S. J. VERNSTEN.

DRIER.

APPLICATION FILED MAR. 18, 1909.

944,707.

Patented Dec. 28, 1909.

7 SHEETS—SHEET 1.

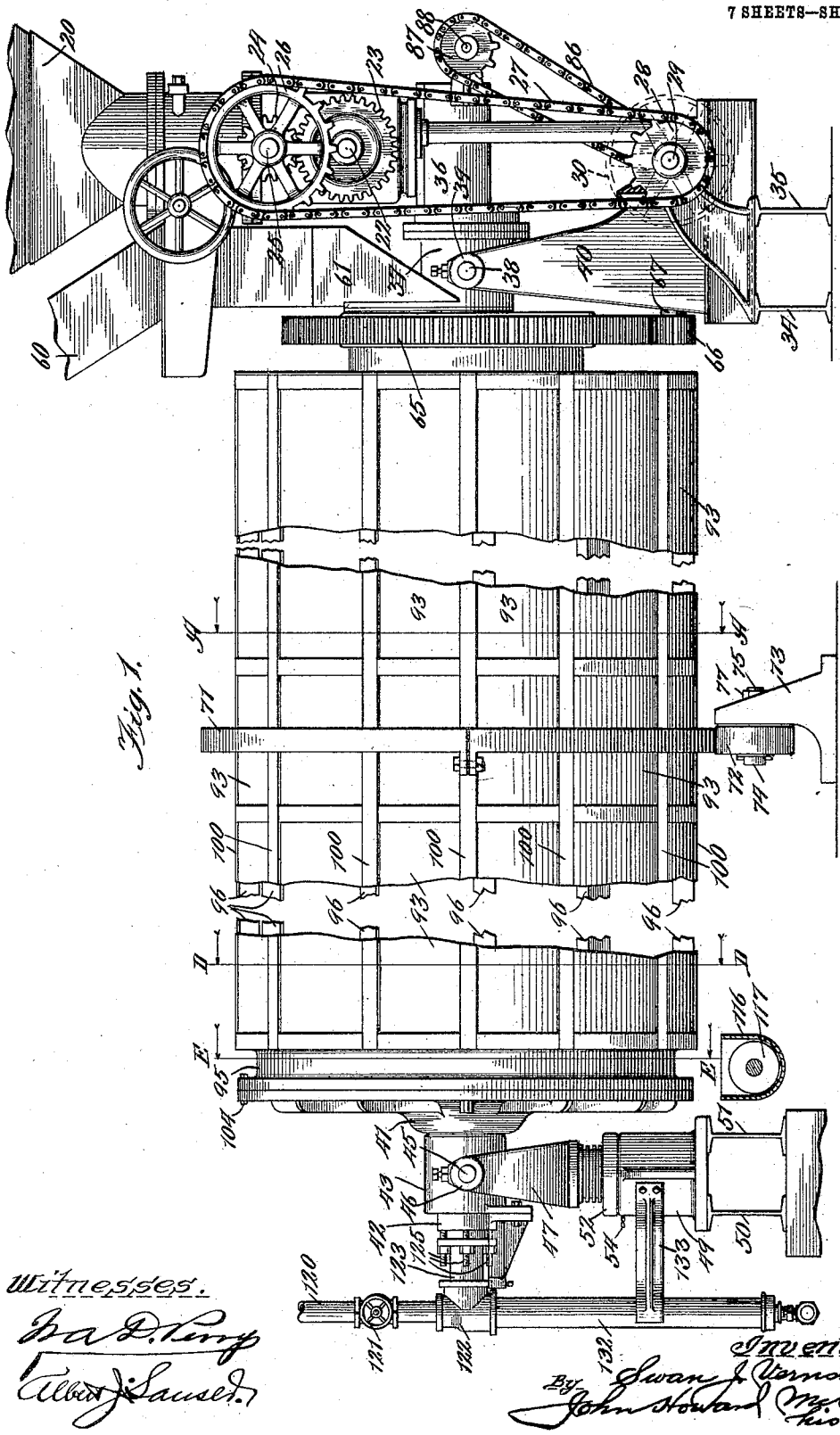

Fig. 1.

Witnesses.

Albert J. Sauseda

Inventor:

By Swan J. Vernsten

John Howard McElroy

his Attorney

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7 SHEETS—SHEET 2.

