A. R. SELDEN.

CENTRIFUGAL DRIE

APPLICATION FILED APR. 17, 1911.

1,025,485.

Patented May 7, 1912.

5 SHEETS—SHEET 1.

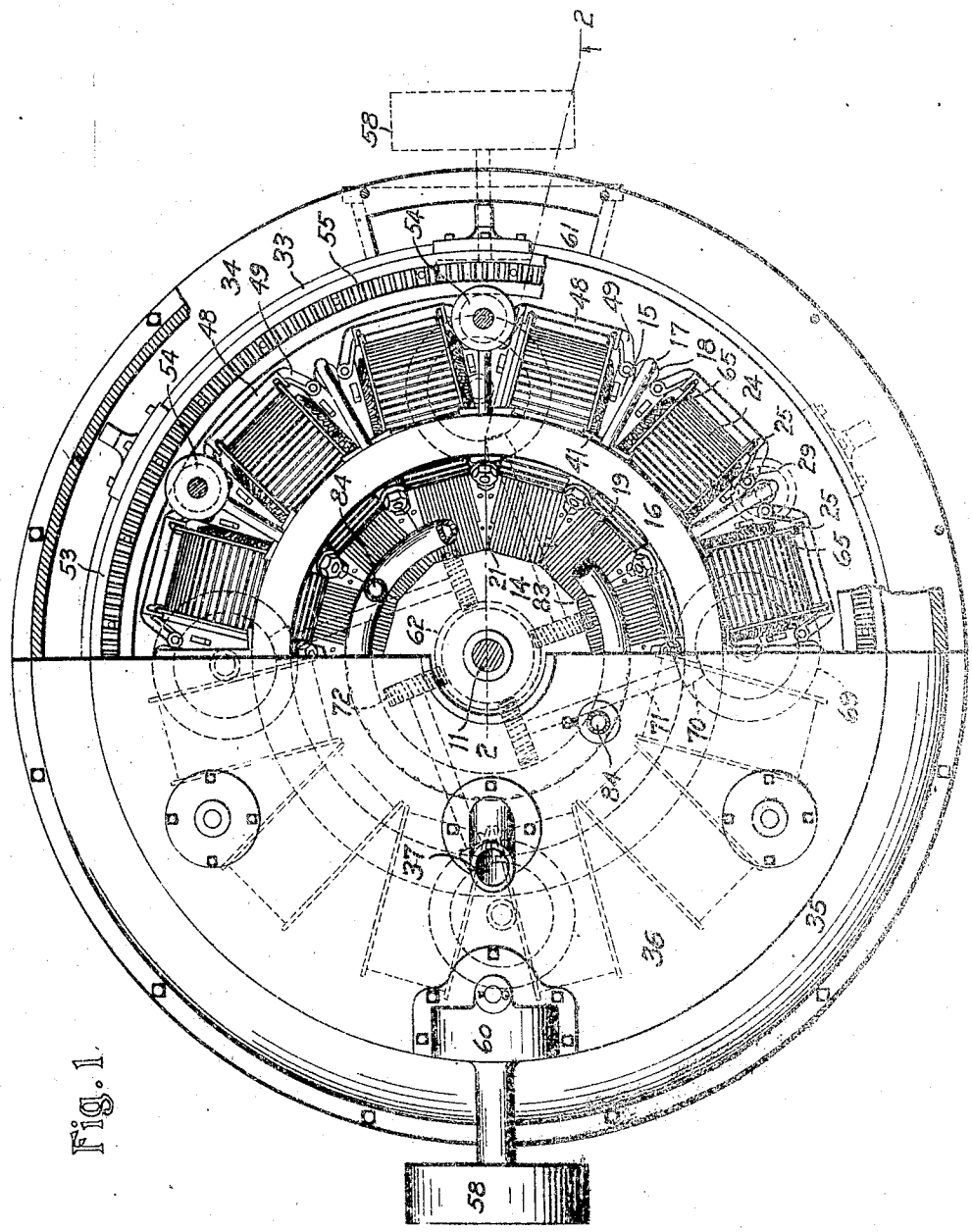

Fig. 1.

