

No. 829,758.

PATENTED AUG. 28, 1906.

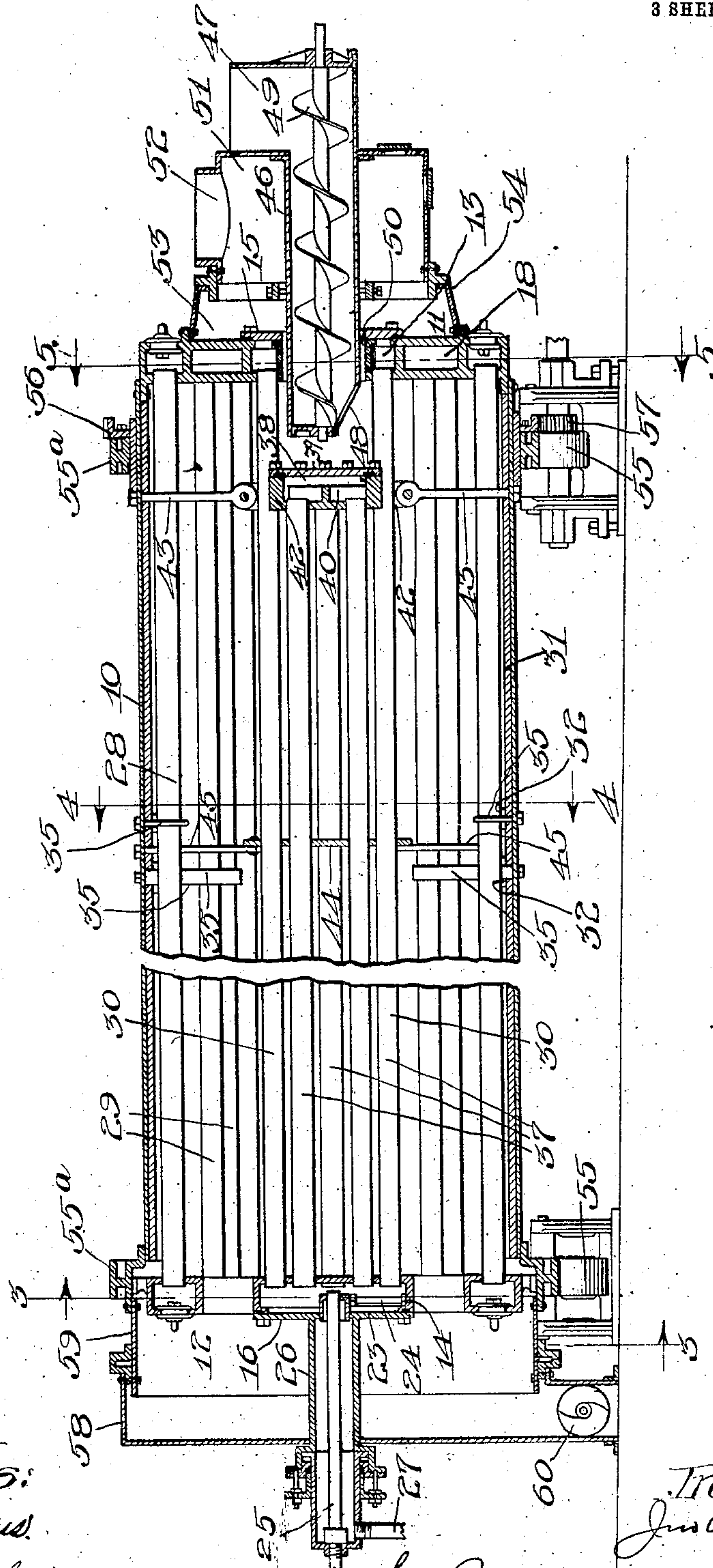
J. W. BILES.

ROTARY STEAM DRIER.

APPLICATION FILED MAR. 23, 1906.

3 SHEETS—SHEET 1.

Fig. 1.