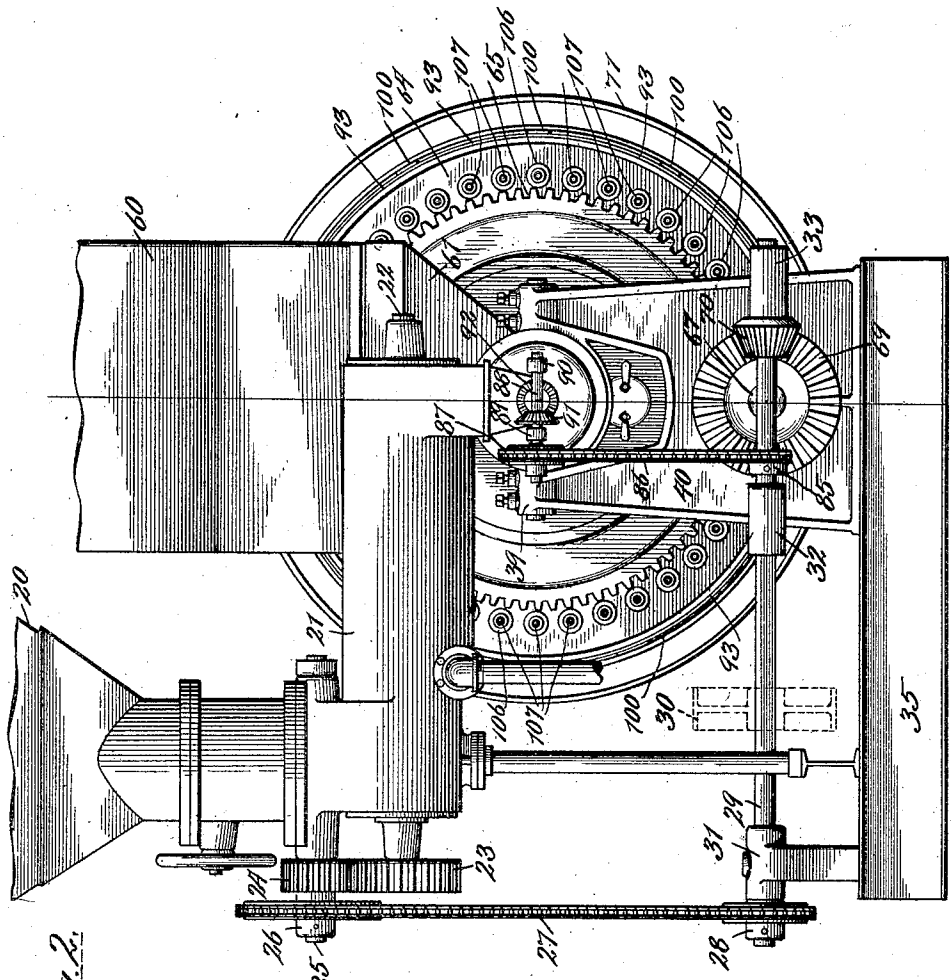

Fig. 2.

Witnesses:

Inventor:

Swan J. Vernsten,

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7 SHEETS—SHEET 3.

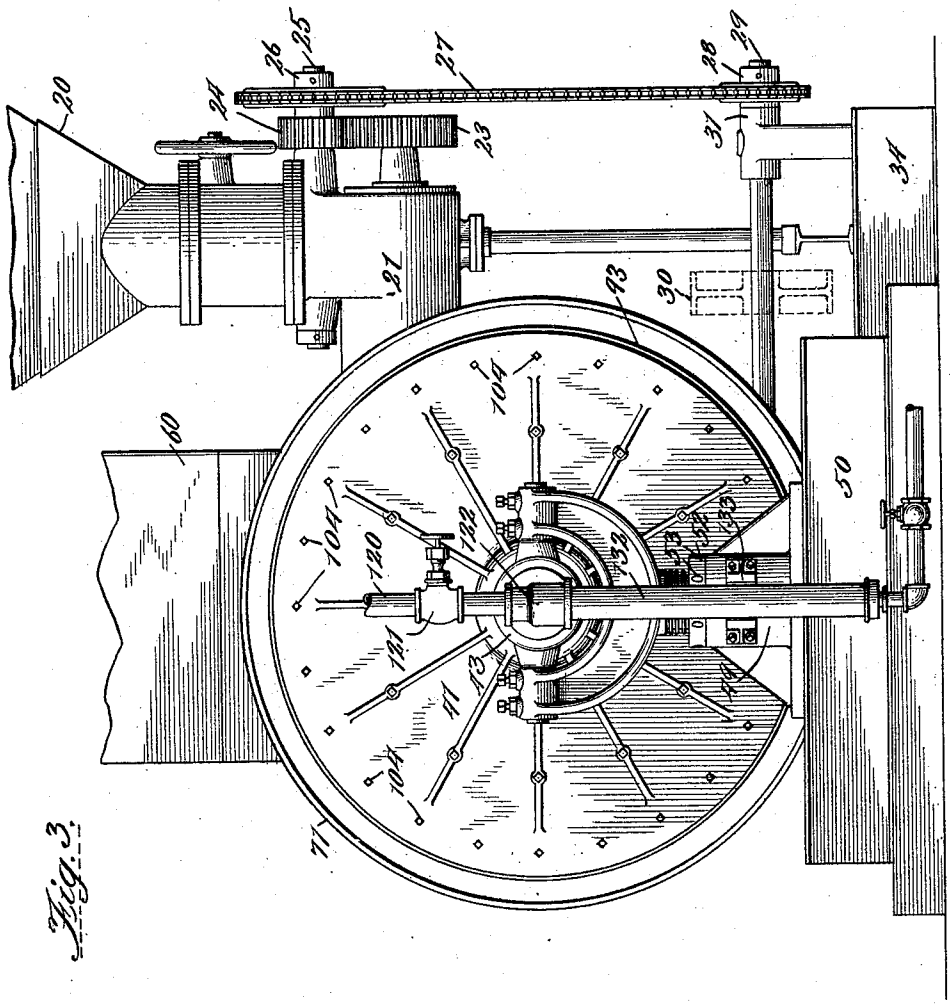

Fig. 3.

Witnesses:

Inventor:

Swan J. Vernsten

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7 SHEETS—SHEET 4.