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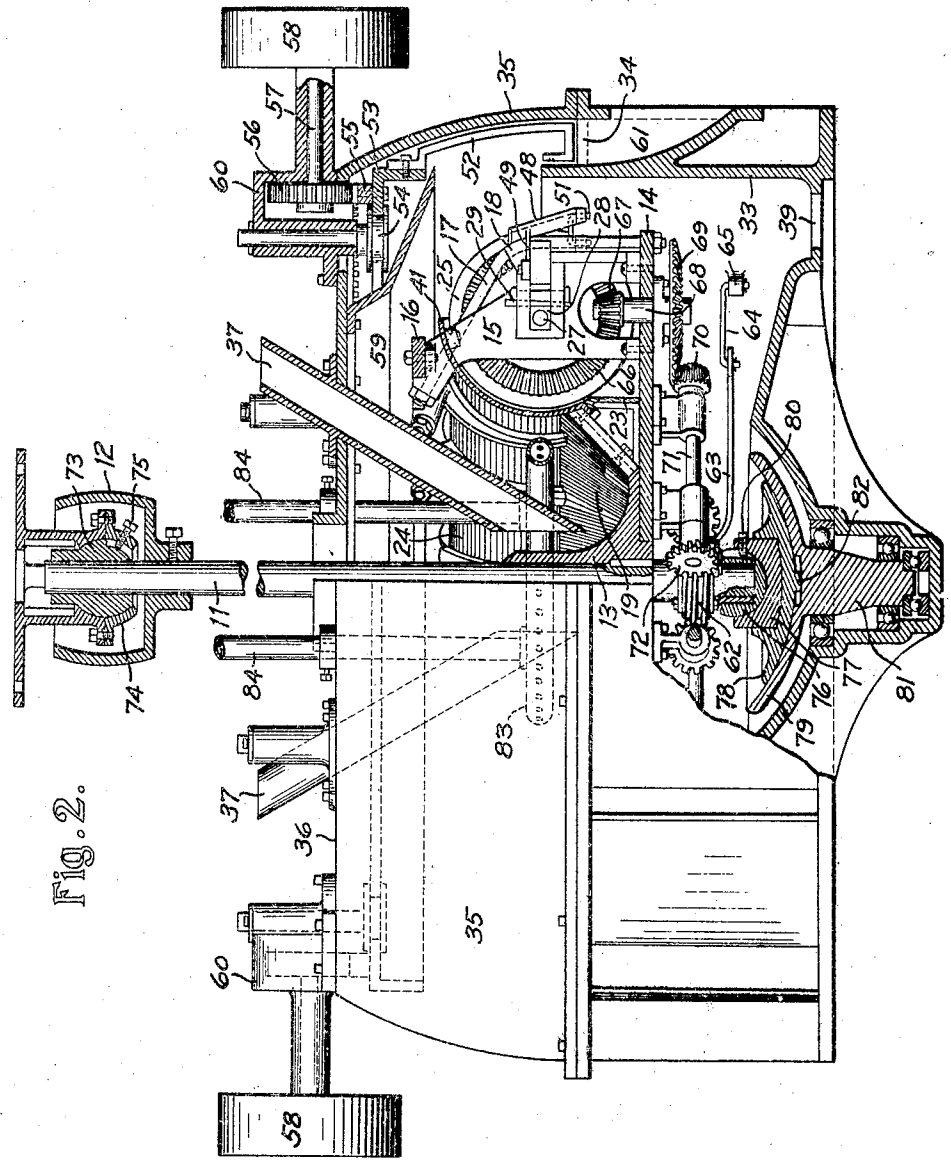

Fig. 2.

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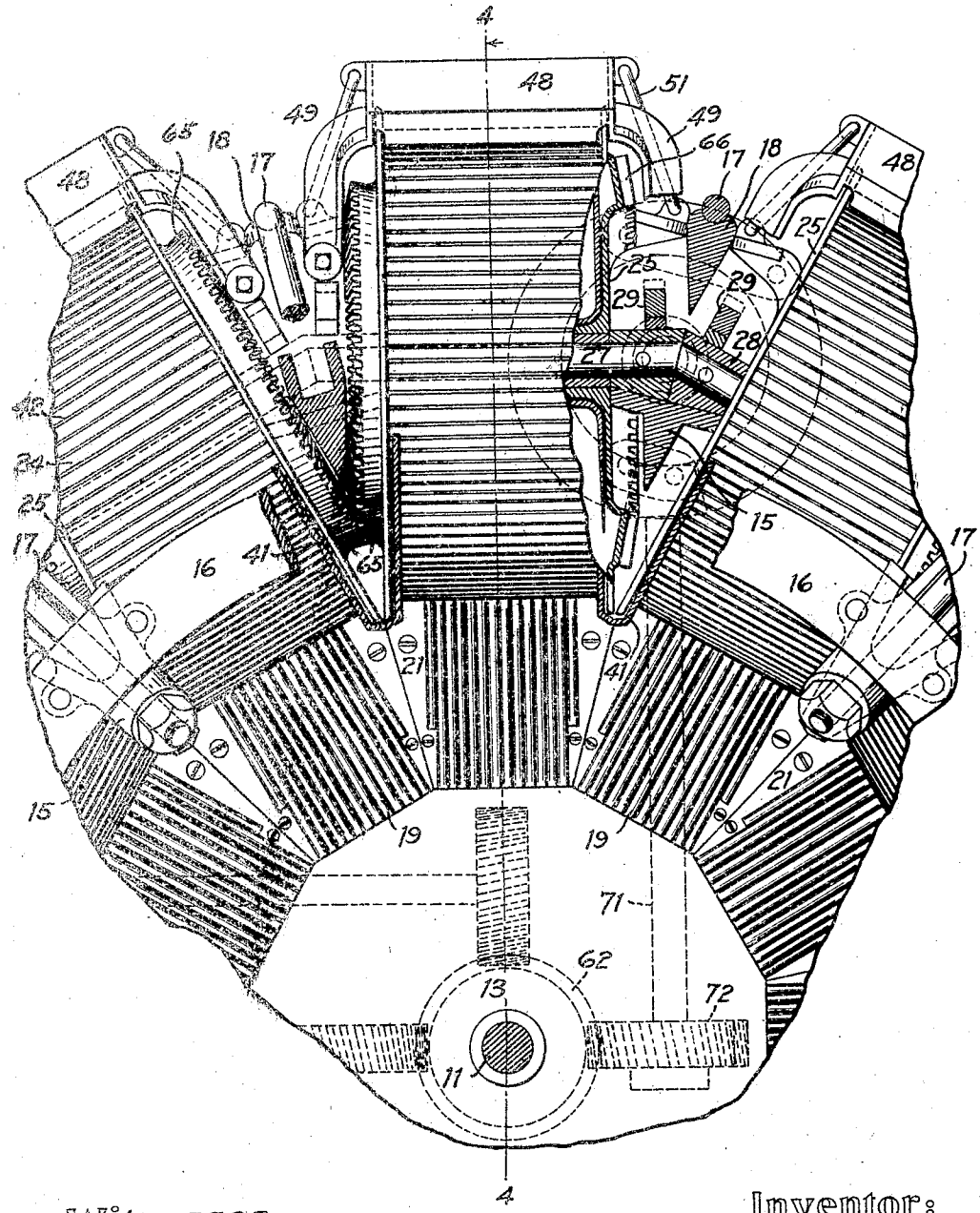
5 SHEETS—SHEET 3.

