. 5, 6, and 7 are details. Fig. 8 shows a modification. Fig. 9 is a vertical section, enlarged, of the aspirator-chamber.

This invention relates to a separating-machine in which the material fed in is divided into different grades, according to its specific gravity, both the heavier and lighter particles being delivered through their respective outlets, the lighter particles being collected in and discharged from a chamber which is separate and apart from the aspirating-chamber.

In the machine shown in the drawings, A A represent generally the frame work of the machine.

B B′ is an inclosing shell or casing, of which the lower part, B, is funnel-shaped, the upper part, B′, being preferably circular in cross-section and of uniform diameter throughout.

C is a shell or casing, preferably circular in cross-section and of uniform diameter, but of less diameter than the shell B′, and arranged concentric therewith, these parts forming between them an annular chamber, *b*, closed at its upper side by a dock or top plate.

c is a flange projecting inward from the shell C a short distance above its lower edge, and is, by preference, made of wood and secured by screws passing through the shell and into the periphery of this flange.

D is a ring or downward, projecting flange connected at its upper edge to the inner edge of the flange *c*, and preferably funnel-shaped, as indicated.

E is a funnel-shaped shell concentric to the outer shell, B, and somewhat larger at its upper end than is the flange D at its lower edge, which projects down a short distance within the shell E. I propose to connect the upper end of this shell E with either the shell B or the shell D, or both, by means of ties or braces *e e*. (See Fig. 1.) In connection with these shells or casings, I propose to use an aspirator for the purpose of separating material into different grades, according to the size and specific gravity of the parts of which it is composed, and will proceed to describe one form of such aspirator which I have found well adapted for the carrying out of my invention.

F F are the blades of the fan, the vertical shaft G of which is supported at its upper end in a bearing, *g*, which in turn is supported in the upper wall, H, of the fan-case, and at its lower end in a bearing or step *h*, which is connected to and carried by other parts of the machine, as will be explained.

I is the bottom wall or head of the fan, which is connected to and supported upon the flange *c* by means of arms or brackets *i i*. The shell *f* of the fan-case is, by preference, not circular, but somewhat scroll-shaped, as indicated in Fig. 3, the mouth of the fan opening into the annular space or dust-separating chamber between the concentric shells B′ C. The section *f′* of the wall of this annular space may be made in a separate piece, or it may consist of one end of the part *f* bent backward, so as to form one side of the mouth of the fan.

J J′ J² represent the outer shell or inclosing-casing of an aspirator-chamber, the open upper end of which connects with the eye of the fan, and in fact, by preference, is fitted tightly into this eye and secured thereto by screws or pins when the head of the fan-case is made of wood, or it may be soldered thereto when the head is made of sheet metal. By preference the central or intermediate section, J, of this aspirator-shell is not only circular but cylindrical, and *j j* are a series of rings of different diameters arranged concentrically within the part J.

j′ j″ are a series of funnel-shaped rings arranged one within another, and each connected at its upper edge to the lower edge of one of the cylinder-shaped rings *j*—as, for example, by ties *j*³. Thus there is formed within the shell of the aspirator a series of annular chambers. (See particularly Figs. 1, 6, and 7.)

K K are a series of flaring rings, three in

number and of different diameters the upper smallest one being suspended by its lower edge from the lower edge of the inner funnel-shaped ring, *j'*. The next larger ring K is suspended in like manner from the next larger of the funnel-shaped rings *j*, and so on.

L L' are respectively the arms and hollow sleeve of a spider, the spokes or arms L of which are inclined downward and outward from the sleeve L', and are at their lower ends attached to horizontal plates or bars *l* by riveting or soldering; or these arms L may be bent outward on horizontal lines to take the place of the plates *l*.

*j*² *j*²-represent a series of valves or dampers attached by their upper edges to the plates or bars *l*, and fitting closely the outer faces of the rings *j j*, and projecting downward below their lower edges (when in the position shown in Fig. 1) and into the annular spaces or channels or throats between the funnel-shaped rings *j' j'*, and between the outermost of these rings and the part J' of the aspirator-shell. I prefer to connect the series of rings *j j'* K from the section J² of the shell of the aspirator by means of a series of ties, *j*⁴. (See particularly Fig. 9.)

L² is a lever projecting through the fan-head and the shell J², and connected at its inner end to the sleeve L', whereby the valves may be operated by lifting the spider and all of the valves simultaneously to regulate the strength and velocity of the air-currents.

M is a feeding-disk of any ordinary sort attached to and carried by the fan-shaft G.