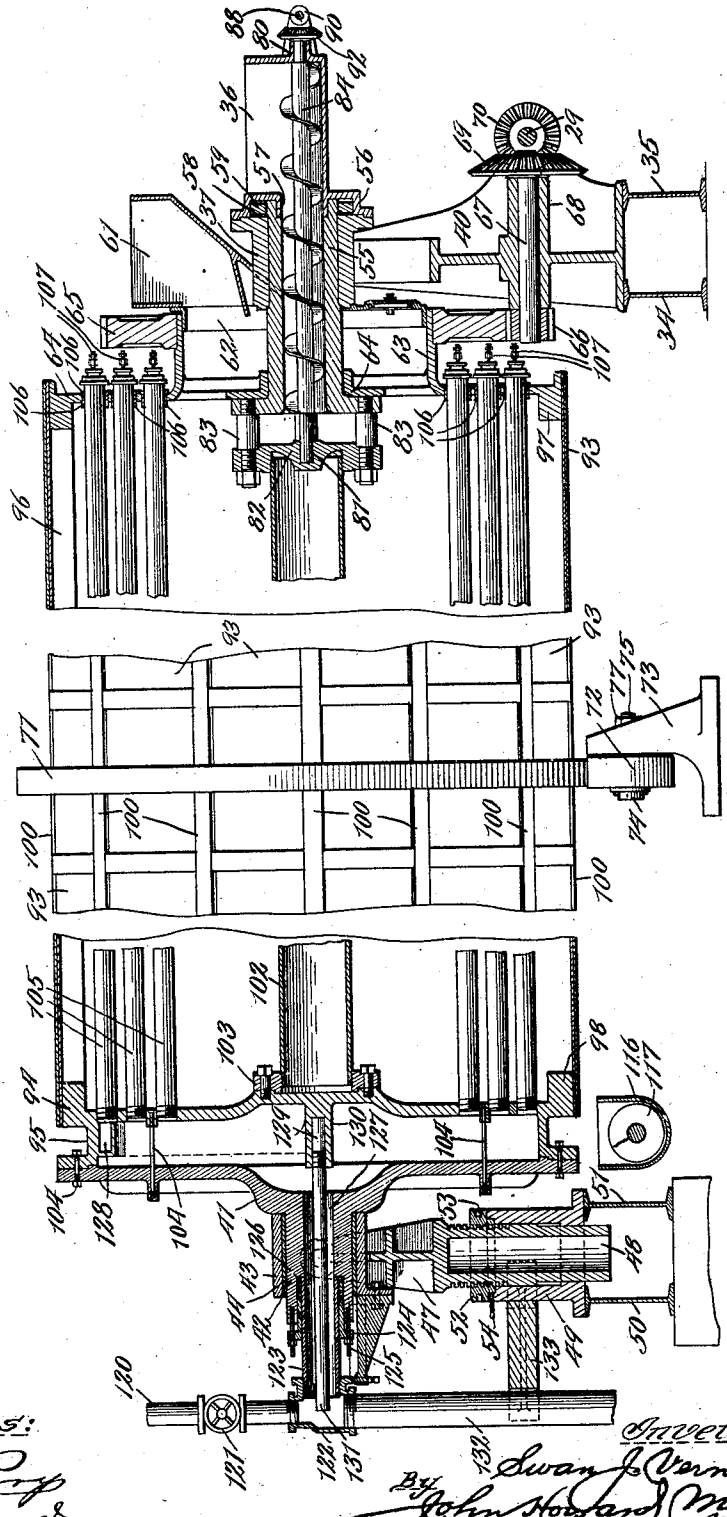

Fig. 4.

Witnesses:

Inventor:

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By John Howard McElroy

Atty.

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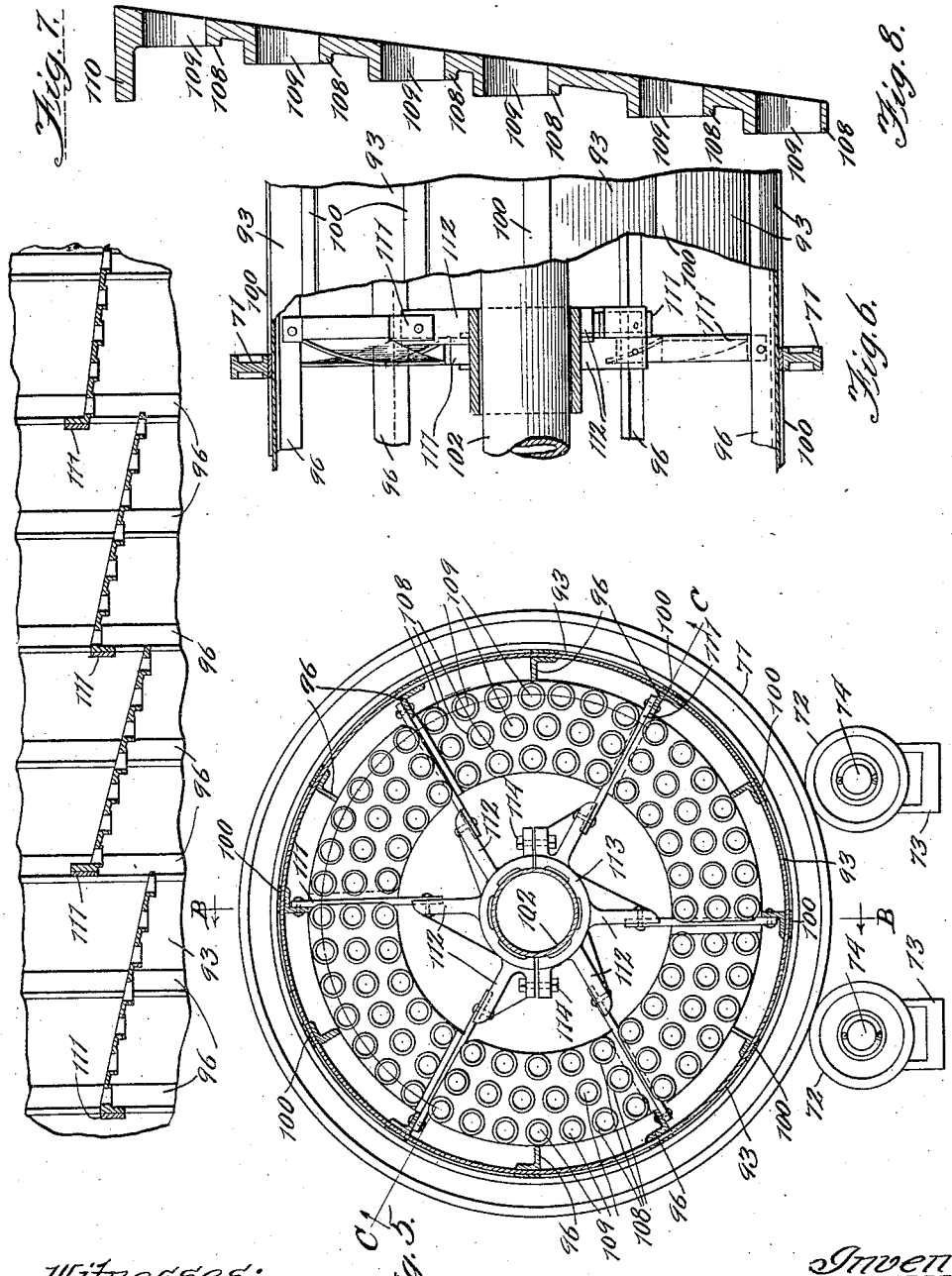
7 SHEETS—SHEET 5.