Fig. 3.



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5 SHEETS—SHEET 4.

Fig. 4.

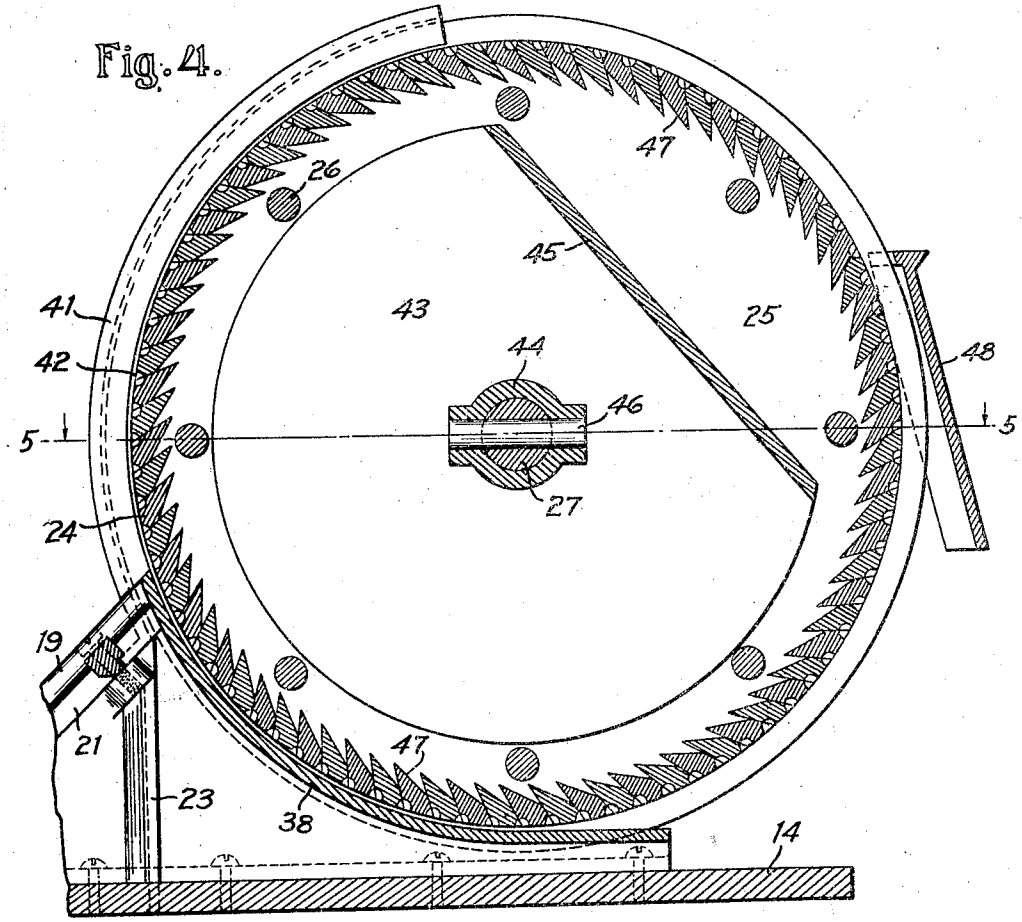


Fig. 8.