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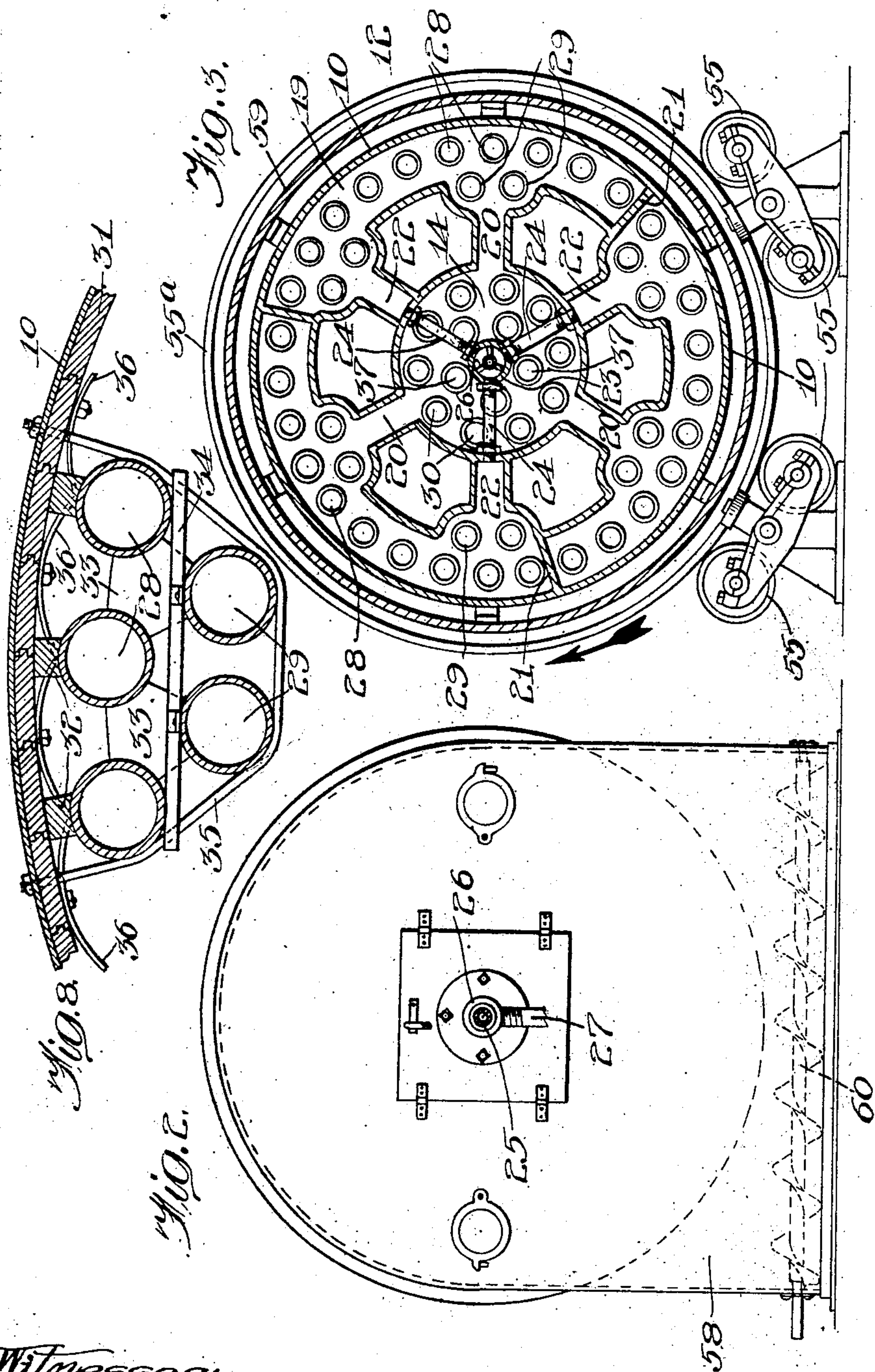
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3 SHEETS—SHEET 2.



