

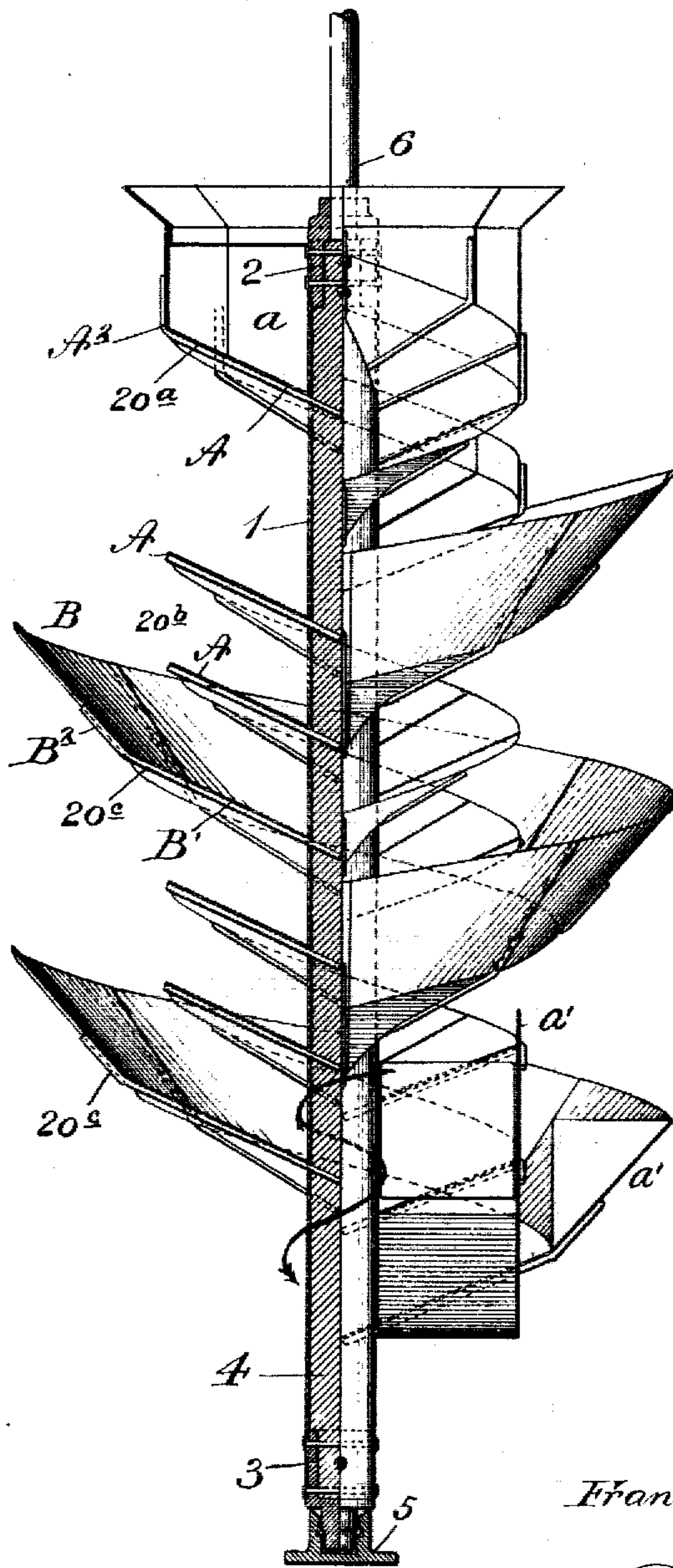
No. 815,856.

PATENTED MAR. 20, 1906.

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SPIRAL SEPARATOR.
APPLICATION FILED MAR. 17, 1905.

4 SHEETS—SHEET 1.

Fig. 1.



