

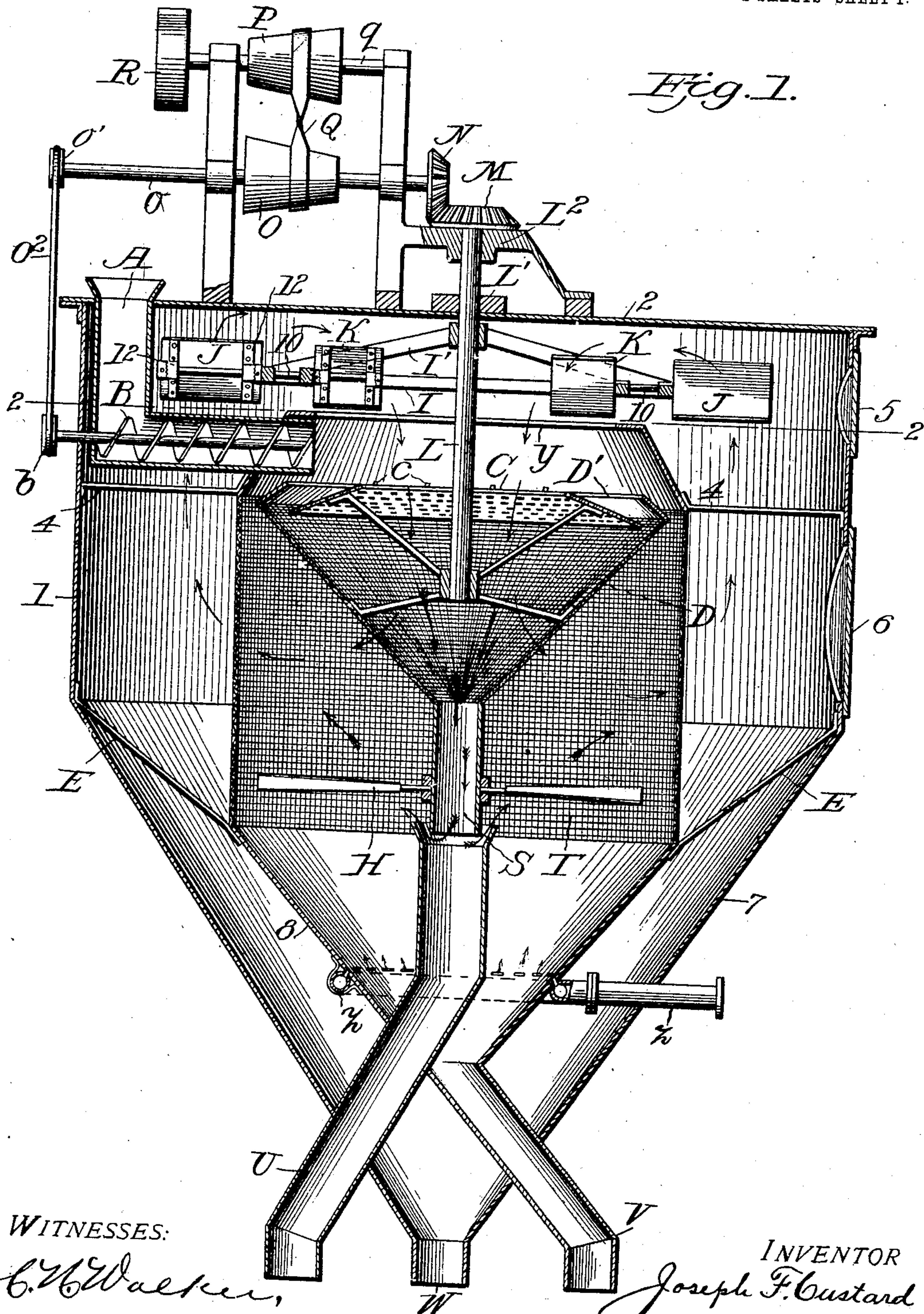
No. 832,012.

PATENTED SEPT. 25, 1906.

