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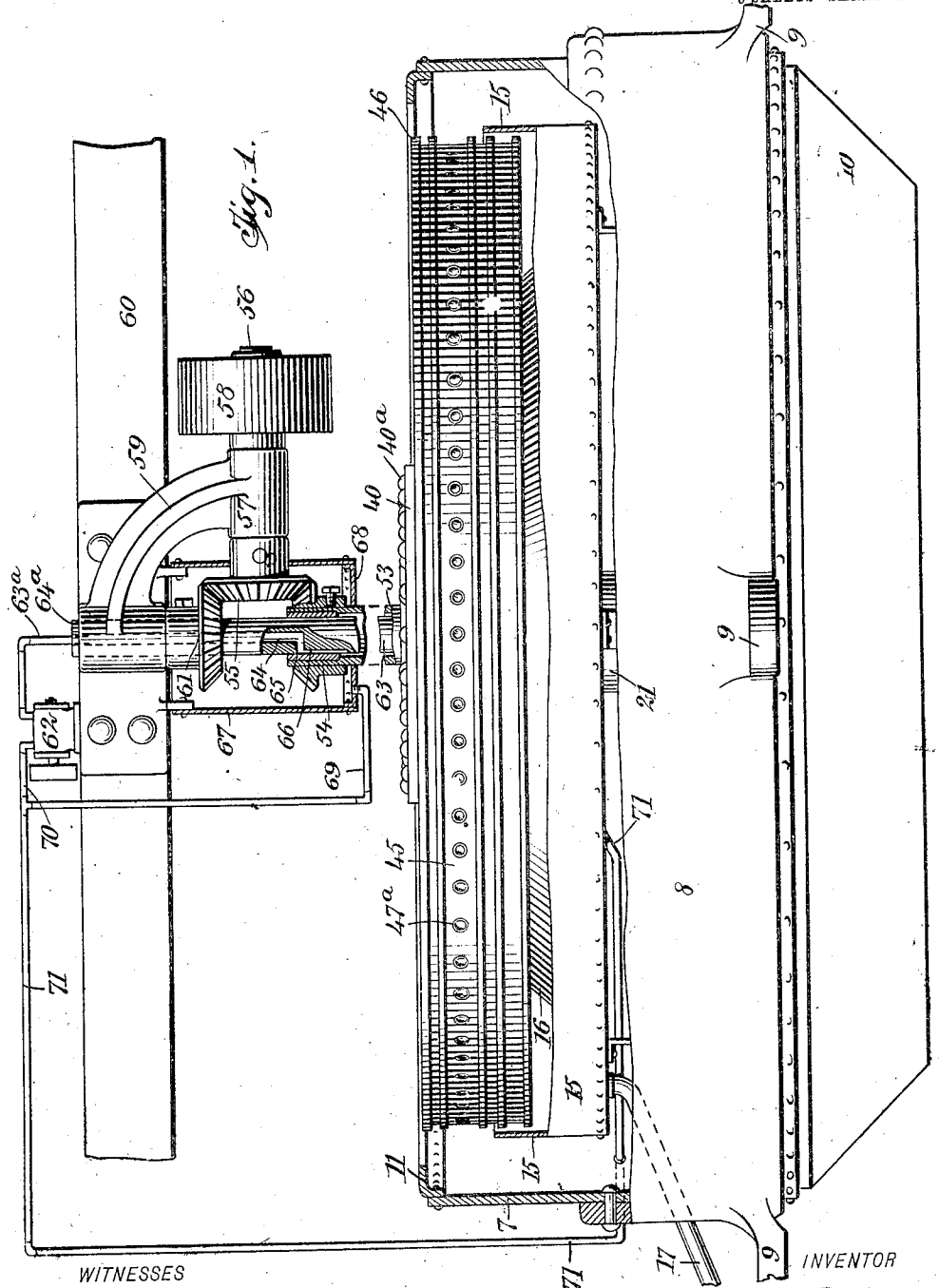
APPLICATION FILED JAN. 24, 1908.

926,859.

Patented July 6, 1909.

5 SHEETS—SHEET 1.

Fig. 1.



