G. H. ELMORE.

CENTRIFUGAL DRIER.

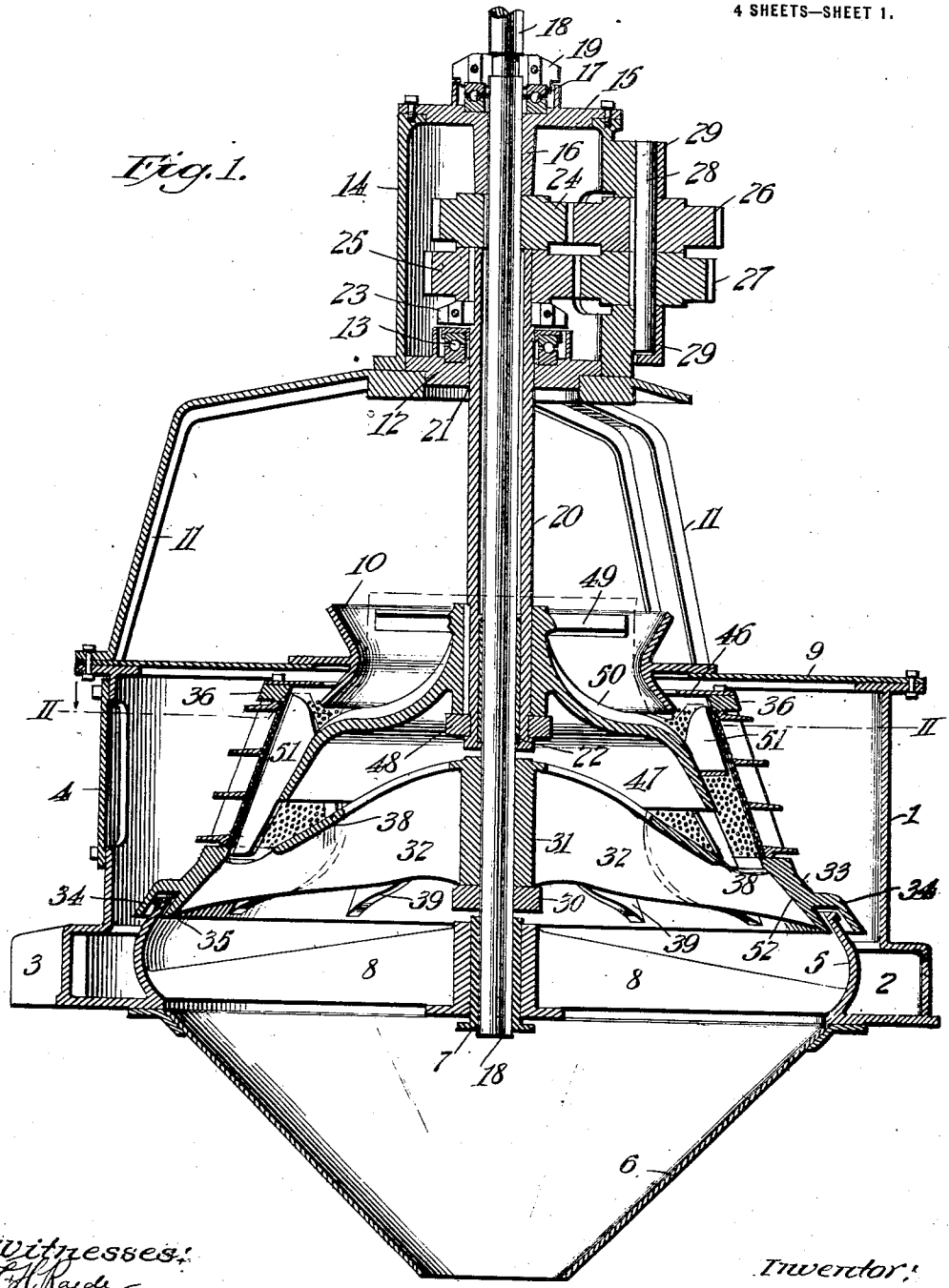
APPLICATION FILED SEPT. 6, 1912.

1,235,193.

Patented July 31, 1917.

4 SHEETS—SHEET 1.

Fig. 1.