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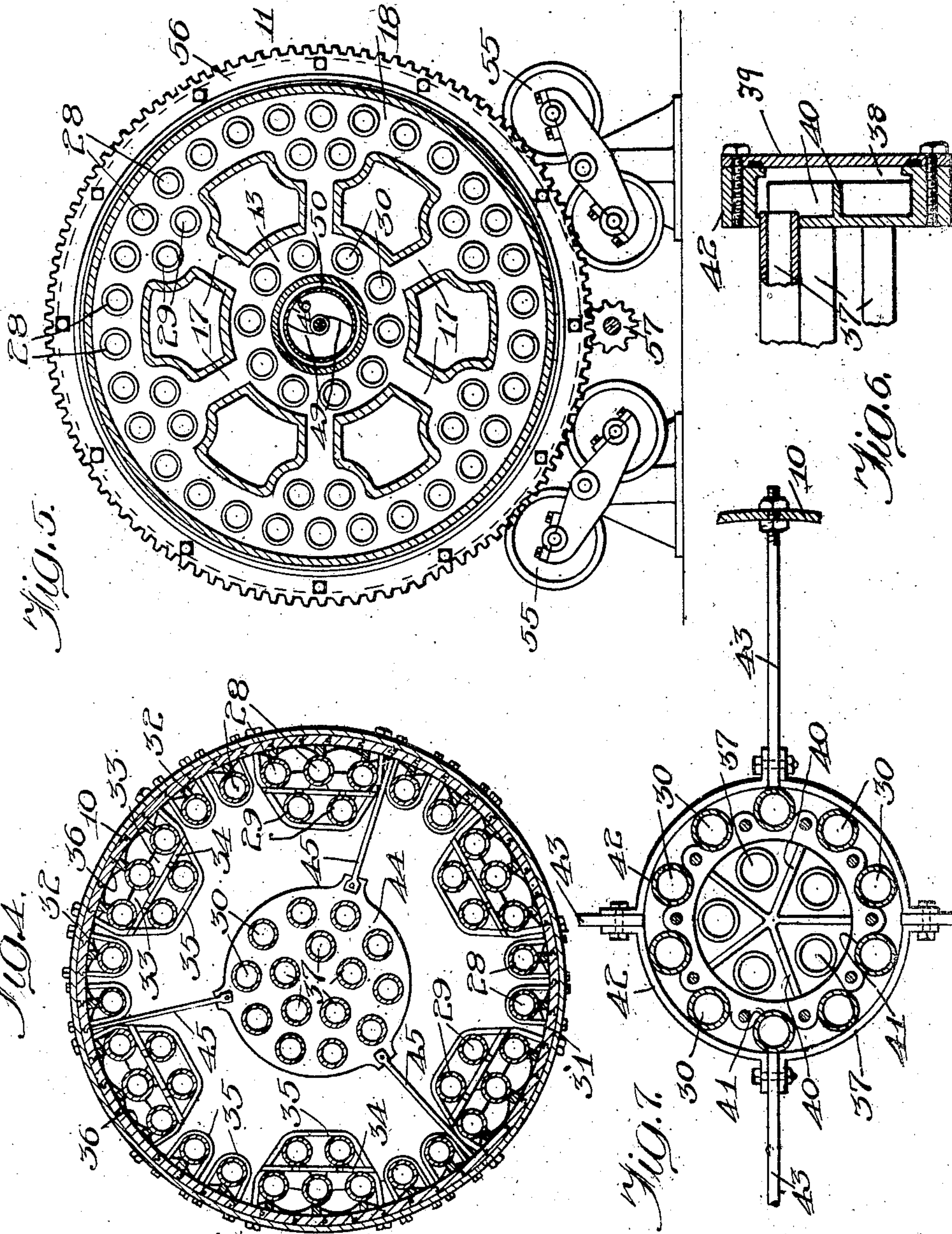
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

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ROTARY STEAM-DRIER.

No. 829,758.

Specification of Letters Patent.

Patented Aug. 28, 1906.

Application filed March 23, 1906. Serial No. 307,660.

To all whom it may concern:

Be it known that I, JOHN W. BILES, a citizen of the United States, residing at Louisville, in the county of Jefferson and State of Kentucky, have invented certain new and useful Improvements in Rotary Steam-Driers, of which the following is a full, clear, and exact specification.

This invention relates to improvements in rotary steam-driers; and the object of the same is to provide an improved arrangement of the steam or fluid pipes whereby the material may be thoroughly dried.

A further object is to provide an improved means for supporting and retaining the pipes in position.

A further object is to construct an improved device of this character comprising a plurality of concentric series of heating-pipes and an improved form of manifold-head.

A further object is to construct an improved form of head for one of the manifolds which is so disposed and arranged as to serve as an additional support for the adjacent manifold.

A further object is to construct an improved device of this character which will be simple in construction, cheap to manufacture, and effective in operation.