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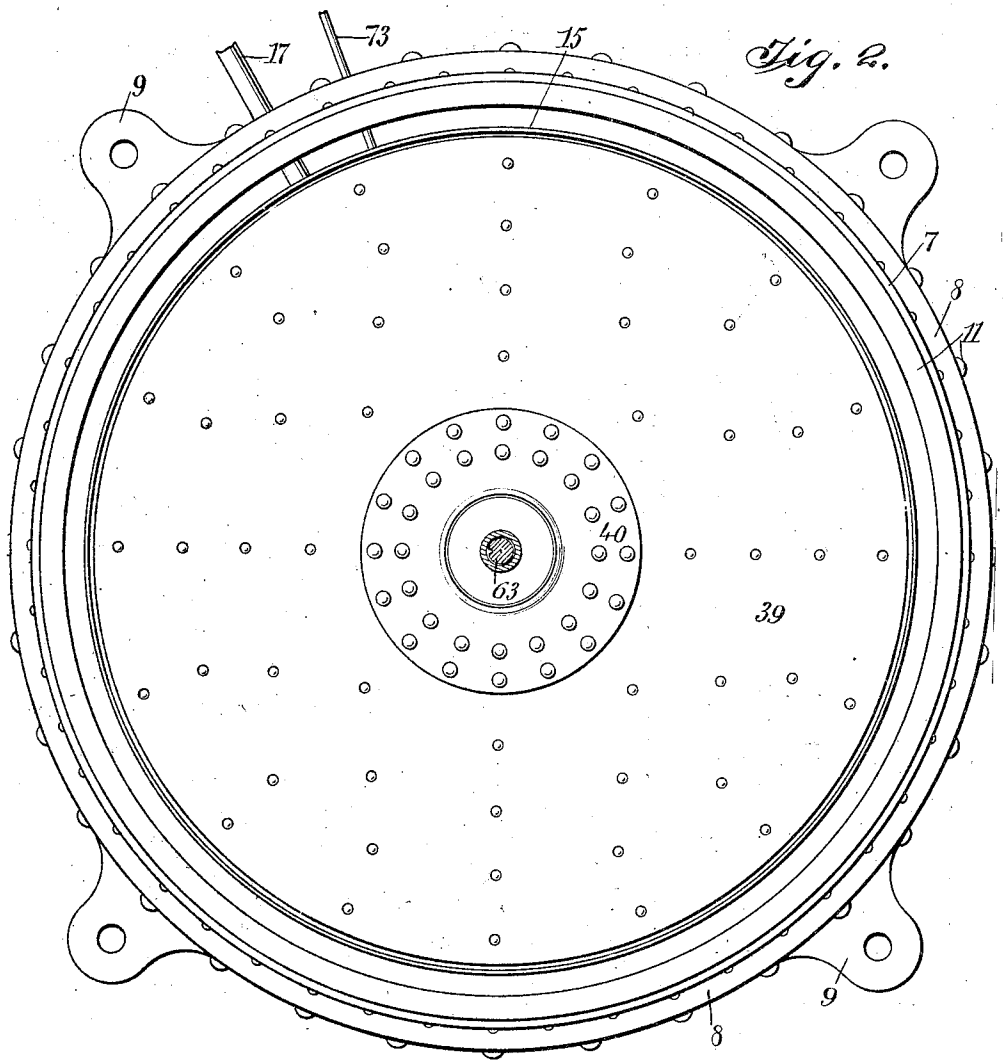
5 SHEETS—SHEET 2.

Fig. 2.



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5 SHEETS—SHEET 3.