Witnesses:

Inventor:

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7 SHEETS—SHEET 6.

Fig. 9.

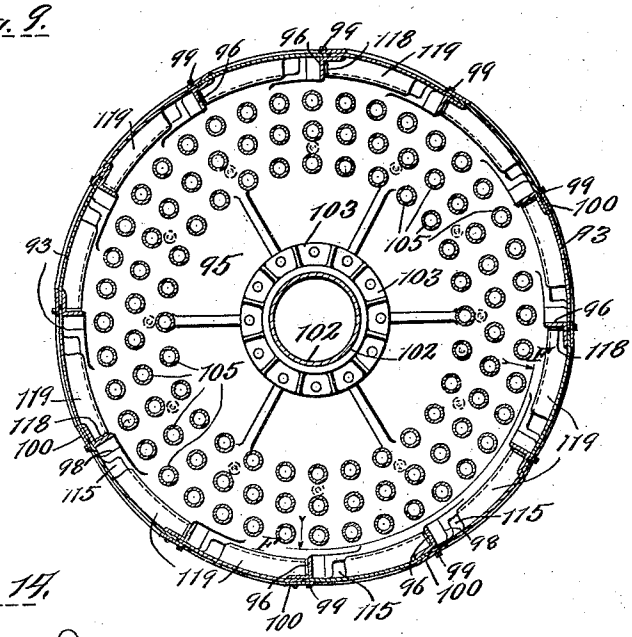


Fig. 14.

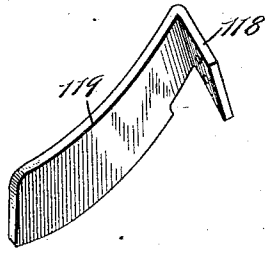


Fig. 15.

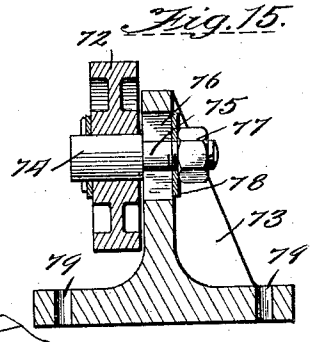
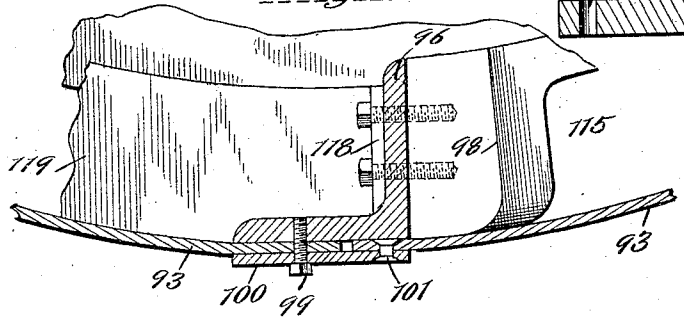


Fig. 13.



Witnesses:

Ira D. Perry

Albert J. Sauer Jr.

Inventor:

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his Atty.

S. J. VERNSTEN.

DRIER.

APPLICATION FILED MAR. 18, 1909.

944,707.

Patented Dec. 28, 1909.

7 SHEETS—SHEET 7.

Fig. 10.

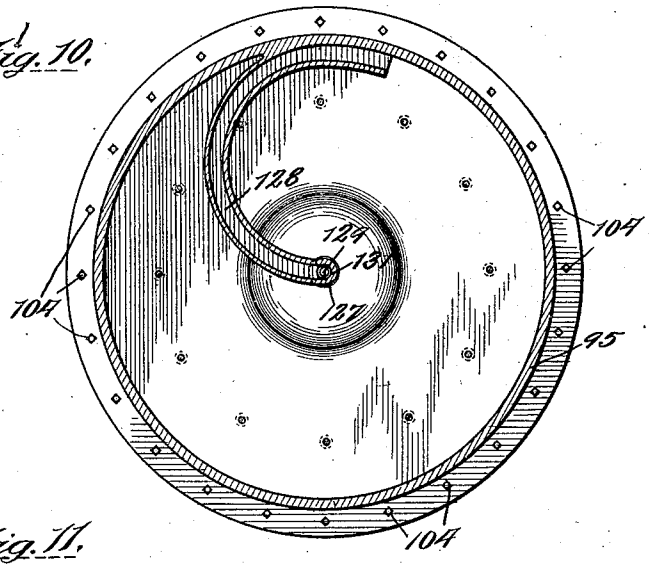


Fig. 11.