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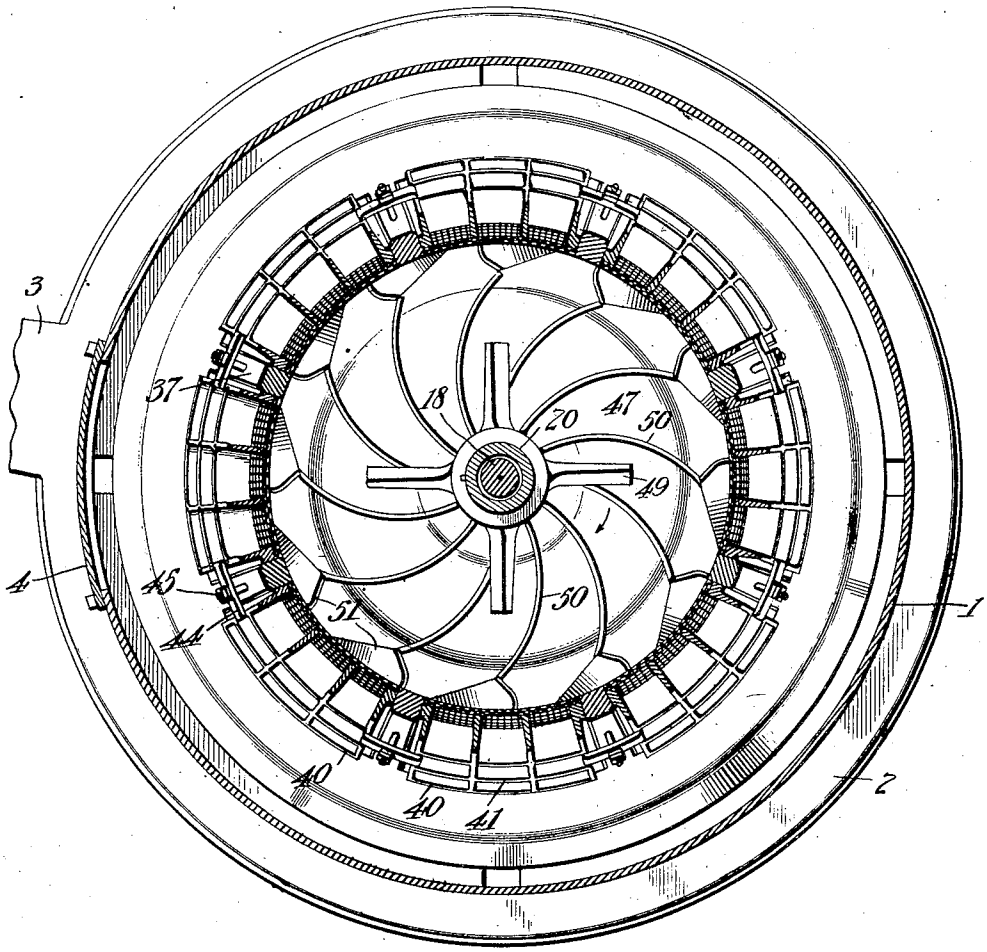
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4 SHEETS—SHEET 2.

Fig. 2.



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4 SHEETS—SHEET 3.

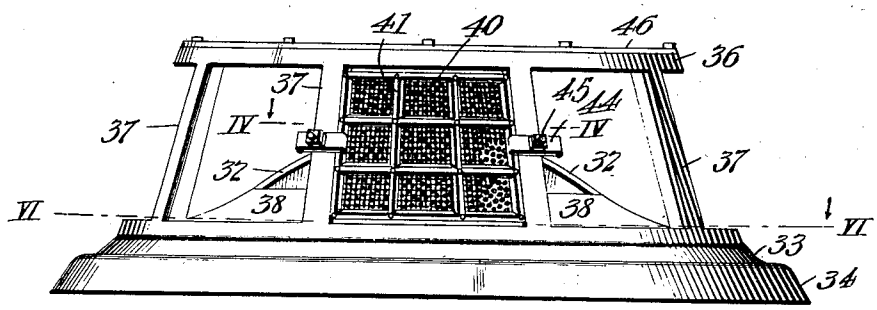


Fig. 3.

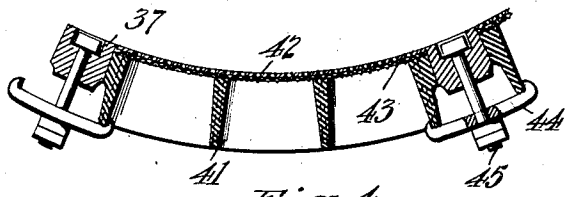


Fig. 4.