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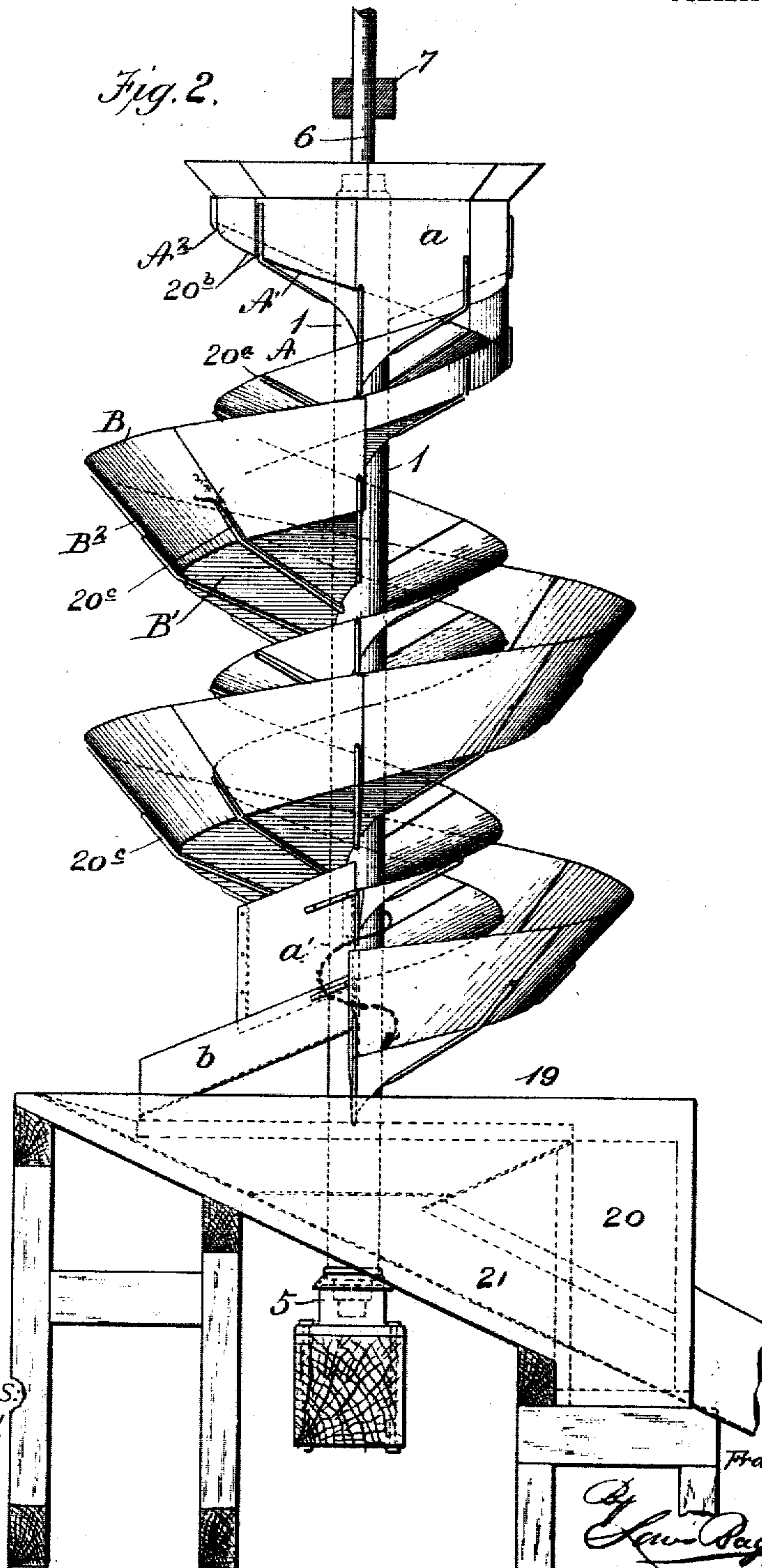
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4 SHEETS—SHEET 2.

Fig. 2.