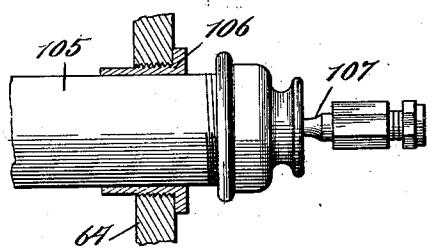
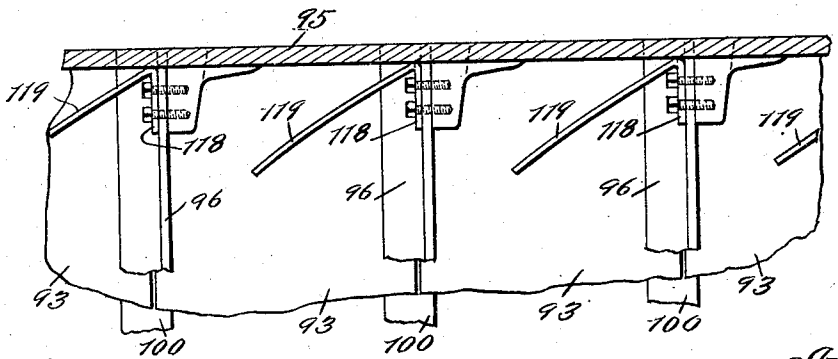


Fig. 12.



Witnesses:

Jas. D. Perry

Albert J. Sawtell.

Inventor:

Swan J. Vernsten,

By John Howard McElroy

his Atty.

UNITED STATES PATENT OFFICE.

SWAN J. VERNSTEN, OF CHICAGO, ILLINOIS.

DRIER.

944,707. Specification of Letters Patent. **Patented Dec. 28, 1909.**

Application filed March 18, 1909. Serial No. 484,211.

To all whom it may concern:

Be it known that I, SWAN J. VERNSTEN, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Driers, of which the following is a full, clear, and exact specification.

My invention is concerned with a novel construction in driers of the rotary steam type intended to dry brewery grains, distillery mash, and wet products of a similar character, which must be dried rapidly and economically in order to render them commercially valuable, and it is intended to produce a drier of the class described which shall not only be economical in its operation and durable and satisfactory, but which shall be capable of being manufactured more cheaply than similar devices having the same capacity.

To this end, my invention consists in certain novel combinations of elements, which will be described in detail in the specification and particularly pointed out in the claims.

To illustrate my invention, I annex hereto seven sheets of drawings, in which the same reference characters are used to designate identical parts in all the figures, of which,—

Figure 1 is a side elevation of the complete apparatus with a portion of the body of the drier broken out on each side of the center thereof; Fig. 2 is an elevation of the right-hand end of the machine, as seen in Fig. 1; Fig. 3 is a similar elevation of the left-hand end of the machine; Fig. 4 is a view similar to Fig. 1, but with the end portions in central vertical section; Fig. 5 is a vertical section on the line A—A of Fig. 1; Fig. 6 is a detail, partly in section, on the line B—B of Fig. 5; Fig. 7 is an extended plan view of a portion of the machine as it would appear in section on line C—C of Fig. 5 if the section were rolled out into a straight line; Fig. 8 is a sectional view on an enlarged scale of one of the central supporting wings; Fig. 9 is a section on the line D—D of Fig. 1; Fig. 10 is a similar view on the line E—E of Fig. 1; Fig. 11 is an enlarged detail showing one of the hot-air valves in the end of one of the pipes; Fig. 12 is an extended plan view as it would appear in section on line F—F of Fig. 9 if the section were straightened out; Fig. 13 is an enlarged view of a portion of Fig. 9; Fig. 14 is a perspective view of one of the deflecting wings shown in Fig. 12; and Fig. 15 is a detail showing the adjustment of one of the supporting rollers.

In its general construction, the drier of my invention may be briefly described as a cylinder provided with means for rotating it and adapted to receive grain at one end, which is carried by the rotation of the cylinder to the other end, which is preferably lower than the receiving end, and there discharged. The heat for drying the grain in its passage through the cylinder is furnished by a series of steam pipes extending parallel to the axis of the cylinder and supplied with steam under any desired pressure from the discharging end of the cylinder.

In connection with the drier of my present invention, I preferably use a "squeezer" to press out some of the water before it enters the cylinder, and I have illustrated such a "squeezer" as is shown in my Patent No. 837,010, dated November 27, 1906. This squeezer is seen in elevation in Figs. 1, 2 and 3, where will be seen the receiving hopper 20 through which the grain is forced into the cylindrical body 21 of the squeezer, where the water is forced out by the action of a screw of diminishing pitch secured on the shaft 22 journaled in the ends of the cylinder 21. The shaft 22 has secured on the left-hand end the spur gear 23 meshing with and driven by the pinion 24 secured on the shaft 25 journaled in suitable bearings in the squeezer and provided with the sprocket wheel 26 over which runs the sprocket chain 27, which, through the medium of the sprocket wheel 28 secured on the shaft 29 and the driving pulley 30 secured on the shaft 29, drives the squeezer. The shaft 29 is journaled in suitable bearings 31, 32 and 33 supported by brackets from the transverse I beams 34 and 35 by which that end of the machine is supported. As seen in Figs. 2 and 4, the discharge end of the squeezer opens into the hopper 36 which is supported from the bearing sleeve 37, which sleeve is provided with the trunnions 38 journaled in bearings 39 on the upper end of the supporting bracket 40, which is seen in side and end elevations in Figs. 1 and 2. This trunnion support for the bearing 37 is, of course, provided so that the other end of the drying cylinder may be raised or lowered, as may be necessary to secure the proper rate of feed of different materials