J. F. CUSTARD.
SEPARATOR.

APPLICATION FILED APR. 7, 1905.

2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

Fig. 2.

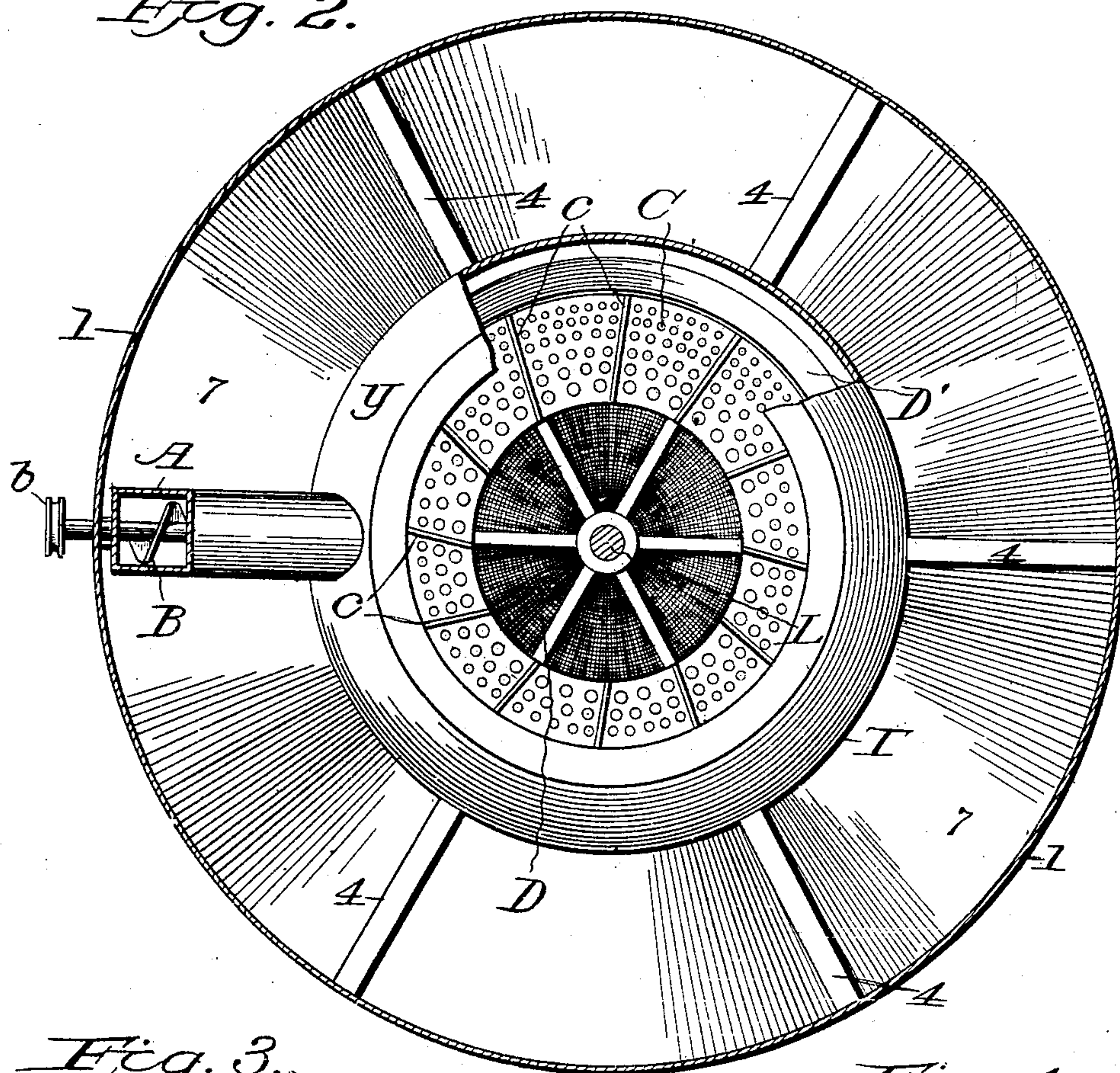


Fig. 3.