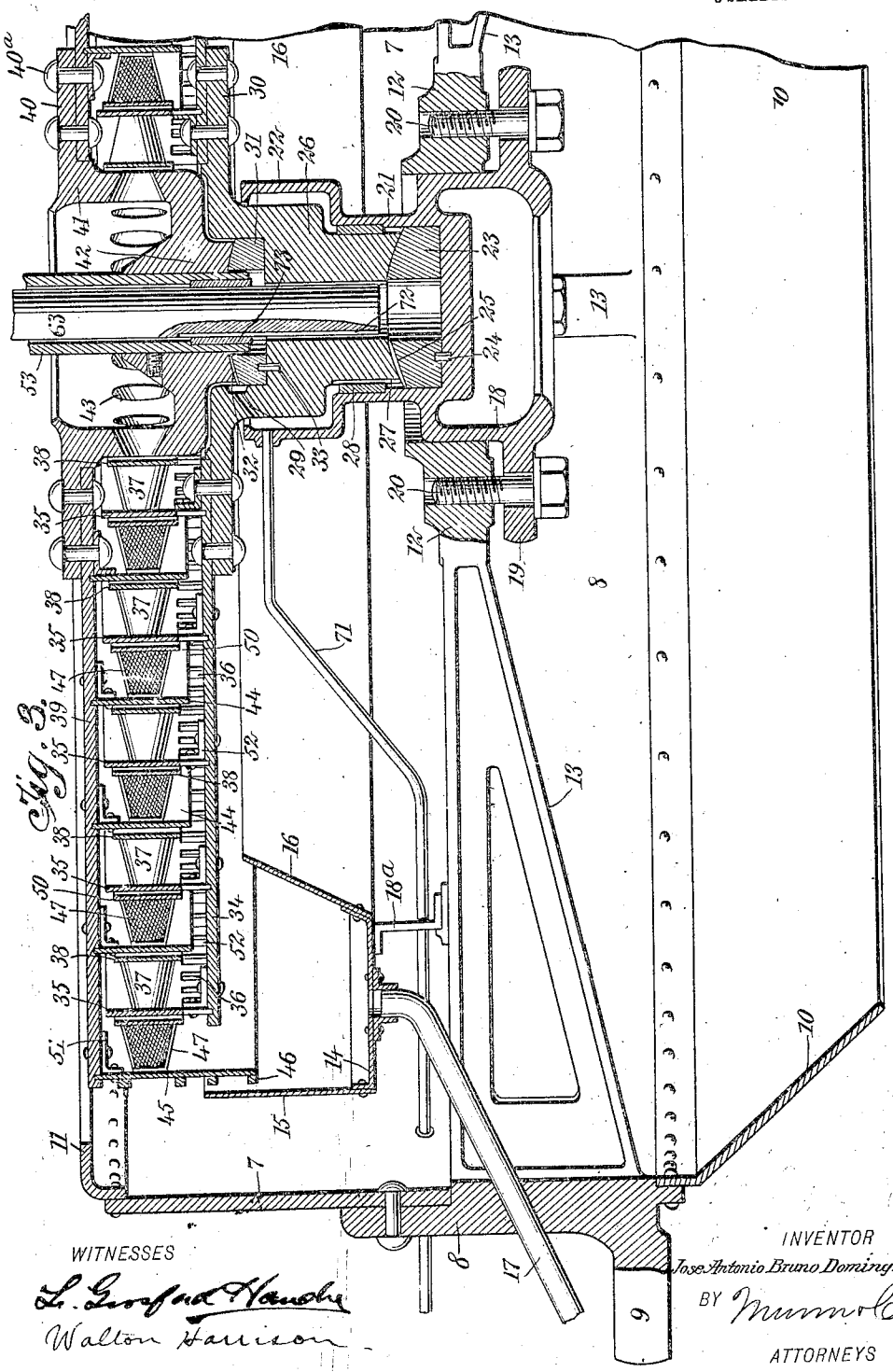

Fig. 3.