To the attainment of these ends and the accomplishment of other new and useful objects, as will appear, the invention consists in the features of novelty in the construction, combination, and arrangement of the several parts hereinafter more fully described and claimed, and shown in the accompanying drawings, illustrating an exemplification of this invention, and in which—

Figure 1 is a longitudinal sectional view of a machine constructed in accordance with the principles of this invention. Fig. 2 is an end elevation of Fig. 1. Fig. 3 is a transverse sectional view on line 3 3 of Fig. 1 looking in the direction of the arrows. Fig. 4 is a transverse sectional view on line 4 4 of Fig. 1 looking in the direction of the arrows. Fig. 5 is a transverse sectional view on line 5 5 of Fig. 1 looking in the direction of the arrows. Fig. 6 is an enlarged detail sectional view of the auxiliary manifold-head. Fig. 7 is a front elevation of the auxiliary manifold-head with the top removed, showing the arrangement of the pipes with relation thereto and the means for supporting the same. Fig. 8 is an enlarged detail view, partly in section,

of an improved device for supporting the pipes intermediate their ends.

Referring more particularly to the drawings, and in which similar reference-numerals designate the same parts throughout the several views, the numeral 10 designates a drying chamber or casing of any suitable size and shape, preferably in the shape of a cylinder, having its respective ends closed by means of headers, (designated generally by the numerals 11 and 12.) Each of these heads is provided with a centrally-disposed chamber or compartment, (designated, respectively, by the numerals 13 14,) each having a cap or cover 15 16, respectively, secured in position in any suitable manner.

Extending or radiating from the chamber or compartment 13 in the header 11 are hollow spokes or passages 17, which open into or communicate with an annular chamber or compartment 18, arranged adjacent the periphery of the header and concentric with the chamber or compartment 13. (See Fig. 5.) The header 12 is also provided with an annular chamber 19, arranged concentric with the chamber or compartment 14, and 20 designates hollow spokes or passages radiating from the compartment and communicating with the annular chamber 19. This annular chamber is divided into a plurality of compartments by means of walls or partitions 21, (see Fig. 3,) and extending from each of the compartments and toward the compartment or chamber 14, and preferably adjacent each of the partitions 21, are passages 22, which are closed at the end adjacent the chamber or compartment 14. These passages are so arranged with relation to each other that each of the compartments in the annular chamber 19 formed by the partitions 21 has communicating therewith a passage 20 and 22.

Located within the compartment 14 and opening through the cap or plate 16 thereof is a supplemental chamber or compartment 23, and 24 designates short sections of tubes or pipe, which are tapped through the wall of the chamber or compartment 23 and the adjacent closed end of the passages 22 of the chamber 19, thereby forming a communicating passage between the two compartments or chambers 19 and 23. There may be one of these tubes employed for each of the passages 22, and said tubes are held or secured in place in any suitable manner.

A steam-supply pipe 25 projects through

the chamber 23 and into the compartment or chamber 14, and 26 designates partitions arranged within the chamber 23 and between the wall thereof and the pipe 25, thereby forming a plurality of compartments. One end of this chamber is open and communicates with a tube or pipe 26, which preferably surrounds the supply-pipe 25 and is provided with a drain-pipe 27, leading therefrom.

The headers 11 and 12 are connected by a plurality of series of pipes 28 29 30. (More clearly shown in Fig. 3.) The series 29 are arranged concentric with the series 28 and connect the peripheral chambers 18 and 19, while the series 30 connect the centrally-disposed chambers or compartments 13 and 14. The series 28 and 29 may comprise any number of pipes; but the number of pipes in the series 29 is preferably considerably less than the number in the series 28 and are preferably arranged in pairs, so that each pair will stand adjacent one of the passages or openings 20 22. This arrangement will cause the two series to be formed into a plurality of separated groups of pipes, with some of the pipes of the outer series intermediate the groups.

The drying chamber or casing 10 may be provided with a lining 31, of wood or any other suitable material, to protect the same against corrosion or the corrosive action of acids contained in the material to be dried. Suitable blocks or supports 32, (see Fig. 8,) held in position in any suitable manner, are disposed between each of the pipes 28 and the wall of the chamber or casing 10, against which the said pipes rest.