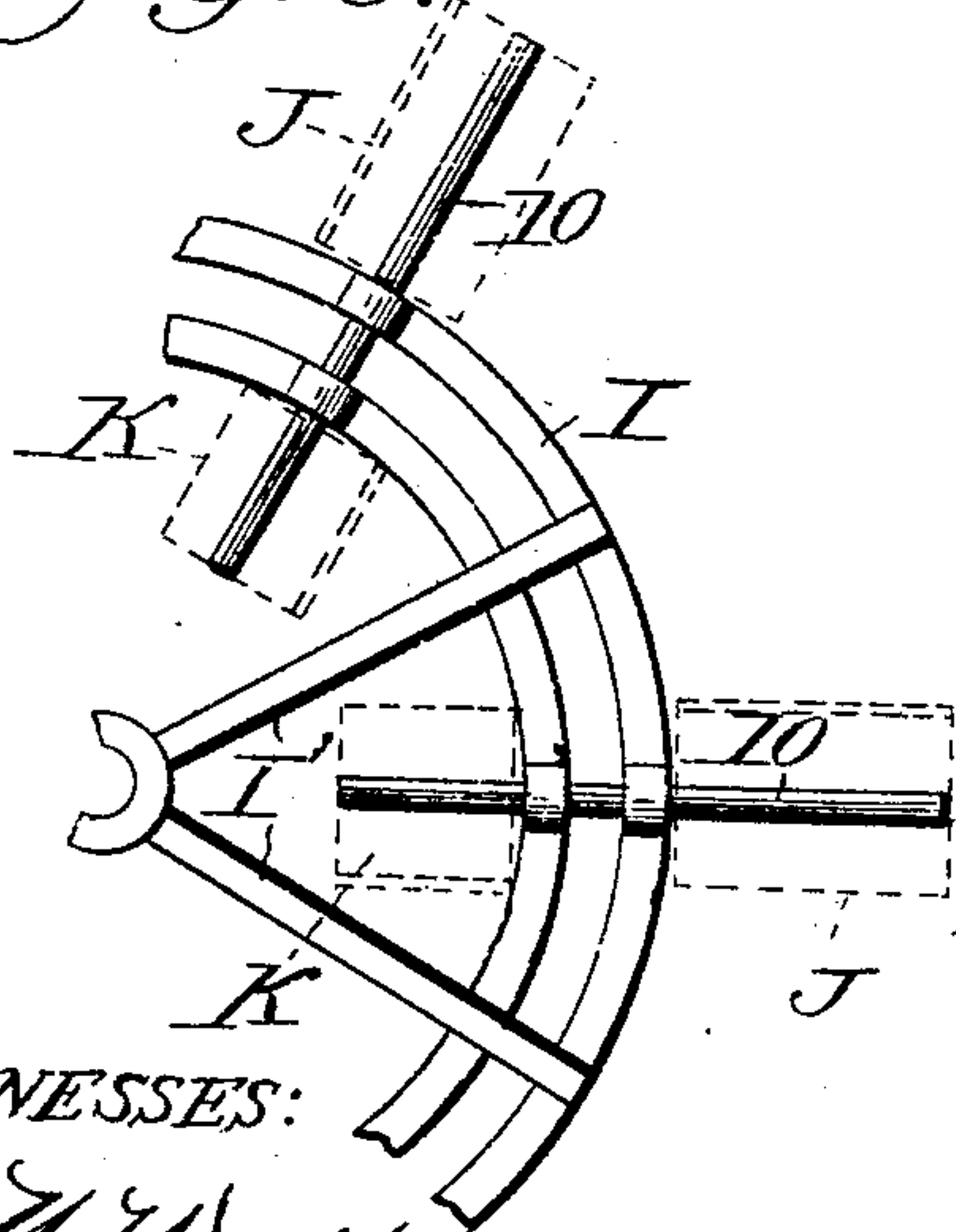


Fig. 4.