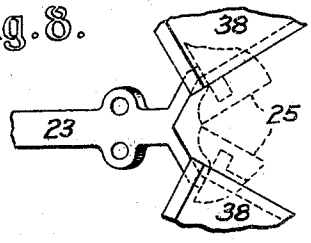
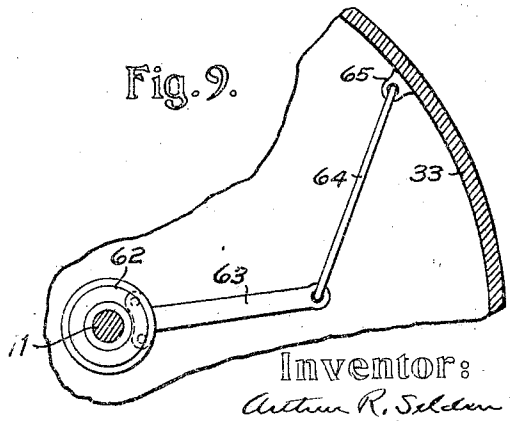


Fig. 9.



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5 SHEETS—SHEET 5.

Fig. 5.

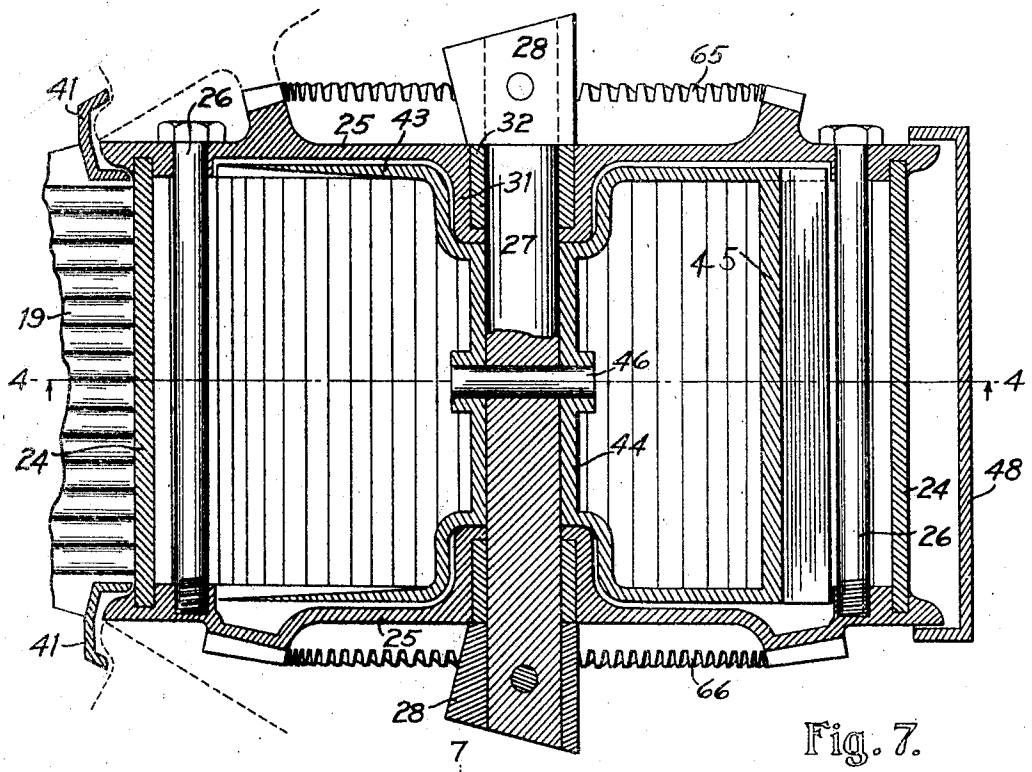


Fig. 7.

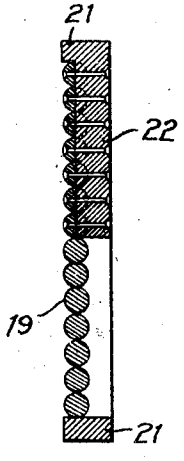
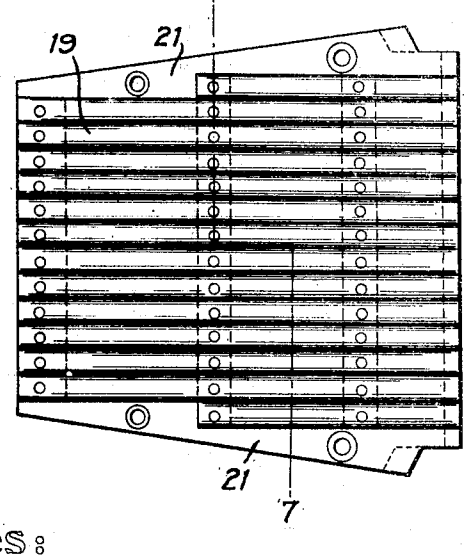


Fig. 6.



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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL DRIER.

1,025,485. Specification of Letters Patent. Patented May 7, 1912.

Application filed April 17, 1911. Serial No. 621,715.

To all whom it may concern:

Be it known that I, ARTHUR R. SELDEN, a citizen of the United States, and resident of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Centrifugal Driers, of which the following is a specification.