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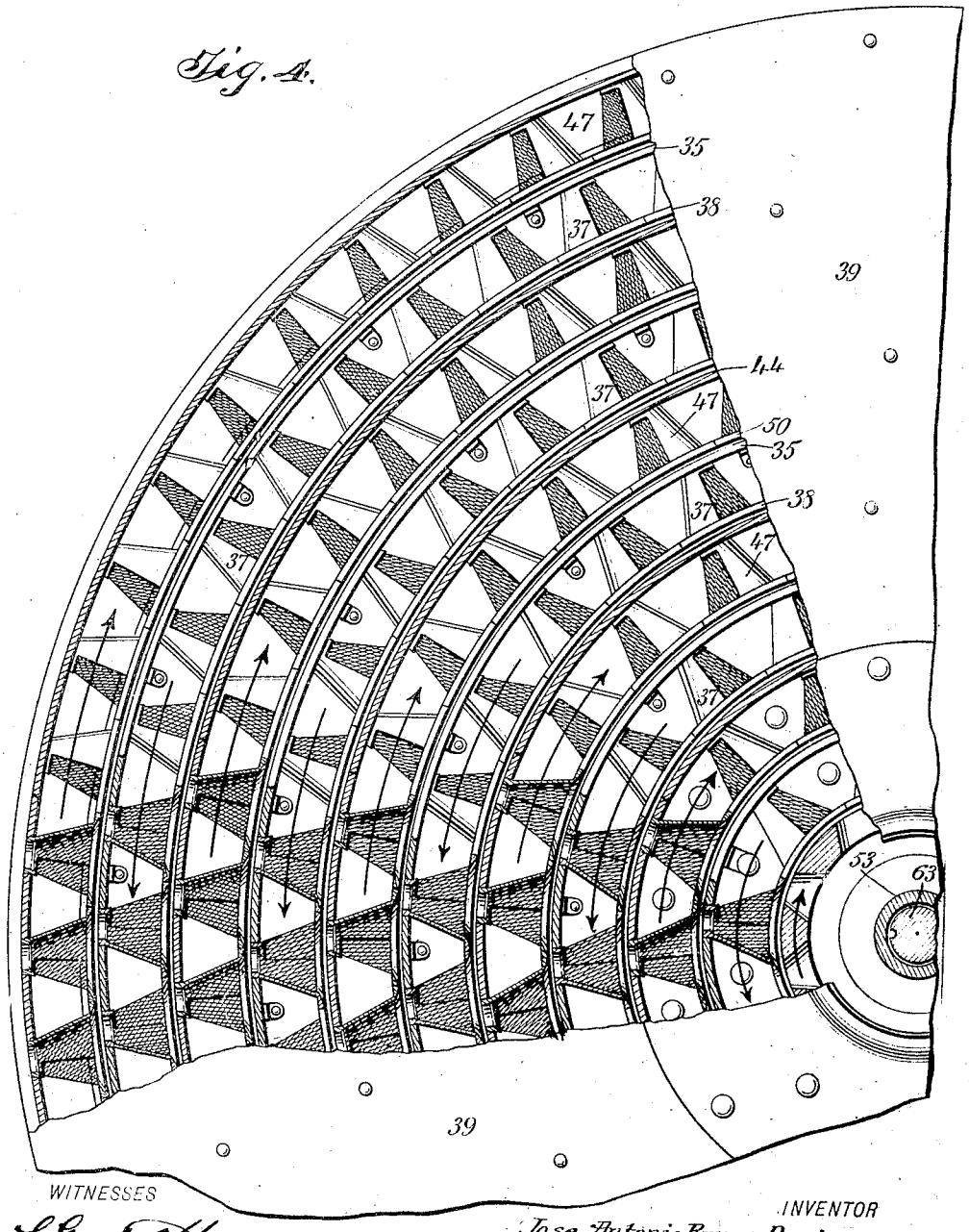
5 SHEETS—SHEET 4.

Fig. 4.



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5 SHEETS—SHEET 5.

Fig. 5.