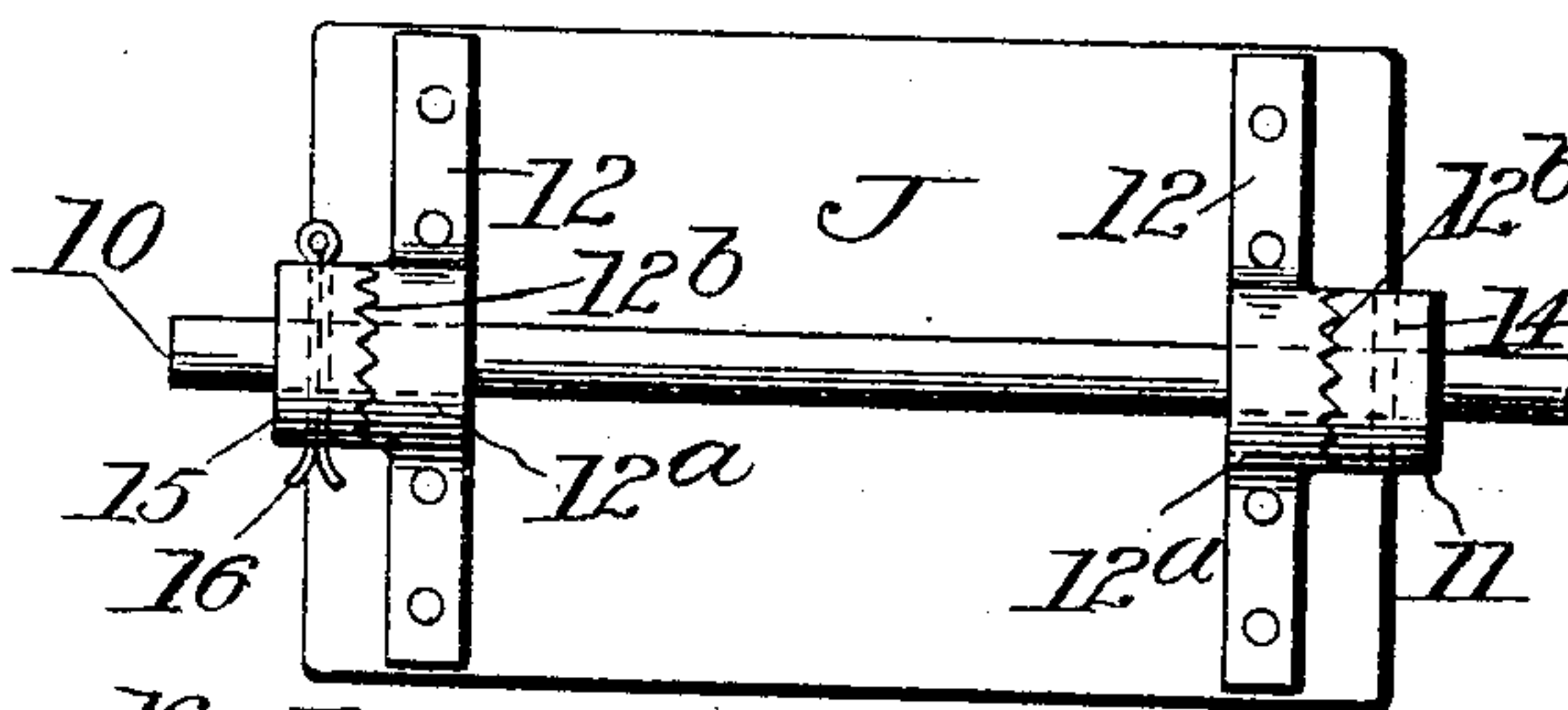
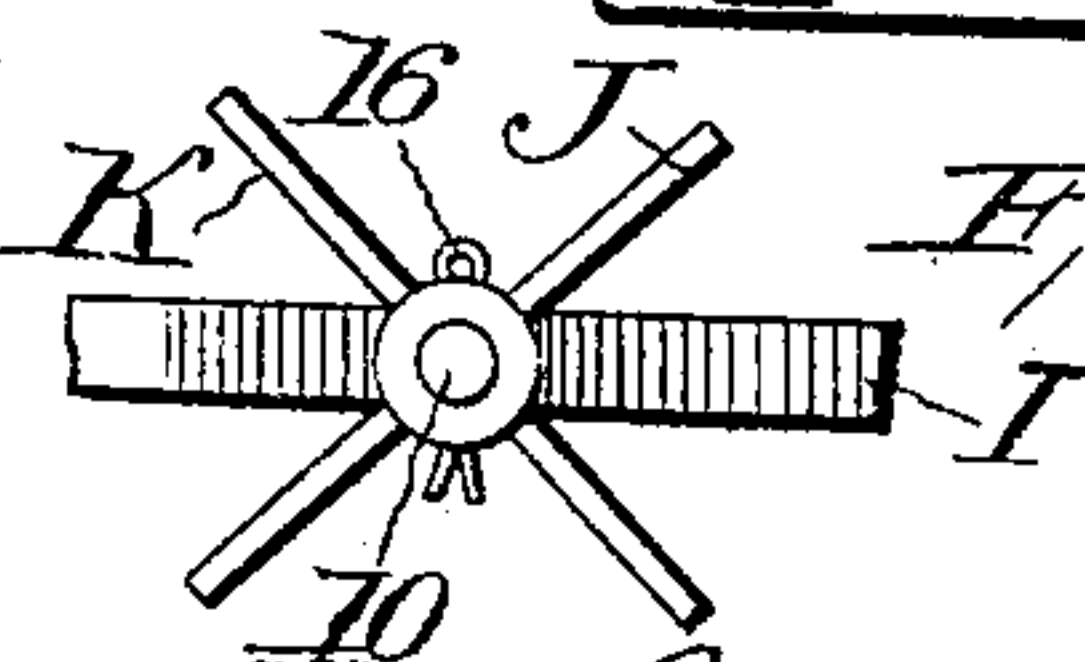