This invention relates to centrifugal drying machines of the type in which the material to be separated or dried may be introduced continuously without interrupting the rotation of the machine, so as to save the time usually consumed in stopping, recharging and starting the machine.

One object of the present invention is to produce a machine of the type in question in which the moving parts of the basket by which the material is continuously discharged therefrom, are of simple and rigid construction and efficient in operation.

Another object of the invention is to provide for the automatic clearing of the fluid-passages or interstices in the foraminiferous drums employed in connection with the basket, and a third object of the invention is to provide for the efficient collection and removal of the solid material from the casing of the machine.

Further objects of the invention, and the features of construction and operation by which these several objects are attained, will be set forth in connection with the following description of the illustrated embodiment of the invention.

In the accompanying drawings:—Figure 1 is a plan-view of a centrifugal machine embodying the present invention, with parts removed to show the interior construction; Fig. 2 is a side-elevation of the machine of Fig. 1, shown partly in section on the line 2—2 in the latter figure; Fig. 3 is a plan-view, on a larger scale, of a portion of the basket, a part of the figure being in horizontal section; Fig. 4 is a vertical section, on a still larger scale, on the line 4—4 in Figs. 3 and 5; Fig. 5 is a horizontal section on the line 5—5 in Fig. 4; Fig. 6 is a detail-view of one of the inclined gratings, seen in a direction normal to the upper surface of the grating; Fig. 7 is a section on the line 7—7 in Fig. 6, looking from right to left in the latter figure; Fig. 8 is a detail-view, showing the connection between certain portions of the structure illustrated in Fig. 4, looking downward; and Fig. 9 is a plan-view showing the means for holding the worm against rotation.

The illustrated embodiment of the invention is a machine adapted particularly for operating upon mixtures of liquid and comminuted solid material, and operates to separate the liquid from the solid material and to deliver the latter in a dry, or substantially dry, condition.

The illustrated machine consists, broadly speaking, in a basket which rotates about a vertical axis, and a casing which incloses the basket and acts as a receptacle for the material discharged therefrom. This general arrangement is common in machines of the kind in question. The basket is supported upon, and rotated by, a vertical shaft 11 which is provided, at its upper end, with a pulley 12 through which it may be connected with any suitable source of power. As shown particularly in Fig. 2, the basket is provided with a frame-work comprising a central portion or hub 13 which is keyed upon the shaft 11. This hub carries a horizontal circular base-plate 14 upon which a series of uprights 15 are fixed. The upper ends of the uprights are connected by a ring 16, which supports them against centrifugal action. The uprights are further supported and held in place by means of bolts 17, of which the upper and lower ends are provided with nuts engaging, respectively, the upper ends of the uprights and the periphery of the plate 14, and these bolts, at their middle portions, bear against saddles 18 integral with the uprights.

The material to be dried, when first fed into the basket, falls upon the curved upper surface of the hub 13, and is discharged thence, by centrifugal action and gravity, upon a series of inclined gratings which constitute the outer portion of the bottom of the basket. Each of these gratings, as shown in Figs. 6 and 7, comprises a series of round metal bars 19. These bars are supported upon a frame-work comprising side-members 21 and cross-members 22 cast integral therewith. The bars are riveted upon the cross-members, and are placed close together so that there are no apparent openings between them. Owing to the minute irregularities in the surfaces of the bars, which occur in the ordinary commercial material, minute spaces are afforded between these bars which are sufficient for the passage of liquid, although solid material

is effectually prevented from passing between the bars. The gratings are supported upon bracket-shaped members 23 which are fixed to the base-plate 14. The centrifugal action causes the solid material to slide outwardly and upwardly upon the gratings, and in this manner the material is brought into engagement with the transferring means hereinbefore briefly referred to, by which the solid material is gradually transferred to, and permitted to escape from, the periphery of the basket. These means comprise a series of drums, of which the construction is shown particularly in Figs. 4 and 5. The periphery of each drum consists of bars 24, of prismatic form, which are arranged as the elements of a cylinder, and are seated at their ends in annular grooves in two heads or end-plates 25. The end-plates are drawn together and caused to clamp the bars by means of through-bolts 26. Each drum is mounted to turn freely upon a shaft 27. The shaft is provided, at each end, with a block 28 to which it is pinned, and the blocks are seated in slots in the uprights 15, as shown in Figs. 2 and 3. The blocks are secured in place by means of wedges 29 driven into vertical openings in the uprights, and thus the shafts are held against rotation. Since it is inconvenient to lubricate the bearings of the drums, and since these are more or less moistened by the water or other liquid constituting a constituent of the material to be separated, the drums are provided with bearing-bushings 32 of suitable material, such as wood impregnated with paraffin or other solid lubricant, these bearings being seated in sleeves 31 constituting the hubs of the end-plates 25.

The casing of the machine comprises a lower portion 33 of generally-cylindrical form, which terminates at its upper edge on a level with the axes of the drums. This portion of the casing is provided with an outwardly-extending horizontal flange or shelf 34. The upper portion of the casing is formed by a cover 35 made in two halves, of which one is removed in Fig. 1. This cover has a flat top 36 with a wide central opening to receive the shaft 11.