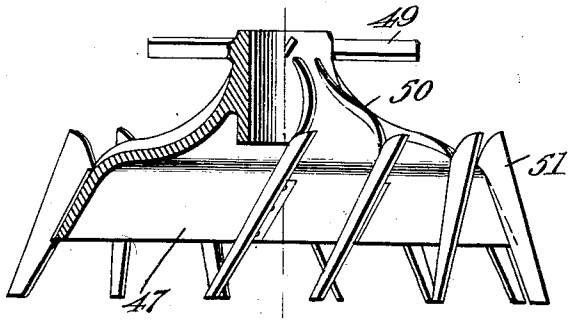


Fig. 5.

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CENTRIFUGAL DRIER.

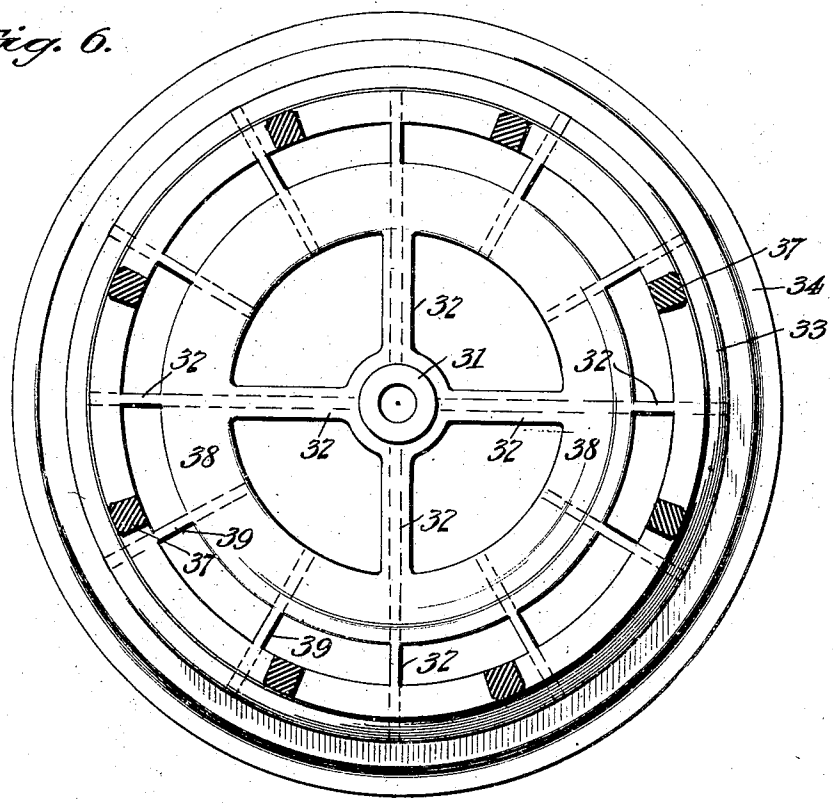
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4 SHEETS—SHEET 4.

Fig. 6.



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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL DRIER.

1,235,193. Specification of Letters Patent. Patented July 31, 1917.

Application filed September 6, 1912. Serial No. 718,931.

To all whom it may concern:

Be it known that I, GUY H. ELMORE, a citizen of the United States, residing at Swarthmore, in the county of Delaware and State of Pennsylvania, have invented certain new and useful Improvements in Centrifugal Driers, of which the following is a specification.

This invention relates to centrifugal driers primarily intended for drying granular materials such as coal, but also adapted for use in drying wet pulpy masses such as finely divided ores prepared for use in cyanid processes and the like.

This invention relates more particularly to the conical form of the rotary screen and to the form of the conveyer blades for use with this screen to effect an easy feed and discharge. Other details of improvement relate to the sectional construction of the screens whereby replacements are readily made, the reduction in the number of parts, and the general simplification of the device to adapt it to commercial use.

In the drawings:

Figure 1 is a vertical axial section of the complete device;

Fig. 2 is a section on the line II—II of Fig. 1;

Fig. 3 is an elevation of the rotating screen structure, showing the mode of attaching the removable screen sections;

Fig. 4 is an enlarged section on the line IV—IV of Fig. 3;

Fig. 5 is a part axial section and part elevation of the conveyer or feeder member; and

Fig. 6 is a section on the line VI—VI of Fig. 3.