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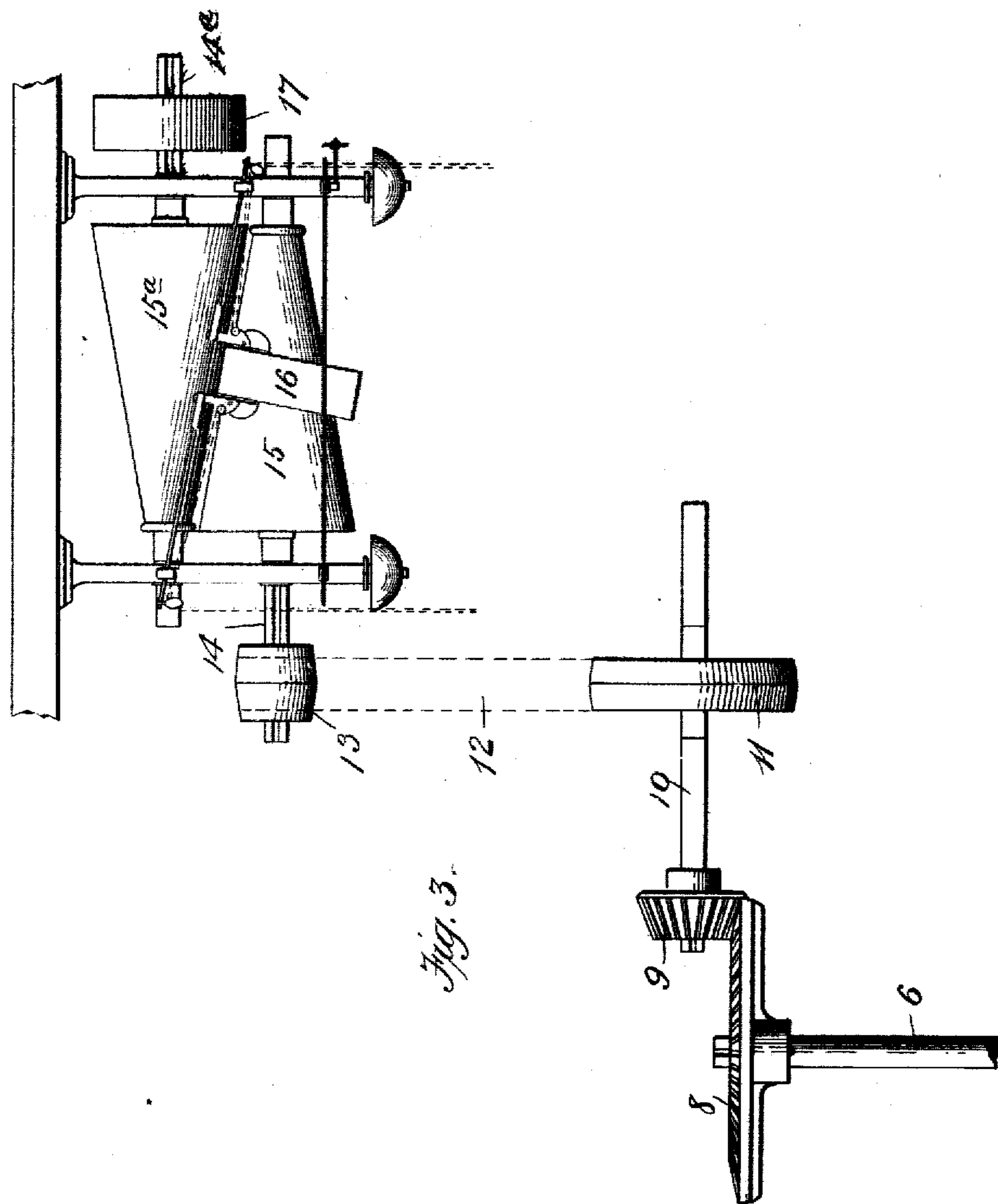
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