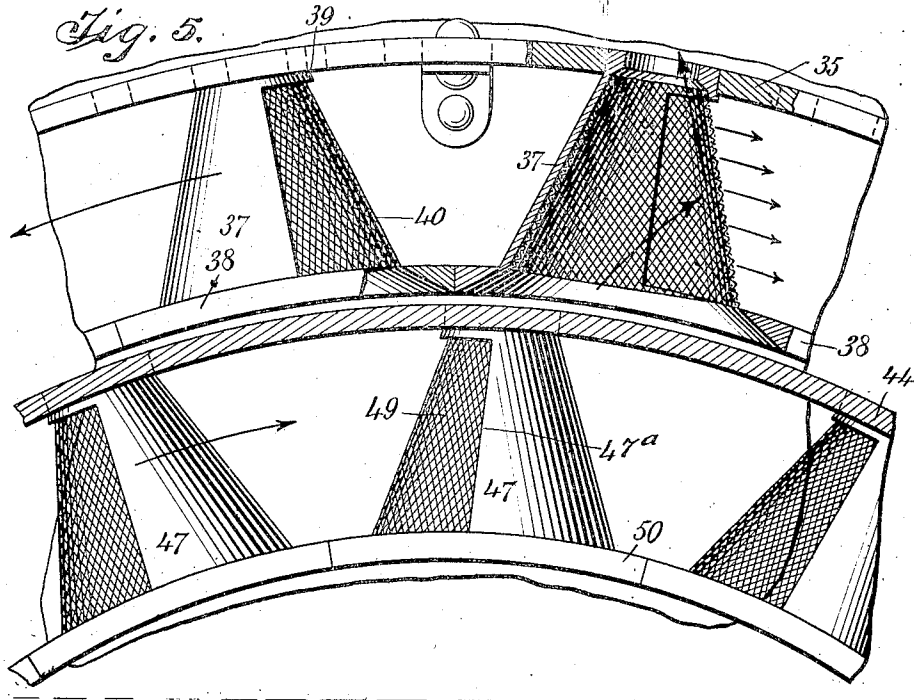
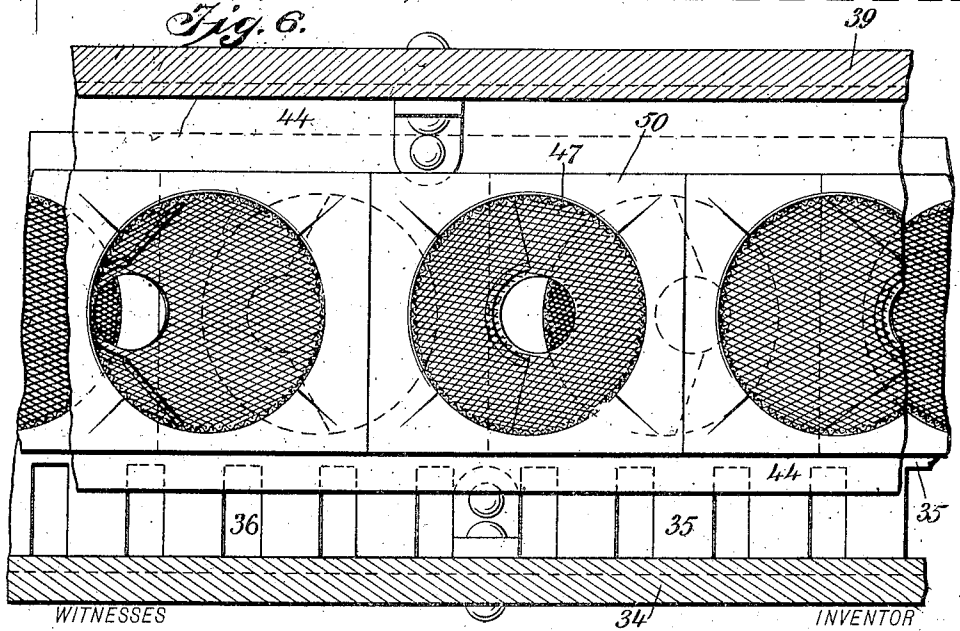


Fig. 6.



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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL SEPARATOR.

No. 926,859. Specification of Letters Patent. Patented July 6, 1909.

Application filed January 24, 1908. Serial No. 412,430.

To all whom it may concern:

Be it known that I, JOSÈ ANTONIO BRUNO DOMINGUEZ, a citizen of Porto Rico, and a resident of the district of Guayama, Porto Rico, have invented a new and Improved Centrifugal Separator, of which the following is a full, clear, and exact description.

My invention relates to centrifugal separators, admitting of general use but more particularly applicable to the separation of sugar and molasses from the crude product known as masse-cuite, or in other words, from the material received from the evaporators.

Among the several objects of my invention are the following: I, to render the separation continuous in the sense that the masse cuite is supplied continuously and the sugar and molasses are fed out of the machine continuously; II, to thoroughly baffle the masse cuite while subjecting it to the action of centrifugal force in conditions adapted to promote drainage; III, to avoid the necessity for excessive speeds, by frequently alternating the direction in which the rotary force is applied to obtain centrifugal action; IV, to cause the masse cuite to be transferred from one screen to another, the various succeeding screens having successively increased centrifugal action; V, to take advantage of the principle of inertia so as to cause the latter to exert pressure due to the sudden stoppage of the masse cuite; VI, to provide various improved details of construction admitting of general use in machines of this type.