The main frame and housing of the machine consists of a cylindrical casting 1, having the duct 2 around its bottom through which the water extracted in the drier may flow to discharge spout 3. A manhole 4 gives access to the interior of the housing for the inspection and repair of the screen rotor. The duct 2 is formed around the outside of a curved discharge guide-plate 5, which is cast integrally with housing 1, and which receives the solid material discharged from the screen rotor and deflects it into the discharge spout 6 bolted to housing 1. The lower bearing 7 for the main shaft is carried at the center of a spider-frame 8 also cast integrally with housing 1. The top of the housing 1 is closed by an annular cover-plate 9, which supports a supply hopper 10 of the form clearly illustrated in Fig. 1.

Supported on top of the main frame or housing 1 is a tripod frame 11 on which is carried a bearing-plate 12 with a thrust-bearing 13, and the differential gear-housing 14. The cap-plate 15 of the housing 14 is provided with a bearing 16 and a thrust-bearing 17. The main shaft 18 of the drier turns in the bearings 7 and 16, and is sustained upon thrust-bearing 17 by a split collar 19 clamped in a groove in said shaft. A sleeve 20 surrounding shaft 18 turns at its upper end in a bearing 21 in plate 12, and at its lower end turns on said shaft 18, the sleeve being lined at 22 with Babbit metal. This sleeve 20 is supported upon thrust-bearing 13 by means of a split collar 23 clamped on said sleeve. The shaft 18 carries the screen rotor, while the sleeve 20 carries the conveyer rotor or feeder.

The shaft 18 is driven by any suitable mechanism, and the sleeve 20 is driven from shaft 18 in the same direction but at somewhat slower speed, by the differential gears 24, 25, 26 and 27, the gears 24 and 25 being keyed on shaft 18 and sleeve 20 respectively, while gears 26 and 27 are keyed to a jack-shaft 28 turning in bearings 29 on gear-housing 14.

The screen rotor is keyed on the shaft 18, and is further held by a split collar 30. The rotor frame is cast in one piece, and consists of the hub 31, radial spokes 32 of the form shown in the drawing, base ring 33 provided with the water guard flanges 34 and 35 which straddle the inwardly extending rim of discharge guard-plate 5, the top ring 36, and the inclined uprights 37, all as shown clearly in Figs. 3 and 6. As is most clearly shown in Fig. 6, the spokes 32 are four in number, and are tied together by a deflector-plate 38 from which radiate intermediate spokes 39 to the base ring 33.

The screen elements proper consist of bronze frames 40 having cross bars 41 which support the screen surface. This last comprises an inner sheet of bronze 42 having fine, closely spaced holes, and an outer layer of heavy wire 43 which gives support to the bronze sheet without blanking the holes therein. The above straining elements are

suited for granular material, but I contemplate mounting in frames 40 any of the well known filtering mediums or fabrics, which may be better suited to the drying of pulps or other materials. The frames 40 are inserted and fit closely in the openings bounded by the top ring 36, bottom ring 33, and inclined uprights 37. They are held in place by yokes 44 and bolts 45 passing through the uprights 37. The top of the screen rotor is closed by an annular plate 46 bolted thereto and surrounding the hopper 10.

The screen rotor thus forms a conical perforate shell, and the angle of the element of the cone to the axis is a function of the character of material to be handled, the normal speed of rotation of the rotor, etc. The angle is determined by experiment according to the following theoretical considerations. Material passing through the screen rotor is subjected to centrifugal force acting horizontally, and to gravity acting vertically. The resultant of the two forces acting upon a particle of material at any one instant acts downward and outward, and will make some angle Θ with the element of the rotor cone. Obviously the resultant force exerts a downward feeding tendency which varies with the value of Θ, and there is some limiting value of Θ at which the material will just begin to feed itself slowly through the rotor. This value of Θ is a function of the angle of repose of the material handled, and theoretically a value might be determined for Θ at which the material would automatically feed at exactly the correct rate. Since, however, the angle of repose is variable for very slight changes in coarseness and wetness of the particles, I find such automatic feed extremely variable and impracticable. My invention, therefore, contemplates the use of such a value for Θ that the feeding tendency is not ever sufficient to actually cause a feeding, but is sufficient to relieve the mechanical conveyer or feeder of practically all load. By this means I secure a relatively free running device, with all the advantages of mechanical feed.

This mechanical feed is effected by a bell-shaped conveyer rotor 47 keyed on sleeve 20, and further held thereon by a split collar 48. Formed above the bell 47, but integrally with it, are stirrer arms 49, and formed on the bell are helical ribs 50, both designed to secure an even distribution of material to the screen rotor. Mounted on the rim of the conveyer rotor are quick-pitch helical blades or flights 51, inclined forward with reference to the direction of rotation of the bell 47, so that when the machine is running, since the screen rotor moves the faster, the flights 51 tend to feed the contained material downward. As previously explained, this feeding is attained without overcoming very great resistance, yet serves to control the rate of feed positively.