The material is fed into the machine through two feed-chutes 37 which are mounted in the cover and arranged to discharge the material near the center of the basket, as shown in Fig. 2. In order that the liquid and the solid constituents of the material may be separately collected in different parts of the casing, the basket is provided with certain guides to catch and direct these constituents respectively. Beneath each drum, and outside of the corresponding grating, is a curved guide 38 mounted on the base-plate 14, which acts to catch the liquid which is forced through the gratings by centrifugal action, and thus such liquid is prevented from engaging and passing through the drum. From the outer extremities of the guide 38 the liquid is projected, by centrifugal force, in a horizontal direction against the inner surface of the lower portion 33 of the casing. After being arrested against this surface the liquid falls into the bottom of the casing, and is discharged through an outlet-opening 39. At the juncture of each pair of drums a curved, channel-shaped guide 41 extends upwardly, inclosing the inner edges of the heads of the drums, and thus preventing material from passing between the ends of the drums. This guide is fixed, at its lower end, to one of the brackets 23, and, at its upper end, to the uprights 15. The bars 24 of the drum, as shown in Fig. 4, are hollowed at their outer angles to form grooves 42, and these grooves act both to retard to some extent the sliding of the material over the surface of the drum and also as receptacles for the collection of liquid. The bars 24, like the rods of the grating, are placed close together, but minute interstices are provided between the bars by slightly roughening their contacting surfaces in any convenient manner, so that the liquid can pass between the bars while the solid material is prevented from so doing.

Within each drum is a guide comprising end-pieces 43 (Figs. 4 and 5) connected by a sleeve 44. This sleeve is mounted upon the shaft 27, being fixed against rotation by means of a pin 46 passing through the shaft and the sleeve. At their outer portions the end-members 43 are connected by an inclined plate 45. The guide just described acts to catch liquid which is forced to the interior of the drum by centrifugal action, and this liquid is directed downwardly by the plate 45, being discharged centrifugally from the lower edge of this plate at a point substantially below the upper edge of the part 33 of the casing. From the lower edge of the plate 45 the liquid is discharged against the bars of the drum which are at the time in the outermost position, and the liquid then passes reversely between these bars and thence into the casing. This reverse flow of the liquid between the bars has the important advantage that it causes the liquid to wash out from between the bars any minute particles of material which may have lodged in the spaces between the bars and which would otherwise clog these spaces. The prismatic form of the bars is employed to prevent the discharge of liquid from the upper portion of the drum, where it might mingle with the solid material discharged from the basket. The inclined inner surfaces 47 of the bars are so arranged that at the upper portion of the drum any liquid remaining on these surfaces is not thrown outwardly between the bars by centrifugal

force, but is caused to drain downwardly to the edge of each bar and thence is thrown to the surface 47 of the next bar. This will be apparent from an examination of the right-hand portion of Fig. 4. As the bars approach the level of the axis of the drum, however, the rotation causes the surfaces 47 to assume an inclination in which the liquid will be thrown upwardly and outwardly upon these surfaces. At this point, therefore, a guide 48 is provided, the upper edge of this guide being so located that it will catch all liquid discharged from the drum through the action just described. The lower edge of the guide 48 extends below the upper edge of the lower portion 33 of the casing, so that the liquid, when discharged from the lower edge of the guide, is caught by this portion of the casing. Each guide 48 is provided with arms 49 by which it is fixed to the upright 15, and the lower portion of the guide is connected, by bent rods 51, with lugs on the uprights.

The drums are rotated outwardly upon the shafts 27 by means which will be presently described, so that the solid material resting upon their surfaces is gradually carried upward and outward to points near the tops of the drums, where the centrifugal force overcomes the friction of the material against the drums and the material is thus thrown horizontally from the drums. The material so discharged strikes against the inner surface of the cover portion 35 of the casing, and then falls down into the annular channel of which the shelf or flange 34 constitutes the bottom. To provide for the constant discharge of this solid material from the machine, one or more scrapers 52 (Fig. 2) are mounted upon a ring 53, this ring being supported in horizontal position at the top of the machine by engagement of its inner edge with a series of grooved rollers 54. The ring is rotated constantly by means of a rack 55 fixed to the upper surface of the ring and engaged by pinions 56. These pinions are fixed on shafts 57 journaled in housings 60 fixed to the top of the casing, and the shafts are rotated by means of pulleys 58, by which they are connected with any suitable source of power. The driving mechanisms just described are preferably used in duplicate, but a single mechanism may be used for the same purpose. By the rotation of the ring 53 the scraper 52 is caused to traverse the inner surface of the cover 35, thus scraping from such surface any solid material which may have adhered thereto and at the same time pushing the material along the shelf 34 until it reaches one of a series of peripheral outlets 61, through which the material is discharged from the casing into any suitable receptacle. A bell-shaped guard 59 depends from the top of the casing to protect the mechanism by which the scraper 52 is actuated.