The pipes 29 may be supported intermediate their ends by means of blocks or supports 33, standing between said pipes and the adjacent pipes of the series 28, and a suitable bar or rod 34, engaging the adjacent pipes 29, extends across and rests upon the adjacent pipes 28. A band or strap 35 surrounds the pipes in each group with its ends secured in any suitable manner to the drying-chamber 10, and said band or strap also serves as a means for preventing displacement of the blocks or supports 33 and the bar or rod 34. The pipes of the series 28, which are located intermediate these groups, may also be spaced from the wall of the drying-chamber by means of the blocks 32, and similar bands or straps 35 surround each of the pipes and have their free ends secured to the drying-chamber wall. Secured between each two of the pipes 28 are plates or shields 36, which are preferably curved and located between the blocks or supports 32 and serve as a means to form a dead-air space to prevent undue radiation of heat and also to prevent the material from accumulating in the corners formed by the blocks and the wall of the

chamber or between the pipes 28 and the wall.

A series of pipes or tubes 37, having one end thereof secured to and communicating with the compartment or chamber 14, are arranged within the series 30 and terminate short of the opposite end of the drying-chamber 10. These tubes or pipes 37 are connected at their free ends by means of a header 38, which is preferably provided with a movable cap or cover 39, and said header is provided with a plurality of ribs or partitions 40, each of which is located between the ends of two of the pipes 37 and serve as a means for evenly distributing the steam. The periphery of this header is recessed or provided with a plurality of seats 21, in which the pipes 30 rest, and said header serves as an additional support for the pipes 30. A band 42, preferably sectional in construction, surrounds the series of pipes 30 at a point concentric with the header 38, and said ring serves as a means for supporting the header to prevent strain in the pipes 30 and is held in position by means of rods or bars 43, one end of each of which is secured to the wall of the drying-chamber 10 in any suitable manner and the other end being connected to the ring 42.

A plate 44 (see Fig. 4) is provided with a plurality of suitable apertures, through which the pipes 30 and 37 pass. This plate is located at any desired point midway of the ends of the pipes, serving as an additional means for supporting said pipes, and this plate is secured in position in any suitable manner, preferably by means of rods or bolts 45, one end of each of which is secured to the plate 44 and the other end to the wall of the drying-chamber.

A suitable tube or conduit 46 projects through the header 11 in a direct line with the header 38 and into the space formed between the two headers 11 and 38. This tube is provided with a hopper 47 and an opening 48 at the opposite end, through which the material is discharged into the chamber 10. Mounted within this tube 46 is a conveyer 49, preferably in the form of a screw or auger. The diameter of the tube 46 is smaller than the diameter of the opening in the header 11, through which the tube passes, in order to provide a space or passage, through which the vapor generated in the drying-chamber 10 will pass into a supplemental or vapor chamber 51 and out of the stack 52. This chamber 51 may be supported by the tube 46 in any suitable manner and disposed between the header 11 and the said chamber 51 is a sleeve or collar 53, which is secured to the header 11 and has a flanged bearing 54 with the chamber 51 to permit the drying-chamber to revolve and yet prevent the escape of the vapor. The drying-chamber 10 may be supported by

any suitable means, such as antifriction rollers or bearings 55 and flanges or tracks 55^a and on the desired angle of inclination. A rotary motion may be transmitted to the chamber in any well-known manner, such as a peripheral gear 56 and a pinion 57. Arranged adjacent the discharge end of the cylinder is a casing 58, into which the drying-chamber discharges, and disposed between the chamber and this casing is a collar or sleeve 59, having flanged connections, and within the casing 58 is a discharge conveyer or chute 60, which conveys the material to any desired point or receptacle. Suitable hand-holes may be provided wherever the necessity may require to permit the parts to be cleaned.

The operation of this apparatus is as follows: The heating fluid, which in this exemplification of the invention is steam, is admitted by means of the supply-pipe 25 and discharged into the compartment or chamber 14 in the header 12. From there a portion passes through the pipes 30 37 and into the header 38. The rest of the steam passes through the pipes 30 and into the compartment or chamber 13 in the header 11, up through the passages 17, into the annular or peripheral chamber 18, back through the two series of pipes 28 29, and into the respective compartments forming the annular chamber 19 in the header 12. Owing to the inclination of the drying-chamber 10, the water of condensation formed in the tubes will drain toward the header 12 and will be collected in the passages 22, from where it passes through the tubes or pipes 24 into the chamber 23, through the tube or pipe 26, and out through the drain-pipe 27. The water of condensation formed in the tubes or pipes 37 will be discharged into the compartment 14, passing through the passages 20 into the chamber 19, and then out through the passages 22 and pipe 24 in a similar manner. A rotary motion is transmitted to the drying-chamber, and the material to be dried is fed into the hopper 47 and forced through the tube 46 by means of the auger 49, out through the opening 48 in the tube into the space within the drying-chamber between the headers 11 and 38. The material falling to the bottom of the chamber as it is discharged from the tube 46 will be caught by the pipes 28 29 and the shields or plates 32 and carried upward toward the top of the chamber as the latter revolves. The material falls as it reaches a point near the top of the chamber and in its descent strikes the pipes 30 37, some of the material passing around and some of it between the pipes. The angle of inclination of the chamber will cause the material to advance from the feed to the discharge end thereof where it enters the chamber or housing 58 and is conveyed therefrom by means of the conveyer 60. It