through the apparatus. As seen in Fig. 4, the casting 41 which constitutes the other end of the machine is provided with the hub 42 which rotates in the bearing sleeve 43, a sleeve of graphite 44 being preferably interposed for purposes of lubrication. The sleeve or housing 43, as seen in Fig. 1, is provided with trunnions 45, which are journaled in bearings 46 provided in the yoke 47, the lower end of which has the sleeve 48 which is adapted to slide in the stationary cylinder 49, supported on the transverse I beams 50 and 51. A portion of the upper part of this sleeve 48 is threaded, and a nut 52 coöperates with this threaded portion and is provided with apertures 53 by which the nut can be turned, so that by turning the nut 53 the trunnions supporting that end of the machine can be raised or lowered as may be desired. When it has been given the desired adjustment, a set screw 54 threaded through the upper edge of the cylinder 49 and against the inner side of the nut 52 is tightened up to secure the nut against possible rotation and disarrangement of the height of that end of the cylinder.

Turning now to the receiving end of the apparatus, the sleeve or housing 37 has journaled therein the cylindrical hub 55 which supports that end of the cylinder. The hopper 36 is provided at its end with a collar 56 which coöperates with the housing 37 and has the inwardly-extending flange 57 coöperating with the end of the rotating hub 55. A disk of graphite 58 is preferably interposed between the end of the housing 37 and a steel collar 59 threaded onto the end of the hub 55 to furnish a suitable bearing to take up the thrust on the hub. The vapor stack 60 is attached to the casting 61 which is secured to the annulus 62 which projects into the cylindrical portion 63 of the end casting 64 of the cylinder, it being, of course, understood that the casting 61 and the ring 62 are stationary, while the cylinder 63 and the end 64 rotate. The cylinder 63 has secured thereto the spur gear wheel 65, which meshes with and is driven by the pinion 66 secured on the shaft 67 journaled in the bearings 68 formed in the casting 40. The shaft 67 has secured on its outer end the bevel gear wheel 69, which meshes with and is driven by the spur gear pinion 70 secured on the shaft 29, so that by the mechanism described the cylinder is rotated at a slow rate of speed in the bearings provided at the two ends. As these cylinders are usually of considerable length, I preferably locate at one or more suitable points in their length the rings 71 secured to their exterior in any suitable manner and running on the rollers 72 which are adjustably supported in the brackets 73, preferably by the mechanism shown in Fig. 15, where it will be seen that the roller 72 is journaled on the stud 74, which has the reduced portion 75 extending through the vertical slot 76 in the casting 73, so that the position of the roller can be adjusted up and down, and secured in any desired position of adjustment by the nut 77 threaded on the end of the portion 75 and bearing against the washer 78. The brackets 73 are of course provided with suitable apertures 79 by which they can be secured, by bolts or otherwise, in any desired position on the supporting floor.

Journaled in a bearing 80 formed in the end of the hopper 36 and in a bearing 81 formed in the casting 82, which is supported from the sleeve 55 by the pins 83, is a screw conveyer 84 which is driven from the shaft 29 through the medium of the sprocket pinion 85, the sprocket chain 86, and the sprocket wheel 87 secured on the shaft 88 journaled in bearings 89 and 90 supported from the end of the hopper 36. The shaft 88 has secured thereon the miter gear 91 meshing with the miter gear 92 on the end of the worm-screw shaft 84, so that as the cylinder is rotated the material passing through the squeezer will be carried by the screw conveyer 84 into the interior of the cylinder, whence it will drop between the pins 83 and onto the bottom of the cylinder, which, of course, is formed by the covering of sheet steel plates 93 which are fastened at one end to the periphery of the head 84, and at the other end to the periphery 94 of the portion 95 of the head at the discharge end. The heads are connected at their peripheries at suitable intervals by strips of angle iron 96, which, as best seen in Fig. 13, are bolted to the lugs 97 on the head 64 and to the lugs 98 on the head 95. To the horizontal web of the angle irons 96 the plates 93 are bolted or screwed, as by the screw 99 which passes into the flange of the angle iron 96, not only through the plate 93, but through the overlapping flange 100, which is riveted at suitable intervals, as seen at 101, to the edges of the adjacent plates 93. The body of the cylinder is further strengthened by the hollow tube 102 which is threaded at one end into a suitable recess formed in the casting or spider 82, while at the other end it is threaded into the annulus 103 which is bolted onto the center of the head 95 in a manner which will be readily apparent.

The heads 41 and 95 are bolted together, as by the bolts 104, and it will be seen that they are so shaped as to form a steam cylinder between the two heads, and steam admitted to this chamber passes into the steam pipes 105 which have their open ends threaded into the head 95, while their other ends are passed through the bearing sleeves 106 in the head 64. As best seen in Fig. 11, these pipes 105 have their ends outside of the cylinder closed by the hot-air valves 107,

which may be of any suitable construction adapted to open automatically when the pipes become cold and to close automatically when they become hot. It will be understood that the pipes 105 are free to slide in the sleeves 106, so that when they are heated up and elongated by the admission of steam they can expand without any danger of fracturing either themselves or the cylinder.