To produce or control the rotation of the drums, the following means are employed. The drums are geared together in pairs, as shown in Fig. 3, by means of miter-gears 65 formed on the heads 25. One drum of each pair is provided also with a gear 66 on its opposite head, which meshes with one of a series of pinions 67, fixed on vertical shafts journaled in sleeves 68 fixed to the base-plate 14. At their lower ends these shafts carry bevel-gears 69 which mesh with gears 70 (Fig. 2). Each gear 70 is fixed on a shaft 71 journaled in bearings depending from the base-plate, and at its inner end each shaft 71 carries a worm-gear 72. The worm-gears all mesh with a single worm 62, which is journaled loosely upon the shaft 11. To prevent the worm from rotating, while at the same time permitting free lateral movements of the worm with the shaft, the worm is provided with an arm 63 fixed thereto, and the outer end of this arm is connected with a link 64, which is pivoted to a lug 65 upon the inner surface of the casing. As the basket rotates the worm-wheels 72 are carried around the worm, while the latter is fixed against rotation, and thus the worm-wheels are rotated and, through the gearing just described, a constant slow upward and outward rotation is produced in the drums, whereby the solid material is carried upwardly and outwardly as before described. Owing to the centrifugal action of the material in contact with the drums this rotation is assisted, so that the gearing may operate rather as a retarding means to control the rotation than as a positive means for producing such rotation.

The step-bearing for the basket is illustrated particularly in Fig. 2. The upper end of the shaft 11 is supported, in the usual manner, in a bearing adapted to permit lateral movement of the lower portion of the shaft. To this end the shaft rotates in a sleeve 73, which has a spherical outer surface embraced in a bearing-member 74 of corresponding form. The sleeve is prevented from rotating by means of a screw 75 engaging a slot in the sleeve. The lower end of the shaft is fixed in a spherical bearing-member 76, which is seated in a recess of corresponding form in a bearing-block 77. Relative rotation of these parts is prevented by a screw 80 engaging a slot in the bearing-member 76. The block 77 is fixed in a shoe 78, which has a downwardly-convex spherical surface resting in a concave seat 79 of corresponding form. This seat 79 is mounted on the upper end of a stem 81, and this stem is held in ball-bearings of ordinary form. When the shaft and the basket rotate, all of the parts just described rotate together, there being no relative

movement of rotation or revolution between them. The rotation of the seat 79 and its stem is produced by the frictional engagement of the shoe 78. In case the center of gravity of the basket is disturbed by a preponderance of material on one side or the other, the basket at once assumes the position in which it can rotate about its center of gravity, the necessary movement being permitted by the shoe 78 and its seat 79, owing to the fact that the shoe is free to move laterally in the seat. This movement is limited, however, by a pin 82 on the shoe depending into a corresponding recess in the seat. During this adjusting movement the necessary angular movement of the shoe upon the shaft is permitted by the ball-and-socket joint between these parts.

In order that the present machine may be used, when desirable, to dry the solid material passed therethrough more completely than can be done by centrifugal action alone, the machine is provided with means for subjecting the material to a blast of hot air, or other gas or vapor. To this end a circular pipe 83 is mounted within the basket, this pipe being provided with outwardly-directed perforations and being supported and fed through pipes 84 extending upwardly through the top of the casing. The draft through the outlet-openings in the pipe 83 impinges upon the material on the surfaces of the drums, and this draft is assisted by the centrifugal action of the basket, which tends to produce a constant outward flow of air through the drums. The air and vapor finally issue through the outlet-opening 61, or the drainage-opening 39, while a constant indraft of air occurs in the opening in the cover through which the shaft enters. By the use of heated air, or superheated steam, the material may be delivered in a dry, or substantially dry, condition.

My invention is not limited to the embodiment thereof hereinbefore described and illustrated in the accompanying drawings, but may be embodied in various forms within the nature of the invention, as it is defined in the succeeding claims.

I claim:—

1. A centrifugal machine having, in combination, a rotary basket provided with a rotatable transferring member having a surface against which the material in the basket is held by centrifugal force when the basket is rotated, said surface being movable, while the basket rotates, first upwardly and then outwardly so as to transfer the contents of the basket from the interior to the periphery thereof, and mechanism for rotating the basket and for controlling the movement of the transferring member.

2. A centrifugal machine having, in combination, a rotary basket provided with an upwardly and outwardly-inclined bottom and with transferring members adjacent its periphery, said members having surfaces against which the material in the basket is held by centrifugal force when the basket is rotated, said surfaces being movable, while the basket rotates, in a direction transverse to the direction of said rotation, so as to transfer the contents of the basket from the bottom thereof to a point of delivery at the periphery, and mechanism for rotating the basket and for controlling the movement of the transferring members.

3. In a centrifugal machine, a rotary basket provided with an annular series of foraminiferous drums rotatable about axes lying substantially in a plane normal to the axis of rotation of the basket, and means for controlling the rotation of said drums.