Among the principles embodied in my machine is that of developing centrifugal force in a rapidly rotating body and that of causing such body to exert increased pressure, if its direction of motion is suddenly reversed.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a side elevation partly broken away, and showing the gearing for rotating the revoluble parts, and also showing the system of lubrication for this gearing; Fig. 2 is a plan view of the external casing, the discharge chute for the molasses, and one of the pipes used for lubricating certain movable parts; Fig. 3 is a fragmentary vertical section through the outer and inner casings, and the various sieves arranged in annular rows and moving in opposite directions; Fig. 4 is a fragmentary plan, partly in section, showing the concentric arrangement of the sieves in annular rows, the sieves of each row alternating in direction of rotation with the sieves of the next row; Fig. 5 is an enlarged fragmentary view showing the details of the sieves and their mountings, and also showing how one annular row of sieves turns in a direction opposite to that of another row of sieves; and Fig. 6 is a fragmentary section showing some of the sieves in elevation and disclosing how the same are mounted, this view also showing the slots whereby the molasses and other liquid substances make their escape.

An outer cylinder is shown at 7 and is bolted rigidly upon an annular casting 8 provided with feet 9 and with a hopper 10. The upper edge of the cylinder 7 is provided with an inwardly projecting flange 11. The parts thus described together constitute a stationary member which I designate as the outer casing. Mounted centrally within this outer casing (see Fig. 3) is an annular spider 12 provided with radially projecting braces 13 engaging the casing 8 and supporting the spider concentrically to the outer casing. An annular bottom piece 14 (see Fig. 3) is provided with walls 15, 16, the latter inclining inwardly, the piece and walls just mentioned together constituting an annular trough-like member which I designate as the inner casing and which is supported by brackets 18^a resting on the braces 13. Said casing is used for collecting the molasses, or other drainage, from the raw sugar, and is provided with a chute 17 whereby the products thus received are removed from the machine.

A bearing block 18, of hollow form, is provided with a flange 19 through which pass threaded bolts 20, the latter engaging the spider 12 so as to support the bearing block 18 from the spider. By turning the bolts 20 the height of the bearing block 18, relatively to the spider 12, may be varied or adjusted at will. The bearing block 18 is provided with a cylindrical portion 21 constituting a step bearing, this part being provided with an enlarged cylindrical portion 22. Mounted within the step bearing 21 is a step 23 secured rigidly in position by aid of

a key 24 and provided with a radially disposed channel 25. A revoluble journal 26 rests upon the bearing block 23 and is provided with a small vertically disposed channel 27.

Mounted within the step bearing 21, which has the form of a cup, is an annular packing 28 which encircles the lower end of the journal 26 so as to render the same as nearly oil-tight as practicable. The journal 26 is provided with a radially disposed passage 29, and is hollowed out at its upper end, so as to constitute a step bearing. An annular bearing block 31 is supported by the journal 26 and is provided with a radially disposed passage 32. This bearing block 31 is secured rigidly to the journal 26 by aid of a key 33. The upper portion of the journal 26 is spread out and bolted rigidly to a disk 34 which is thus rendered revoluble with the journal. Secured upon the disk 34 and extending upwardly therefrom are a number of rings 35 of metal each provided at its bottom with radially disposed slots 36. The liquids discharged by the upper rings 44 hereinafter described and those discharged by the lower rings 35 are mixed together and are driven out through the slots 36 in the rings 35, by the action of centrifugal force. These liquids, in passing outwardly through the slots 36, glide upon the surface of the lower disk 34, and after impinging against the inner surface of the ring 45 drop into the receptacle 14. A number of cones 37 are connected with each ring 35 and adapted to discharge material therethrough when subjected to the action of centrifugal force. The cones 37 are thus arranged in circular rows disposed concentrically. Parallel with each ring 35 is another ring 38 supported upon the cones 37 and revoluble with these cones and with the disk 34.

A revoluble disk 39 is bolted rigidly to a flange 40 which is integral with a hub 41, the latter being provided with an annular journal 42 resting upon the annular bearing block 31. Bolts 40^a are used for the purpose of connecting the disk 39 with the flange 40. The hub 41 is provided with apertures 43 of substantially conical form and is made hollow for the purpose of receiving material to be discharged into the cones 37 of the inner row, as hereinafter explained.