N *n* is a feeder-tube, of which the outer ring, n_1 is adjustable by link and lever *n' n*² relatively to the disk M, as is customary in that kind of feeder, and carries at its lower end an outward-projecting flange, $n^{\times}$, which practically closes the space between the feeder-tube and the lower end of the innermost ring *j*.

N' is a feed-spout.

O is a hopper, and *o* a delivery-spout.

In Fig. 9 the shell E is omitted, so that the separating-chamber *b* consists of a practically unbroken space between the outer shell, B B', and the shell C and the aspirator, the upper fan-head, H', extending entirely across the shell B', the lower fan-head, I, closing the annular space between the shell C and the upper end of the shell of the aspirator, except that the feed-spout passes through the fan-heads.

My machine may be operated as follows: The fan and feeder being put in operation by a belt from any suitable motor to the pulley on the upper end of the fan shaft, material fed in through spout N' is delivered by the feeding-disk M in a sort of spray, and falls thence outside of the rings K K, where it is separated by the air-currents which move upward, substantially as indicated by the arrows in Fig. 1, the lighter particles being taken up by the ascending air-current and passing through the fan out of its mouth and into the separating-chamber, where such lighter particles are separated from the air-current by centrifugal action and are discharged at the lower end of the machine. Under some conditions the material taken out from the aspirating chamber by the air-current will be divided into two grades, by reason of differences in the specific gravity of the particles, some of which will pass down through the space between the shells B E, other parts going down inside of shell E and out through the spout at its lower end. I propose to regulate the strength of the air-current through the aspirator by means of the link and lever L², it being evident that by raising the spider L L' and the valves or dampers *j*² the throats between the lower edges of these rings and the funnel-shaped rings *j'* will be widened, thus permitting a stronger air-current to pass upward with a given or uniform speed of the fan, it being of course understood that each of these valves fits somewhat closely to the ring *j* which it surrounds. Such material as is delivered to the aspirator through the feed-spout but is not taken out by the air-current passes over the flaring rings K, thence into the funnel O and out through the spout *o*. The air from which the material has been separated within the separating-chamber passes again through the aspirator and out through the mouth of the fan. Thus it will be seen that the air-current follows substantially the same serpentine course round and round again through the machine, separating the material into different grades according to its specific gravity, the finer particles being removed from the air-current by centrifugal action.

While under many circumstances a satisfactory separation of the material will be effected with an annular space between the shells of the proportion indicated in Fig. 1, yet it may be sometimes found advantageous to make the outer shell much larger in proportion to the others than is shown in the drawings, or to relatively reduce the horizontal diameters of the inner shells; and where but two grades are desired the shell E may be omitted, so that all the material which is taken out by the air-current while passing through the aspirator is discharged at the bottom of the shell B.

Of course the ties or other connections between the flaring rings K and the converging rings *j'* should be of such character as will permit a free passage for the middlings, or the rings K may be attached to or carried by the fan-shaft.

It will be seen that after the air-current leaves the aspirator and enters the separating-chamber its velocity is greatly reduced, by reason of the separating-chamber being of so large size or capacity relatively to the aspirating-chamber, one result being that material which is taken out by the air-current will fall to the bottom of the separating-chamber irrespective of any effect of centrifugal action. This becomes a quite important feature in the operation of the machine, especially when it is being used for separating particles or small granular substances which are so heavy that

they can only be taken from the mass by a quite strong air-current—as, for instance, when the machine is being used for the grading or cleaning of grain—it being well known that it is frequently desirable to separate shriveled broken grain and other things from grain as it is ordinarily received into a mill, elevator, or other place of storage.

It will also be understood that the air-current as it travels in a curvilinear path, like a vortex, around inside of the funnel-shaped shells B E makes the circuit of these shells in less and less time as it descends from their upper wider ends, this increase in the rapidity of rotation being useful in separating the material from the air-current by centrifugal action. So, also, an effective separation, particularly of the finer particles, and all dividing of the material into different grades, are facilitated by the use of the shell E with its large open end uppermost, and the presence of the shell C, which is of larger diameter than shell E, and consequently occupies a position intermediate between shells E and B, materially modifies the movements of the air-current after leaving the fan, and insures that such air-current and the material carried by it shall be directed downward into the annular space between the funnel-shaped shells E and B.

It will also be understood that the arrangement of the aspirating-chamber below the fan and at some distance below the upper ends of the surrounding separating-chambers is very advantageous, because, among other things, it insures that the air-current shall have the finer particles of material effectually separated therefrom before it re-enters the aspirating-chamber. Again, by arranging the aspirating-chamber below the fan and interposing the valves j^2 in the air-passages and above the points where the material falling through the aspirating-chamber is first acted upon by the air-currents I am enabled to regulate with great accuracy the amount of air which goes through the concentric air-passages or throats between the lower edges of the rings K and the adjacent rings j' without in any manner disturbing the sizes or proportions of those parts or their areas in cross-section, and am thus able to regulate with great accuracy the character of the material which is taken out by the air-currents.