4. In a centrifugal machine, a rotary basket comprising an upwardly and outwardly-inclined foraminiferous bottom and an annular series of foraminiferous drums arranged to receive material from said bottom and to rotate upwardly and outwardly so as to discharge said material from the periphery of the basket, and means for controlling the rotation of the drums.

5. A centrifugal machine having, in combination, a basket rotatable, as a whole, about a vertical axis and provided with a plurality of foraminiferous drums independently rotatable about horizontal axes and with a bottom terminating adjacent the drums and substantially above the bottoms thereof, and means for rotating the basket about its vertical axis and for rotating the drums about their said axes in a direction to cause their inner portions to move upwardly and outwardly.

6. A centrifugal machine having, in combination, a basket rotatable, as a whole, about a vertical axis and provided with a plurality of foraminiferous drums independently rotatable about horizontal axes and with an outwardly- and upwardly-inclined bottom terminating adjacent the drums and substantially above the bottoms thereof, and means for rotating the basket about its vertical axis and for rotating the drums about their said axes in a direction to cause their inner portions to move upwardly and outwardly.

7. A centrifugal machine having, in combination, a basket rotatable, as a whole, about a vertical axis and provided with a plurality of foraminiferous drums independently rotatable about horizontal axes and with an outwardly- and upwardly-inclined foraminiferous bottom terminating adjacent the drums and substantially above the bottoms thereof, and means for rotating the drums about their said axes in a direction to cause their inner portions to move upwardly and outwardly.

8. A centrifugal machine having, in combination, a basket rotatable, as a whole, about a vertical axis and provided with a plurality of drums journaled to rotate independently about horizontal axes, each drum comprising parallel bars separated by minute passages, and means for rotating the basket about its vertical axis and for rotating the drums about their horizontal axes.

9. A centrifugal machine having, in combination, a basket provided with a plurality of rotatable drums, each drum comprising parallel bars with minute passages between adjacent bars and the adjacent outer angles of the bars being cut away to form parallel grooves in the outer surface of the drum, and means for rotating the basket, as a whole, and for independently rotating the drums about their axes.

10. A centrifugal machine having, in combination a basket provided with a plurality of drums, each drum comprising parallel bars of prismatic form placed close together at the outer surface of the drum so as to form minute passages between the bars, and means for rotating the basket, as a whole, and for independently rotating the drums about their axes.

11. A centrifugal machine having, in combination, a basket rotatable, as a whole, about a vertical axis and provided with a plurality of foraminiferous drums rotatable independently about their axes so as to transfer solid material from a point within the basket to a point of centrifugal discharge, each drum being provided, within itself, with means for deflecting liquid passing to the interior of the drum, to cause such liquid to be discharged centrifugally through and from the the drum at a different level from the point of discharge of the solid material, means for separately receiving and collecting the solid and liquid material discharged from the basket, and means for rotating the basket about its vertical axis and for independently rotating the drums about their axes.

12. A centrifugal machine having, in combination, a basket rotatable, as a whole, about a vertical axis and provided with a plurality of drums independently rotatable about horizontal axes, the drums acting to transfer solid material from a point within the basket to a point of centrifugal discharge at the tops of the drums, each drum comprising parallel bars with minute passages between them for liquid, the bars having inner inclined deflecting surfaces arranged to direct liquid entering the drum through said passages to a point below said point of centrifugal discharge for the solid material, whereby the liquid is discharged centrifugally in a reverse direction through said passages at a lower level, stationary means for separately receiving and collecting the solid material and the liquid discharged from the basket, and means for rotating the basket about its vertical axis and for independently rotating the drums about their horizontal axes.

13. A centrifugal machine having, in combination, a basket rotatable, as a whole, about a vertical axis and provided with a plurality of foraminiferous drums independently rotatable about horizontal axes, the drums rotating in a direction to transfer solid material from a point within the basket to a point of centrifugal discharge at the tops of the drums while the liquid separated from the solid material passes to the interior of the drums through their foraminiferous surfaces, and a guard located within each drum and adapted to deflect such liquid to a point at a lower level than the point of discharge of the solid material, so as to permit the liquid to pass again, in a reverse direction, through the foraminiferous surface to the exterior of the drum and to be discharged thence centrifugally at a lower level than the point of discharge of the solid material, stationary means for separately receiving and collecting the solid material and the liquid discharged from the basket, and means for rotating the basket, as a whole, about its vertical axis and for independently rotating the drums about their horizontal axes.

14. A centrifugal machine having, in combination, a basket rotatable, as a whole, about a vertical axis, the basket having a plurality of foraminiferous drums independently rotatable about horizontal axes, and a bottom comprising substantially radial bars placed close together with minute interstices between the bars, and means for rotating the basket about its vertical axis and for rotating the drums about their horizontal axes.

15. A centrifugal machine having, in combination, a basket rotatable, as a whole, about a vertical axis, the basket having a plurality of foraminiferous drums independently rotatable about horizontal axes, and an outwardly- and upwardly-inclined bottom terminating adjacent the drums and comprising substantially radial bars placed close together with minute interstices between the bars, and means for rotating the basket about its vertical axis and for rotating the drums about their horizontal axes.

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