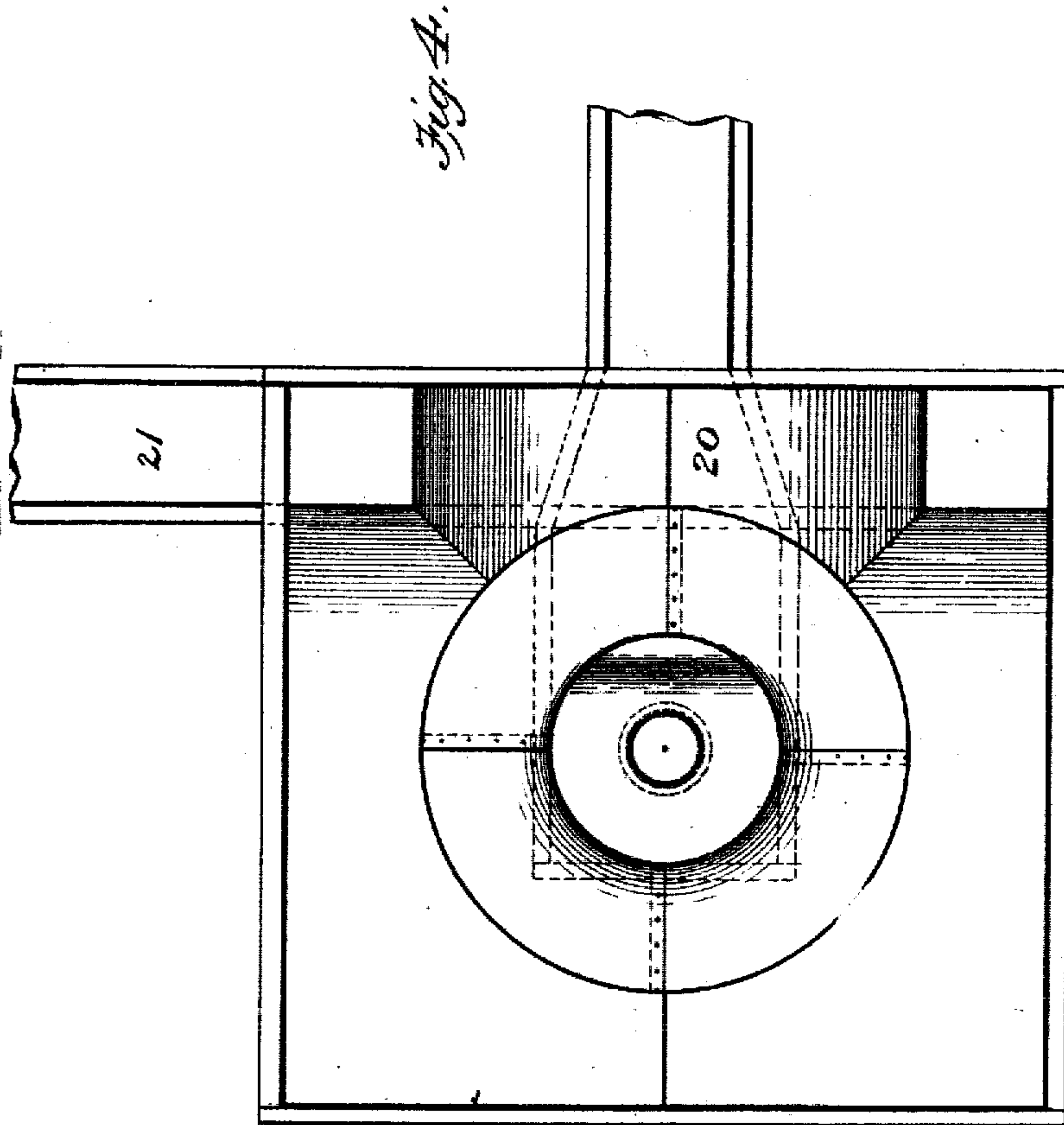
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UNITED STATES PATENT OFFICE.