It will also be seen that the feed-spout is in part eccentric to the fan-case, its lower part being carried in through the shell of the aspirator and surrounding the fan-shaft.

I am aware that it is common to arrange a series of flaring rings of an aspirator between fan-blades suspended from above and projecting down to about a line with the upper edge of the lowermost ring, with a valve below these parts for regulating the inflow of the air; but in such earlier machine the diameter of the fan (which had the feeding-disk attached to it) was such that the draft would be much stronger through the lower air-throats of the series than through the upper ones, particularly when the valve was closed to such an extent as to materially impede the inflow of air, whereas by my construction and arrangement, having the valves interposed between the eye of the fan and the air-throat, such objection is obviated.

I also propose to use the machine for the separating of the breaks of wheat from grinding-rolls or other reducing machinery, such operation being usually known as "scalping," and in which this machine can be advantageously used, because, among other things, such scalping can be effected with but little abrasion of the broken wheat or partially-reduced wheat, whereby there is effected a marked saving in the amount of fine flour or dust produced by the frequent separations which are involved in the system of milling which is commonly known as "gradual reduction."

I have shown a form of aspirator and a form of separating-chamber which I regard as being the best adapted for the carrying out of my invention; but do not wish to be limited to the specific devices herein shown.

What I claim is—

1. In a separating-machine, the combination of a fan, an aspirating-chamber below the fan and connected with the eye of the fan, and a separating-chamber surrounding the aspirating-chamber and connected to the mouth of the fan, whereby air put in motion by the fan is caused to travel continuously through the fan, the aspirating-chamber, and the separating-chamber, substantially as set forth.

2. In a separating-machine, the combination of a fan, an aspirating-chamber below the fan and connected with the eye of the fan, a funnel-shaped separating-chamber surrounding the aspirating-chamber and connected to the mouth of the fan, whereby the air-current put in motion by the fan has imparted to it a whirling motion within the separating-chamber and travels in a circular path of reduced diameter after leaving the fan and before entering the lower part of the aspirating-chamber, substantially as set forth.

3. In a separating-machine, the combination of a fan, an aspirating-chamber below the fan and connected with the eye of the fan, a separating-chamber surrounding the aspirating-chamber, and a shell interposed between the outer wall of the separating-chamber and the aspirating-chamber, substantially as set forth.

4. In a separating-chamber, the combination of a fan, a fan-casing provided with vertical walls around the blades of the fan, a separating-chamber the upper part of which surrounds the fan, and an aspirating-chamber below the fan and connected with its eye, the lower part of the aspirating-chamber being arranged within the funnel-shaped part of the separating-chamber, substantially as set forth.

5. In a separating-machine, the combination of a fan, an aspirating-chamber below the fan, and a series of valves arranged in the air-passages of the aspirator above the point at which the air-currents first act upon the falling ma-

terial within the aspirating-chamber, substantially as set forth.

6. In a separating-chamber, the combination of a fan, an aspirating-chamber, a separating-chamber surrounding the aspirating-chamber, a funnel-shaped shell open at its upper end and interposed between the outer shell of the separating-chamber and the aspirator, and a downward-projecting flange arranged between the upper open end of the funnel-shaped chamber and the outer wall of the separating-chamber, substantially as set forth.

7. In a separating-machine, the combination, with the outer casing, B B′, of the shell C, the fan within the shell C and opening into the chamber between the casing B B′ and shell C, the aspirating-chamber below the fan and connected with he eye thereof, a discharge-opening at the bottom of the casing B B′, and the hopper below the aspirating-chamber, provided with a discharge-spout, *o*, substantially as set forth.

8. In a separating-machine, the combination of the outer casing, the fan arranged within the outer casing, the aspirating-chamber below the fan, the valves, and a lever, L^2, in the wall of the aspirator-chamber, substantially as set forth.

9. In a separating-machine, the combination of the outer casing, the fan within the outer casing, the feeder within the aspirating-chamber, and the lever n', pivoted in the wall of the aspirating-chamber, substantially as set forth.

10. In a separating-machine, the combination of the outer casing, the fan, the aspirating-chamber within the outer casing connected with the eye of the fan above the feeder within the separating-chamber, and the feed-spout arranged eccentric to the fan and passing through the separating-chamber and through the wall of the aspirating-chamber, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

NOAH W. HOLT.

Witnesses:
H. H. DOUBLEDAY,
M. P. CALLAN.