Where the cylinder is of considerable length, as is preferable, I locate at one or more points in its length a series of supporting flanges 108, which are preferably castings provided with circular recesses 109 to permit the passage of the steam pipes, and with the flanges 110 by which they are bolted to the arms 111 which extend between the alternate angle irons 96 and the arms 112 of the spider 113, which is made up of the two hub portions and the radial arms which are adapted to be clamped on the pipe 102, as by the bolts 114. As it is necessary for the material passing the length of the cylinder to pass these supporting members 108, I incline the bodies thereof to the flanges 110 at such an angle that a space is left between the free end of each of the members and the flange end of the adjacent member, and the flanges are directed so that as the cylinder is rotated in a certain direction the tendency is for the grain to be carried through the openings between the adjacent members. I preferably stagger the arms 112 and arrange the flanges 110 pointing alternately in opposite directions, as seen in Fig. 7. As the supporting members 108 are shown in Fig. 6, the apertures 109 are omitted, as they would not show up well on the drawings on the small scale of the figures. When the grain reaches the discharge end, it escapes through the head 95 which is provided with the lugs 98, which extend out from the body of the head 95 far enough to form the support for the angle irons 96, and between the lugs 98 are the recesses indicated at 115 in Fig. 13, and through these recesses the grain falls into the conveyer trough 116, which is preferably provided with a screw conveyer 117 to carry the grain to any desired destination. To aid in directing the grain to the recesses 115, I preferably bolt to the angle irons 96 the flanges 118 of the deflector plates 119, which, as best seen in Fig. 12, extend inward into the cylinder in such a direction and at such an angle that as the cylinder turns in its intended direction, the plates guide the grain which is arriving at that end to the recesses 115, through which it is discharged into the conveyer trough.

To supply steam to the pipes, I provide the steam pipe 120, which has the valve 121 located therein, and which opens into the joint 122, from the side of which extends the pipe 123 which leads into the hub 42 of the head 41. A packing gland 124 surrounding the pipe 123, and secured to the hub 42 by the bolts 125, serves as a means for securing the packing 126 in place so that the steam passing through the pipe 123 will not escape to the atmosphere, and will pass under full pressure through the passage 127 in the hub 42 into the steam chamber formed between the heads 41 and 95. To take care of the water of condensation which runs out from the pipes into the bottom of this steam chamber, I form in said chamber, preferably by casting it onto the head 95, a spiral passage 128, which leads from the periphery of the head 95 to the opening 129 in the projection 130 at the center of the head 95. A pipe 131 screwed into the aperture 129 and extending into the connection 122 serves to carry the water which is scooped up as the head revolves and carried to the center of the head into the pipe 132, which is screwed into the bottom of the union 122 and extends downward and is connected to a suitable steam trap, so that the water of condensation can be discharged therefrom without permitting the steam to escape. To hold the pipe 132 in place despite the variations in the height of that end of the machine, I preferably secure the supporting arm 133 to the cylinder 49 and extend the pipe 132 through the fork of the support. To hold up the connection 122 and keep the pipe 123 true in the gland 124, I secure the arm or bracket 134 to the housing 43, and thread the screw 135 through the outer end thereof up against the connection 122.

The operation of my improved apparatus will be readily apparent, as it is evident that when power is applied to the belt wheel 30, the cylinder will be slowly rotated in a certain direction, and the squeezer will be operated to squeeze the grain and discharge it into the hopper 36, whence it is carried by the worm shaft 84 into the interior of the cylinder, along the bottom of which it passes, coming in intimate contact with the pipes 105, which of course are heated to any desired degree by steam under pressure. By the time the discharge end of the cylinder is reached, the grain can be dried to any extent which may be desired.

While I have shown and described my invention as embodied in the form which I at present consider best adapted to carry out its purposes, it will be understood that it is capable of modifications, and that I do not desire to be limited in the interpretation of the following claims except as may be necessitated by the state of the prior art.

What I claim as new, and desire to secure by Letters Patent of the United States, is:

1. In a drier, the combination with a cylinder composed of two heads and a shell connecting them, and means for rotating it, of steam pipes secured to one head and extending through the shell, sleeves in the other

head, through which the pipes project and in which they are free to move, means for supplying steam to the interior of the pipes through the head to which they are secured, and valves at the other end of said pipes.

2. In a drier, the combination with a cylinder composed of the two heads and the intermediate supporting disk and the shell supported thereby, and means for rotating it, of the steam pipes extending through said shell secured to one head and passing through the intermediate support and the other head, and means for supplying steam to the interior of the pipes through the head to which they are secured, said intermediate support comprising the pipe supporting sections supported from one end at an angle to the axis of the shell so as to permit the material to pass between said sections.

3. In a drier, the combination of a cylinder composed of the two heads and intermediate support, a central shaft connecting the heads, the shell likewise connecting said heads and the intermediate support, said intermediate support being made up of a spider secured on said shaft, bars connecting the arms of the spider and the periphery of the shell, and the perforated plates secured to the bars at one end and having the bodies thereof extending helically to permit the passage of the material.

4. In a drier, the combination of a cylinder composed of the two heads and intermediate support, a central shaft connecting the heads, the shell likewise connecting said heads and the intermediate support, said intermediate support being made up of a spider secured on said shaft, bars connecting the arms of the spider and the periphery of the shell, and the perforated plates secured to the bars at one end and having the bodies thereof extending helically to permit the passage of the material, and the plurality of steam pipes secured to one head and extending through the perforated plates and the other head, substantially as described.

5. In a drier, a hollow cylindrical shell, a head closing one end having supports for steam pipes near its periphery, a large annular flange projecting outward just within the boundary of the steam pipes supports, a hollow journal at the center of the head, a vapor stack opening into and closing the annular flange, and means for introducing material through the hollow journal.

6. In a drier, a hollow cylindrical shell, a head closing one end having supports for steam pipes near its periphery, a large annular flange projecting outward just within the boundary of the steam pipes supports, a hollow journal at the center of the head, a vapor stack opening into and closing the annular flange, and means for introducing material through the hollow journal consisting of a screw conveyer extending through said journal, and means for rotating the conveyer.