A number of rings 44 of metal are connected rigidly with the disk 39 and are revoluble therewith. These rings are plain and not provided with slots, but are smooth at their lower edges, and their upper and lower edges extend above and below the upper and lower edges of the rings 35. An outer ring 45, also of metal, is mounted near the outer peripheral edge of the disk 39 and is provided with strengthening bands 46. This ring 45 extends a little distance below the disk 34. A number of cones 47, similar to the cones 37 above described are mounted upon the respective rings 44, 45, and supported by these cones are rings 50, the latter being revoluble therewith and with the disk 39. Each cone 47 is provided with a mutilation 47^a and is fitted with a sieve 49 of conical form. The ring 50, as may be seen in Fig. 5, is made up of separate plates, each plate being connected with a cone 47. Brackets 51 are used for supporting the rings carried by the upper disk 39. Brackets 52 are similarly used for supporting the rings carried by the lower disk 34.

A tubular shaft 53 is connected rigidly with the hub 42 and is provided at its upper end with a bevel gear 54. The latter meshes with a bevel gear 55 mounted upon a stub shaft 56, this stub shaft being supported by a bearing 57. The bearing is carried by a hanger 59. Mounted rigidly upon the stub shaft 56 is a pulley 58 for supplying power to the movable parts. The hanger is supported from a horizontal beam 60. Meshing with the bevel gear 55 is a bevel gear 61 which is secured to a solid shaft 63 fitting into the tubular shaft 53, and having secured thereto, the journal 26 with which the lower disk 34 is connected. It will be evident that when the shaft 56 is rotated the gear 61 which is connected with one disk will be rotated in one direction, while the gear 54 which is connected with the other disk will be rotated in the opposite direction.

A force-feed pump is shown at 62 and is supported by a beam 60.

63 is a revoluble solid shaft extending entirely through the tubular shaft 53. The shaft 63 is provided with an oil passage 64 disposed axially in relation thereto, as indicated in Fig. 1. A pipe 63^a leads from the pump 62 to the shaft 63, being connected therewith by a stuffing box 64^a. A packing 65, having the form of an annular ring, encircles the solid shaft 63 and is fitted into the tubular shaft 53, as indicated in Fig. 1. The passage 64 in the solid shaft 63 communicates with a passage 66, so as to enable the lubricating liquid to move downwardly intermediate of the solid shaft 63 and tubular shaft 53.

A casing 67 incloses the bevel gears 54, 55, 61. This casing is provided with a bottom 68 connected with which is a pipe 69 leading upwardly and communicating with the pump 62 by aid of a pipe 70. A pipe 71 connects the upper portion 22 of the cup bearing 21 with the pipe 70, and thence with the pump 62. A passage 72 is provided in the shaft 63 (see Fig. 3) and a packing 73 encircles this shaft and engages the tubular shaft 53.

The operation of my device is as follows: Oil or other lubricating liquid is forced by the pump 62 downwardly through the pipe 63^a and into the passage 64 of the shaft 63. The