Fig. 5.



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UNITED STATES PATENT OFFICE.

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No. 832,012.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, JOSEPH F. CUSTARD, of Bath, in the county of Northampton and State of Pennsylvania, have invented certain new and useful Improvements in Separators; and I hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form part of this specification.

This invention is an improvement in dry-separating machines for grain and other material in which the separations are effected by screens and air-currents.

It comprises a horizontally-revolving distributing-plate, a revolving inverted cone-shaped screen surrounding the distributing-plate at its upper end and open at its lower end for the escape of material, a stationary screen surrounding the revolving cone, a casing inclosing the stationary screen, horizontally-rotating fans or vanes arranged in the upper part of the outer casing and adapted to induce an upward current of air in the chamber exterior to the fixed screen and a downward current of air through the cone, means for conducting off the materials deposited in the cone in the fixed-screen chamber and in the chamber surrounding the fixed screen to separate receptacles, and means for introducing an upward air-blast into the material within the fixed-screen chamber below the cone.

The objects of this invention are, first, to separate ground or crushed dry materials of any description into at least three grades of different fineness or quality, two of which grades are determined by the arrangement and action of the machine and the coarsest or tailings grade depending upon the coarseness of the material delivered to the machine; second, to enable the machine to operate on different weights of material to make the finest and medium separations by varying the relative strength of the air-currents; third, to subject that portion of the material from which the fines or highest grade of material has not all been separated to the influence of the separating air-currents a prolonged time by means of agitating-blades and a secondary air-blast derived from an external blower.

The invention consists in the novel construction and arrangement of parts and in novel modes of operation thereof hereinafter claimed, and in the accompanying drawings I have illustrated the preferred form of the apparatus, which I shall now describe to im-

part a full and complete understanding of the invention.