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SPIRAL SEPARATOR.

No. 815,856.

Specification of Letters Patent.

Patented March 20, 1906.

Application filed March 17, 1905. Serial No. 250,651.

To all whom it may concern:

Be it known that I, FRANK NICTER, a citizen of the United States, residing at Scranton, in the county of Lackawanna and State of Pennsylvania, have invented new and useful Improvements in Spiral Separators, of which the following is a specification.

This invention relates to that class of separators for coal, &c., embodying a vertical spiral way or channel wherein the ore or material fed in at the top is separated by centrifugal action and by gravity and friction in its traverse down the spiral way or channel—as, for instance, in the Pardee type of separators. This type of separator, while applicable for the separation of various substances differing in weight and frictional resistance in traversing an inclined way, is specially designed to operate upon anthracite coal as it comes from the breakers or graders mixed with slate and “bone” and will be described in such connection.

Anthracite coal as it comes from the mines is mixed with deleterious substances known as “slate and “bone,” both of greater specific gravity than the coal and both containing proportions of silicious substance which causes frictional resistance when fed over a platform, table, or like solid surface. It is due to this quality that spiral separators have been found available, for although the coal is of less specific gravity it glides freely over the surface of the spiral floor, moving outward under centrifugal force away from the center of the spiral and passing over the outer edge, while the slate and bone are retarded by frictional resistance and tend to traverse the spiral floor nearer to its center. In traveling down the floor of the spiral incline the more rapidly moving lumps of coal will from time to time impinge on the particles of slate, &c., tending to accelerate the speed of the latter and oftentimes deflecting it toward the outer edge of the spiral, where it may be carried over with the coal, and to correct this fault it has been proposed to give the floor of the spiral special construction, either to deflect the slate, &c., toward the center of the spiral or to provide additional friction-plates to retard the movement of the slate.

One object of my invention is to increase the centrifugal action on the material treated in a given length of spiral separator.

A further object of the invention is to increase the frictional action between the spiral way and the heavier parts of the material treated.

A further object of the invention is to provide for regulating the speed of the material treated over the floor of the spiral way, thus enabling the same machine to successfully handle ores, &c., varying greatly in character and requiring different treatment.

With these objects in view the invention consists in details of construction and combinations, which will be described in the ensuing specification and claimed in the clauses at the close thereof.

In the accompanying drawings, Figure 1 is a vertical section through a rotary separator embodying my improvements. Fig. 2 is a side elevation of the same. Fig. 3 is a plan view showing the driving connection between the source of power and the separator-shaft, whereby the rate of rotation of the separator may be regulated to suit the conditions of the material treated. Fig. 4 is a detail of the distributing-bin.

Referring now to the drawings, 1 designates the vertical rotary shaft of my improved separator, the same comprising in the instance shown a tube or pipe provided at its upper and lower ends with metal stubs 2 and 3, between which the tube is provided with a filler 4, of wood, to give rigidity to the shaft and to afford anchorage for the supporting-arms of the spiral ways, presently to be described. The shaft 1 is at its lower end mounted in a step-bearing 5, suitably secured to afford the required stability, and I prefer to employ a ball-bearing at this point, as shown, to receive the thrust of the shaft and to reduce friction.

The stub 2 at the upper end of the shaft 1 is hollow and is secured rigidly to a shaft 6, journaled in suitably-supported bearings 7 and provided at its upper end with a bevel gear-wheel 8, meshing with a corresponding pinion 9, carried by a counter-shaft 10. This counter-shaft is provided with a pulley 11, which is connected by belt 12 with a pulley 13 on the end of one of a pair of parallel shafts 14 14^a, carrying oppositely-tapered cones 15 15^a, operatively or frictionally connected by a ring 16, shiftable longitudinally of the cones, so that the rotation of the driving-cone 15^a, which is driven at a constant

speed from any suitable source of power through pulley 17; will impart corresponding rotation to the cone 15 and thence to shaft 1 at greater or less speed, according as the ring 5 16 is shifted to one or the other side of the longitudinal centers of the cones. This change-speed device is of familiar construction and forms no part of my invention except in combination. As the material to be operated upon differs greatly as to its specific gravity in different mines and in different veins in the same mine it becomes necessary to the 10 accomplishment of perfect work that the machine should be equipped with means at the operator's disposal to regulate the speed at which the machine is run. Hence I employ the speed-regulating means described, though any other that will accomplish the same end will answer the purpose.