liquid thence passes downwardly through the passage 66 which is spaced intermediate of the solid shaft 63 and the tubular shaft 53, thence through passages 72, 25 and 27, to the pipe 71, being thence returned to the pump through pipe 70. Any excess of the lubricating liquid escaping within the casing 67 (see Fig. 1) passes upwardly through the pipe 69 to the pump, thus joining the liquid carried up by the pipe 71. The lubrication of the movable parts is thus made automatic and continuous. Power now being applied to the pulley 58, the bevel gears are thereby turned, and the disks 34 and 39 are rotated in opposite directions. The masse-cuite being fed continuously into the hub 41 is forced outwardly by centrifugal force. As the masse-cuite passes through the apertures 43, of substantially conical form, the centrifugal force at this point is comparatively weak. After passing through the apertures 43 the masse-cuite enters the inner row of cones 37, the direction of rotation of these cones being opposite to that of the hub 41, and the motion being somewhat faster. It may be noted in this connection that the centrifugal force does not separate the molasses from the sugar. The only office performed by the centrifugal force is to propel the masse-cuite so as to force it to jump from one cone to the next and to cause the molasses, when set free by impact of the masse cuite, to run out of the machine. What really causes the molasses to be set free is the impact of the masse cuite against the inside of the cones, this being due to the sudden baffling effect or abrupt change in the direction of the motion of the masse cuite as it jumps from one set of cones to the next. The idea is, as far as practicable, to knock each particle of masse cuite first in one direction and then in another direction. The force of impact thus exerted upon the masse cuite acts at right angles to the direction of centrifugal force and causes the molasses to go through the sieves in a direction substantially at right angles to the portions of the sieve where the impact takes place. Care should be exercised not to confound the impact effect just described with the ordinary centrifugal effect in machines heretofore employed. The liquid thus removed now passes downwardly and outwardly, passing through the various slots 36 and finally impinges against the ring 45, thence dropping downwardly and being drained off by the chute 17. The masse cuite passes from ring to ring in succession, and each succeeding ring reached by it has a higher speed than the other rings which have heretofore operated upon it. As it passes gradually outward from the center, it increases speed, its motion is reversed, and it leaves one set of cones and reaches another. The result is that the masse cuite is turned over and over, being thus thoroughly baffled, and any part of it containing any trace of molasses or other liquid, is enabled to discharge that portion, no matter where it was originally lodged in the mass. It will be noted that each successive impact of a given mass of masse cuite is progressively more violent than the impact preceding. The effect of increasing the strength of the successive impacts as the masse cuite moves from one set of sieves to the next is to cause the molasses to be forced out more and more at every successive change in the direction of motion. The sugar being relieved, to a great extent, of its molasses, is finally discharged through the ring 45 and impinges against the cylinder 7, thence dropping downwardly into the hopper 10, and piles up below the machine. There is only sufficient clearance between the rings to permit them to rotate freely, and the sugar passes directly from one cone to the other.

The amount of molasses left in the sugar may be regulated at will by controlling the speed of the disks. In doing this the force of the several impacts is also regulated. Any desired polarization can thus be obtained. If it be desired to obtain a maximum polarization by means of the washing process, water is thrown continuously into the apparatus along with the masse cuite. This increases the limpidity of the mixture, rendering the molasses more fluid and causing it to be expelled more thoroughly than would otherwise be the case.

To clean the apparatus, water is poured in continuously. This water follows the course of the molasses, and also the course of the sugar. The result is that all parts accessible to the sugar and to the molasses are thoroughly cleaned by the water. The cones may be easily removed, as may be seen from Fig. 5.

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

1. The combination of a plurality of sieves disposed concentrically, and means for rotating said sieves in opposite directions for the purpose of baffling a material to be operated upon by said sieves.

2. The combination of a pair of revoluble members adapted to rotate in opposite directions, means for actuating said revoluble members, a plurality of sieves mounted upon one of said revoluble members and adapted to operate upon a material and to discharge said material, and a plurality of sieves mounted upon the other of said revoluble members for the purpose of receiving said material discharged from the other sieves.

3. The combination of a plurality of revoluble members, sieves of conical form supported thereby and revoluble therewith, another revoluble member, sieves of conical form mounted thereupon and adapted to receive a material discharged from said first-

mentioned sieves, and means for actuating said revoluble members in opposite directions.

4. The combination of a revoluble member, a substantially conical member mounted thereupon and provided with a mutilation, a sieve of substantially conical form mounted within said substantially conical member, and means for actuating said revoluble member.

5. In a device of the class described, a plurality of members carrying conical sieves, said sieves being arranged in circular form, the sieves of one member concentric with the sieves of the other and means for rotating said members in opposite directions.

6. The combination of a plurality of disks, means for rotating the same in opposite directions, a plurality of sieves mounted upon one of said disks, a plurality of sieves mounted upon the other of said disks, the sieves upon each disk being arranged in circular rows, each row of sieves upon one disk being concentric with the row of sieves upon the other disk, and means for turning said disks in opposite directions.

7. In a separator, a plurality of annular series of sieves arranged in concentric relation, means for feeding masse cuite or the like to the inner sieve, and means for rotating said sieves in opposite directions.

8. In a separator, a plurality of annular series of conical sieves, the series being concentric and the sieves arranged radially with their bases inward, and means for rotating the sieves in opposite directions.

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

JOSÈ ANTONIO BRUNO DOMINGUEZ.

Witnesses:

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RAMÓN COLOMER.