In said drawings, Figure 1 represents a longitudinal vertical section through the complete apparatus. Fig. 2 is a horizontal section on line 2 2, Fig. 1. Fig. 3 is a detail plan view of a portion of the supporting-ring for the fans. Fig. 4 is a detail view of one of the fan-blades. Fig. 5 is a detail view of the oppositely-inclined fan-blades.

1 represents the main outer casing of the machine having a hopper-shaped or conical lower portion 7, terminating in a discharge-spout W, and a top 2. It has openings in its sides closed by covers 5 and 6 to allow access to interior parts. Located axially within the casing is a screen T, preferably cylindrical and supported in position within the casing by means of stays E and 4. A hopper-shaped bottom 8 is connected to the lower part of the screen, so as to catch materials deposited within the screen-chamber and conduct them to a carry-off pipe V, which extends outside the casing, as shown.

The chamber inclosed by screen T may be wholly open at top; but preferably an inwardly-projecting conoidal flange Y is attached to the upper end of screen T, as shown, so that fine particles in the upper part of the settling-chamber will be kept from falling into the screening-chamber.

The screen T is of such fine mesh that only the desired finest grade of material can pass therethrough. Within the screen-chamber and located in the upper part thereof is a rotary inverted conical screen D of coarser mesh and of less diameter than screen T. This rotary screen D is attached to and suspended from the lower end of a vertical shaft L, which extends through the top 2 of the casing and is journaled in suitable bearings L' L², so as to keep the screen D axially located within screen T. Shaft L can be driven by any suitable mechanism and in the drawings is shown as driven by bevel-gears M N from a shaft o, driven from a shaft q by means of cone-pulleys O P and belt Q', shaft q being driven by pulley R, belted to any suitable driver. I do not restrict myself to such drive, as any variable speed gearing may be employed to rotate shaft L and cone D.

The rotary screen D has a spout S at bottom, which discharges into a carry-off pipe U, leading through hoppers 8 and 7 to the outside of the machine. The upper end of screen D is provided with a short conoidal

flange D' to prevent escape of material over the upper edge thereof. Supported on shaft L within the mouth of cone D D is an annular distributing-plate C, which is conoidal-shaped and may be perforated. Plate C is provided with radial ribs *c* on its upper side, said ribs being slightly tangential to the axis of rotation, so as to detain the material discharged on the cone from the feed-hopper A by means of the feed-screw B, which can be driven from shaft *o* by belt *o*² and pulley *o'* *b*, as shown, or in other suitable manner.

Attached to shaft L above the screen-chamber and screens are fans or fan-vanes K and J. The vanes K are arranged in an annular series, moving above the settling-chamber or space between the outer wall of screen T and the inner wall of the casing 1. The fans or vanes K are arranged in an annular series within or concentric to the series of vanes J. Both sets of vanes may be supported on a ring I, connected by arms I' to the shaft L, as shown. Preferably the vanes are adjustable to different inclinations, so as to vary the strength of the blasts produced thereby. Ordinarily, however, the vanes K may be fixed to the ring and the vanes J adjustably attached thereto. In order to adjustably attach the vanes, the construction shown in Fig. 4 may be employed. In this construction radially-projecting rods 10 are attached to the ring I, and on these rods the vanes are rotatably supported by means of end plates 12, having perforated bosses 12^a for the passage of the rod 10, said bosses being serrated on their outer faces, as at 12^b, and adapted to interlock with correspondingly-serrated collars 11 and 15 on the rod. The inner collar 11 may be fastened to the rod by pin 14, while the collar 15 may be removably fastened by a spring-pin 16. By removing or withdrawing collar 15 the vane can be set at any angle desired on the rod, and when collar 15 is replaced and fastened by pin 16 the vane is securely held in adjusted position. The vanes K are set oppositely to vanes J, the latter operating to suck an upward current of air through the settling-chamber exterior to screen T, while vanes K serve to drive a current of air downwardly through the screens D and into the chamber within the screen T. The two fans or sets of blades thus serve to produce a continuous circulation of air, as hereinafter explained.