7. In a drier, a hollow cylindrical shell, a head closing one end having supports for steam pipes near its periphery, a large annular flange projecting outward just within the boundary of the steam pipe supports, a hollow journal at the center of the head, a gear wheel secured to the exterior of the annular flange, a driving pinion meshing therewith, a vapor stack opening into and closing the angular flange, and means for introducing material through the hollow journal.

8. In a drier, the combination with a cylinder having a hollow journal at its receiving end, a gear wheel secured to the end outside of the journal, a driving pinion meshing with the wheel, a screw conveyer in the hollow journal, a driving shaft, and connections from said shaft to the driving pinion and to the screw conveyer to drive them at the proper relative speeds, consisting of a bevel pinion on the driving shaft meshing with a bevel gear wheel secured to the driving pinion, a counter shaft connected to the driving shaft by a sprocket chain and gears, and miter gears connecting the counter shaft and the screw conveyer.

9. In a drier, the combination with a cylinder having a hollow journal at its receiving end, a gear wheel secured to the end outside of the journal, a driving pinion meshing with the wheel, a screw conveyer in the hollow journal, a squeezer discharging into the screw conveyer, a driving shaft, and connections from said shaft to the driving pinion, the squeezer, and to the screw conveyer, to drive them at the proper relative speeds.

10. In a drier, the combination with a cylindrical shell having journals at each end, of the bearing housings having the trunnions, and bearing ears for said trunnions at each end, the bearing ears at one of the ends being vertically adjustable for the purpose described.

11. In a drier, the combination with a cylindrical shell having journals at each end and provided with steam pipes extending through the length thereof, of the bearing housings having the trunnions, and bearing ears for said trunnions at each end, the bearing ears at one of the ends being vertically adjustable for the purpose described, and the journal at one end being hollow to permit the passage therethrough of the material to be dried, and at the other end to permit the introduction of steam and the withdrawal of water of condensation.

12. In a drier, the combination with a cylindrical shell having journals at each end, of bearing housings having trunnions, bearing ears for said trunnions at each end, and means for adjusting the vertical position of the bearing ears at one end, said means comprising a cylindrical standard, a yoke carry-

ing the bearing ears and having a portion of its cylindrical lower end threaded and extending into the standard, and a nut resting on the standard and coöperating with the threaded cylindrical lower end of the yoke.

13. In a drier, the combination with the heads journaled in suitable bearings, of a central shaft connecting the heads, steam pipes connecting the heads toward their peripheries, longitudinal ribs connecting the heads at their peripheries, and cover plates secured to the ribs and the plates.

14. In a drier, the combination with the heads journaled in suitable bearings, of steam pipes connecting the heads toward their peripheries, longitudinal ribs connecting the heads at their peripheries, and cover plates secured to the ribs and the heads.

15. In a drier, the combination with the heads journaled in suitable bearings, of a central shaft connecting the heads, a central supporting mechanism secured to the central shaft, steam pipes connecting the heads and passing through said central supporting mechanism, longitudinal ribs connecting the heads at their peripheries, and cover plates secured to the ribs and the heads.

16. In a drier, the combination with a head containing a steam chamber and journaled in suitable bearings, of an opposed head journaled in suitable bearings and adapted to receive the material to be dried through its bearing, a shell connecting the heads, and steam pipes projecting into the steam chamber and extending the length of the shell and projecting through the receiving head.

17. In a drier, the combination with a head containing a steam chamber and journaled in suitable bearings, of an opposed head journaled in suitable bearings and adapted to receive the material to be dried through its bearing, a shell connecting the heads, and steam pipes projecting into the steam chamber and extending the length of the shell and projecting through the receiving head and provided with valves for the purpose described.

18. In a drier, the combination with a steam chamber head, of steam pipes opening therein, a central shaft secured thereto, a receiving head having a hollow journal, a shell connecting the heads, a disk receiving the other end of the central shaft located within the shell and opposite the hollow journal, pins connecting the disk and hollow journal, and a screw conveyer in the hollow journal having one end journaled in the disk.

19. In a drier, the combination with the two heads journaled in suitable bearings, and a shell connecting the same, one of said heads receiving material, and the other having apertures near its periphery for discharging the material, and helically directed wings connected to said discharge head to direct the material through the apertures.

20. In a drier, a head having peripheral lugs extending beyond the body thereof, bars connected to the lugs, cover plates connected to the bars and to the lugs, and guiding plates connected to the lugs for the purpose described.

21. In a drier, the combination with the steam chamber head having the hollow journal, of a housing for the journal, a spiral passage in the head to carry water of condensation in the chamber to the center of the head, a pipe forming a continuation of the hollow journal, a steam pipe and a water discharge pipe connected to said first mentioned pipe, and a smaller pipe connected to the spiral passage at the center of the head and extending to the water discharge pipe.

22. In a drier, the combination with the steam chamber head having the hollow journal, of a housing for the journal, a spiral passage in the head to carry water of condensation in the chamber to the center of the head, a pipe forming a continuation of the hollow journal, a steam pipe, a water discharge pipe connected to said first mentioned pipe, a smaller pipe connected to the spiral passage at the center of the head and extending through the water discharge pipe, a bracket arm extending from the hollow journal beneath the first mentioned pipe, and a set screw in the end of the bracket cooperating with said first mentioned pipe to support the same.

In witness whereof, I have hereunto set my hand and affixed my seal, this nineteenth day of February, A. D. 1909.

SWAN J. VERNSTEN. [L. S.]

Witnesses:
JOHN HOWARD MCELROY,
F. E. BROM.