20 Secured rigidly to the shaft 1 are spiral troughs or ways A A and B, each comprising what I shall term a "floor" A' and B' and a "wing" A² and B². The spiral ways A A extend from top to bottom of the shaft, and at top the vertical wings A² thereof constitute a hopper, a to receive coal from a suitable chute leading from a breaker or grader. These wings are gradually reduced in height, (see Fig. 1,) terminating approximately in a 30 horizontal plane with the upper end of the way B, from thence downward to the distributing-bin 19. At the lower end of the separator the ways A A comprise the floor A' and its supports. The spiral way B is of greater diameter than the ways A A, its function being to receive coal discharged by centrifugal force from the ways A A and convey it to a distributing-bin 19. The upper end of this way B is located approximately in a 40 horizontal plane with the termination of the wings A² of the ways A A to receive coal, &c., discharged from the outer edge thereof, said way B having a floor B', having a pitch toward the shaft of, say, forty-five degrees, as shown, and a wing B², having a greater incline with relation to the shaft—say eighty degrees, more or less. These ways are supported on the shaft 1 by means of arms 20^a 20^b 20^c, penetrating the tubular shell thereof and having anchorage in the wood or other filling 4, heretofore referred to. The arms 20^a and 20^c are bent at angles to accommodate and properly support the parts of the several ways to which they are appropriate, reference being had to the drawings. The 55 ways A A and B extend to near the base of the shaft 1, where they discharge the separated coal and slate into a hopper 19, leading to chutes 20 and 21, the former taking the slate and bone from the ways A A and the latter taking coal from the way B. Deflector-plates *a'* and *b* are secured at the lower ends of the respective ways A A and B to give proper direction to the material as 65 it is discharged.

By employing a rotary separator I am enabled to obtain much more effective centrifugal action in the separation of the coal and slate, and, moreover, I am enabled to construct the spiral of more rapid pitch than has 70 been heretofore possible in an effective separator, since while the slate and bone traverse the inclined ways more rapidly the friction thereof upon the floors A' and B' will be increased as these floors travel in the direction 75 of the feed of the material.

The foregoing is a description of the spiral ways A A and B, respectively, while in order to increase the capacity or usefulness of my machine in practice I increase the spirals A 80 A to three or four spirals of precisely the same description, leaving the spiral way B as one, serving as a catching-pan of coal for all the three or four spirals A A.

It has been only after long and careful experiment that I found it to be of great benefit 85 to run the spirals in the direction of the feed. This operation is substantially like that of pushing the bottom spiral under the running coal, or equally of having less pitch, besides 90 I get a use of the centrifugal tendency in a peculiar manner—that of having the material run down by action of gravity and at the same time climb the incline from the center of the spiral to the side of the same, and as 95 the slate or rock is much heavier than the coal, or at least very appreciably heavier, the slate or rock by means of the centrifugal tendency will soon be ahead in climbing the incline from the center to the side of the spiral and drop off into an attached catching-pan, as has been ascertained from careful experimentation. Now it has also been ascer- 100 tained from the latter action that coal is not only of different specific gravity in different mines, but of varying gravity from different veins in the same mine. This fact makes it necessary to adjust the spiral separator at will and immediately, so as to change the speed at which it is run. This I accomplish, 110 as I have already stated, by interposing an Evans friction-cone or speed-changing means between the spiral separator and the power-shaft. By this speed-changing means, which may be of any form that will accomplish the 115 purpose, I can treat any reasonably-sized material or material of varying gravity with equal effect and with the greatest precision and highest degree of perfection. This end could not be obtained if the machine were not rendered ca- 120 pable of changing its speed as stated. I of course make no claim to speed-changing means *per se*, but only to its employment in this particular combination.

I claim—

1. A rotary vertical shaft; in combination 125 with a spiral way or floor having a steep pitch toward the shaft supported by the same; and means for rotating the said shaft in the direction in which the coal gravitates; and mech- 130

anism for changing, at any desired moment, the degree of speed at which the shaft and its equipments are rotated, to suit the character or condition of the coal, slate, or other substances operated upon.

2. A rotary vertical shaft; in combination with a spiral way or floor supported thereby; means for rotating the shaft and its equipments in the direction in which the coal gravitates; a catch-pan having downwardly and inwardly inclined ways or floors, and having an inwardly-inclined wall extending outside of said spiral ways; a spiral way for the catch-pan intermediate of the spiral ways first mentioned; and mechanism for changing the degree of speed at which the shaft and its equipments are rotated to suit the charac-

ter or condition of the coal and slate or other substances being operated upon.

3. The combination, for separating coal and cognate substances, of a rotary vertical shaft; a spiral way supported thereby; a catch-pan with steeply-inclined peripheral walls; a spiral floor for each catch-pan; means for actuating the several operative parts; and means for changing, at any desired moment, the degree of speed at which the several parts are operated.

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

FRANK NICTER.

Witnesses:

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