In order to detain and thoroughly agitate material descending through the screen-chamber inclosed by screen T, a small fan-like agitator H may be attached to the spout S, as shown, and to insure the separation of any light particles which might fall into hopper 8 and get out of the air-currents produced by fan J, I provide an annular blast-tube Z around the lower part of the hopper and opening upwardly thereinto, so as to direct a moderate air-blast upwardly therein, which

blast will carry light particles back into the screen-chamber. The tube Z may be supplied with air from an exterior blower (not shown) of any suitable kind.

Operation: The material to be separated is fed into hopper A and delivered by screw B onto plate C, which is revolved by shaft L at any desired speed, and is gradually discharged from said plate into the rotary screen D, whose mesh determines the fineness of the "second" grade of material, any material too coarse to pass through screen D being discharged into pipe U and constitutes the "tailings." Inasmuch as the vanes J are arranged to produce a current of air in an upward direction and vanes K to produce a current of air in a downward direction an endless circulation of air is established in the direction indicated by the tailless arrow in Fig. 1, said currents of air passing upward through the settling chamber or space between the outside casing 1 and fixed screen T to fan J, then to fan K, then down through the openings in the flanges Y D' and the distributing-plate C into the cone-shaped screen D, through said screen into the screen-chamber, and then through the screen T back into the settling-chamber, such continuous currents carrying the finer material through the screens D and T and producing the principal separations of the finest and intermediate grades. Part of the air-current passes downwardly through screen D and spout S, as indicated by the tailed arrows and out between the lower end of spout S and the upper end of spout X into the screen-chamber and passes thence through screen T into the settling-chamber. The material that has passed through the revolving screen D is acted upon by the current of air and is drawn through the screen T and carried into the settling-chamber, where it drops onto the bottom 7 and is directed out of the machine at W. This is the highest grade of material delivered to the machine. Material that is too heavy or too large to be carried through the screen T drops onto the bottom 8 and is carried out through the spout V and forms the second or intermediate grade. The fineness of the material passing through the opening W is determined by the angle of the vanes J and the speed of the fans J K. With the fans J K at a given speed heavy material will require a larger angle of inclination in the vanes J. Material that has been screened through D and has not passed through screen T is kept in motion and under the action of the air-currents by means of the agitator H, which retain the material under the influence of the air-currents, and the detention and separation of materials within screen T are further aided by the blast from the outside introduced through the pipe Z, which drives any small particles of material upwardly into the separating-currents again, thus insuring

a separation of all the "finest" from the middle or second grade of material. Access to the blades to adjust them, if necessary, can be had by removing cover 5, and access can be had to the interior of the casing by removing cover 6.

It will be observed from the foregoing that in my machine I have combined the principle of operation of a revolving screen-separator with that of an air-separator, both coacting to produce the desired results and operating in an effective manner described, so that the material while being operated on by the screen is also subjected to the action of the air-currents.

I perform the first stage of the operation of separation by so inclining the sides of the inverted-cone-shaped screen D as to counteract by the force of gravity the centrifugal force given to the material being screened by the rotating plate C and the rotating cone D. It is while the material is pulled down over this rotating screen D by gravity that the first stage of the operation is accomplished.

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

1. In combination, a fixed casing, a cylindrical screen within the casing, a conical screen rotatably mounted in the cylindric screen, a distributor for directing material into the conical screen, and discharge-spouts for the different grades of material; with means for feeding material onto the distributor, and fans above the screens for creating endless air-currents therethrough.

2. In combination, a fixed casing having a conical bottom, a cylindrical screen within the casing having a conical bottom, an inverted conical screen rotatably mounted in the cylindric screen, a distributor for directing material into the conical screen, and discharge-spouts for the different grades of material; with means for feeding material onto the distributor, and annular series of oppositely-inclined blades above the screens, for the purpose and substantially as described.

3. In combination a casing, a fixed cylindrical screen therein, dividing it into an interior screen-chamber and an exterior settling-chamber, an inverted conical rotary screen within the fixed screen, oppositely-inclined rotating series of vanes located above the screens in said chambers and adapted to create endless air-currents through the screens and chambers, and means for conveying off the different grades of material.