After the flights 51 have forced the material off the screens it reaches the conical surface 52, which has a greater inclination so that the material automatically flows over it to the guard plate 5 and hopper 6.

From the foregoing description it will be observed that the design of my device is such as to produce a very free running mechanism, and one which can be manufactured at comparatively small expense. The particular construction of the screen surface is valuable as it permits the ready removal of worn screens without dismantling the machine. It also permits substitution of one character of screen for another in a similar manner. While I describe the screen rotor as rotating faster than the conveyer rotor, it is possible to operate the device driving the conveyer rotor at the higher speed in the same direction provided the pitch of the conveyer flights on the conveyer rotor be reversed. It is not necessary that the screen be given a true conical form as it might for example be given a conoidal form and still operate in substantially the manner described, the essential feature of my invention being the use of a progressively increasing screen diameter toward the discharge end in such manner to effect the free feeding action described, in combination with a quick pitch conveyer rotor to control the feed. The term "quick pitch" as used in the specification and claims with reference to the flights of the conveyer rotor is used to define pitches in which the longitudinal feed for one revolution is equal to or greater than the circumferential path of the flights.

Having thus described my invention, what I claim is:—

1. In a centrifugal drier, the combination of a rotatable, substantially conical screen; means for feeding material to be dried to the smaller end of said screen; a conveyer rotor mounted to rotate substantially coaxially with said screen and having quick pitch substantially helical conveyer flights turning in close proximity to said screen; and means for rotating said screen and conveyer rotor in the same direction and at slightly unequal speeds, the angle of flare of the screen and its normal speed of rotation being so coördinated that the resultant tendency of the material undergoing treatment to flow is nearly but not quite sufficient to feed said material along said screen.

2. In a centrifugal drier the combination of a substantially conical screen, rotatable upon a vertical axis and mounted with its larger end downward; means for feeding material to be dried to the upper end of

said screen; a conveyer rotor mounted to rotate substantially coaxially within said screen and having substantially helical conveyer flights in close proximity to the screen; and means for rotating said screen and conveyer rotor in the same direction and at slightly unequal speeds, the angle of flare of the screen and its normal speed of rotation being so coördinated that the feeding tendency produced by gravity and centrifugal force is nearly but not quite sufficient to feed the material treated in said drier downward along the said screen.

3. In a centrifugal drier, the combination of a supply hopper; a downwardly flaring substantially conical centrifugal screen drum mounted to rotate on a vertical axis beneath said hopper; a bell shaped distributer mounted to rotate within said screen about a common axis therewith, said distributer being of substantially the same diameter as said hopper; a plurality of quick pitch, substantially helical conveyer flights mounted on the periphery of said distributer and moving in close proximity to said screen; spiral distributing ribs carried by the upper surface of said distributer and adapted to exert an outward feeding tendency on material in said hopper; stirrer arms mounted to turn with said distributer in the mouth of said hopper; and means for driving said screen and distributer in the same direction at slightly unequal speeds.

4. In a centrifugal drier, the combination of a supply hopper; a downwardly flaring substantially conical centrifugal screen drum mounted to rotate on a vertical axis beneath said hopper; a bell shaped distributer mounted to rotate within said screen about a common axis therewith, said distributer being of substantially the same diameter as the hopper; a plurality of quick pitch, substantially helical conveyer flights mounted on the periphery of said distributer and moving in close proximity to said screen; stirrer arms mounted to turn with said distributer in the mouth of said hopper; and means for driving said screen and distributer in the same direction at slightly unequal speeds.

5. In a centrifugal drier, the combination of a supply hopper; a downwardly flaring substantially conical centrifugal screen drum mounted to rotate on a vertical axis beneath said hopper; a bell shaped distributer mounted to rotate within said screen about a common axis therewith, said distributer being of substantially the same diameter as the hopper; a plurality of quick pitch, substantially helical conveyer flights mounted on the periphery of said distributer and moving in close proximity to said screen; and means for driving said screen and distributer in the same direction at slightly unequal speeds, the angle of flare of the screen and its normal speed of rotation being so coördinated that the feeding tendency caused by gravity and centrifugal force shall be nearly but not quite sufficient to cause a feed of the treated material down said screen.

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

GUY H. ELMORE.

Witnesses:
H. V. CROLL,
ANTHONY GROTTHUS.