4. In combination, a fixed casing, a cylindrical screen within the casing, an inverted conical screen rotatably mounted in the cylindric screen and having a discharge-outlet in its lower end, a distributor for directing material into the conical screen; and separate discharge-spouts for the different grades of material, deposited in the conical screen and

on opposite sides of the cylindrical screen, substantially as described.

5. In combination, a fixed casing having a conical bottom, a cylindrical screen within the casing having a conical bottom, an inverted conical screen rotatably mounted in the cylindric screen, a distributor for directing material into the conical screen, and discharge-spouts connecting with the conical bottoms of said casing and fixed screen, substantially as described.

6. In combination, a casing, a fixed cylindrical screen therein dividing it into an interior screen-chamber and an exterior settling-chamber, an inverted conical rotary screen within the screen-chamber, means for creating an endless closed air-current through the screens and chambers, and means for separately conveying off the materials deposited in the rotary screen and the said chambers, substantially as described.

7. In a separator, the combination of a screen-chamber, an exterior settling-chamber, and means for carrying off the deposits in each chamber; with fans above the screen-chamber driving air down therein, and a fan above the settling-chamber for drawing up air therein, the said chambers communicating at top, substantially as described.

8. In a separator, the combination of an inverted conical rotary screen, a distributor above and rotating with such screen, means for feeding material onto said distributor, a fixed screen surrounding the rotary screen, a settling-chamber exterior to and surrounding said fixed screen, and oppositely-acting fans for creating a closed endless circuit of air through the screens, screen-chamber and settling-chamber; means for conducting off materials deposited in the rotary screen, means for conducting off materials deposited in the screen-chamber, and means for conducting off materials deposited in the settling-chamber, substantially as described.

9. In a separator, the combination of a screen-chamber, an exterior settling-chamber, and means for carrying off the deposits in each chamber; with concentric fans above the screen adapted to produce currents of air in opposite directions in the respective chambers; and form a closed endless air-current through the screens and within the casing, substantially as described.

10. The combination of a screen-chamber, an exterior settling-chamber surrounding the screen-chamber, and means for producing a closed endless circulation of air downwardly in the screen-chamber, and upwardly in the settling-chamber; with a supplemental air-blast in the lower part of the screen-chamber for driving back light material dropping in the screen-chamber into the influence of the air-currents, substantially as described.

11. The combination of the screen-chamber, an exterior settling-chamber, a rotary

screen in the screen-chamber, a fan adapted to produce a downward air-current in the screen-chamber, and an adjacent oppositely-acting fan adapted to produce an upward air-current in the settling-chamber, said fans being arranged in the space above both chambers and communicating directly with each chamber.

12. The combination of the screen-chamber, an exterior settling-chamber, and a rotary screen in the screen-chamber; with a fan arranged in the space above the screen-chamber, and an oppositely-acting fan above the settling-chamber, each fan having an annular series of vanes and adapted to create opposite air-currents in the respective chambers, substantially as described.

13. In a separator, the combination of a screen-chamber an inverted conical rotary screen therein, a distributor above and rotating with such screen, and means for feeding material onto said distributor, a fixed screen surrounding the rotary screen, a settling-chamber exterior to said fixed screen and sur-

rounding the screen-chamber, means for conducting off materials deposited in the rotary screen, means for conducting off material deposited in the screen-chamber, means for conducting off materials deposited in the settling-chamber, and means for creating an endless air-current through said chambers, substantially as described.

14. The combination of the screen-chamber, an exterior settling-chamber, a rotary screen in the screen-chamber, a fan adapted to produce a downward air-current in the screen-chamber, a fan adapted to produce an upward air-current in the settling-chamber, and a supplemental air-blast in the lower part of screen-chamber for returning matters into the endless air-current.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

JOSEPH F. CUSTARD.

In presence of—

JOHN S. WORMAN,
EDWIN MEREDITH.