will be seen that by this arrangement the pipes are so arranged as to produce the greatest heating-surface and that they are so distributed as to provide spaces therebetween, through which the material passes, thus greatly increasing the efficiency and insuring a perfect drying of the material. The vapor formed or generated by the wet material coming in contact with the heated pipes will pass through the space 50 between the tube 46 and the wall of the aperture in the header 11 into the chamber 51 and out through the stack 52.

It is to be understood that it is not desired to be limited to the exact construction or arrangement of the several parts, as various changes may be made therein without departing from the spirit of the invention.

What is claimed as new is—

1. In a device of the class described, the combination of a drying-chamber, headers arranged at the ends thereof, a plurality of heating-pipes connecting the headers, a supplemental header disposed within the chamber, and a plurality of heating-pipes connecting said supplemental header with one of the first headers.

2. In a device of the class described, the combination of a drying-chamber, headers arranged at the ends thereof, a supplemental header disposed within the chamber, pipes connecting said supplemental header with one of the first headers, and a plurality of pipes connecting the first two headers, and surrounding the first pipes.

3. In a device of the class described, the combination of a rotary drying-chamber, headers arranged at the ends thereof, pipes connecting the headers adjacent the wall of the chamber, a supplemental header disposed within the chamber and spaced from one of the first headers, and pipes connecting said supplemental header with the other one of the first headers.

4. In a device of the class described, the combination of a rotary drying-chamber, headers arranged at the ends thereof, pipes connecting the headers and disposed adjacent the wall of the chamber a second series of pipes connecting the headers arranged within the first series and located adjacent to and surrounding the diametric center of the chamber, a supplemental header disposed between and surrounded by the second series of pipes, said supplemental header being located adjacent one of the first headers, and pipes connecting the supplemental header and the other one of the first headers.

5. In a device of the class described, the combination of a rotary drying-chamber, headers arranged to close the ends thereof, pipes located adjacent the wall of the chamber and connecting the headers, a supplemental header within the chamber adjacent one of the first headers, pipes connecting the

supplemental header and the opposite one of the first headers, and a series of pipes connecting the first two headers and surrounding the supplemental header and its connecting-pipes, in close proximity thereto and engaging the periphery of the supplemental header for preventing displacement of said supplemental header.

6. In a device of the class described, the combination of a drying-chamber, headers arranged at the ends thereof, pipes connecting the headers and located adjacent the wall of the chamber, a supplemental header disposed within the chamber adjacent one of the first headers, pipes connecting said supplemental header with the opposite one of the first headers, said supplemental header being provided with a plurality of seats in its periphery, and a second set of pipes connecting the first two headers, said second set of pipes being disposed around the supplemental header and resting in the peripheral seats thereon.

7. In a device of the class described, the combination of a drying-chamber, headers arranged at the ends thereof, pipes connecting the headers, a supplemental header within the chamber, disposed adjacent one of the headers, pipes connecting the supplemental header with the remote one of the first headers, and means disposed between the wall of the chamber and the supplemental header for supporting the said supplemental header.

8. In a device of the class described, the combination of a rotary drying-chamber, headers arranged at the ends thereof, pipes connecting the headers, a supplemental header, means for supporting the supplemental header, pipes connecting said supplemental header and one of the first headers, and partitions within the supplemental header disposed between the ends of the pipes.

9. In a device of the class described, the combination of a rotary drying-chamber, headers arranged at the ends thereof, each of said headers being provided with concentric chambers, communicating passages between the chambers, pipes connecting the respective chambers of each of the headers, a supplemental header, and an additional set of pipes connecting the supplemental header with one of the chambers in one of the first headers.

10. In a device of the class described, the combination of a rotary drying-chamber, headers arranged adjacent the ends thereof, each of said headers being provided with concentric chambers, passages between the concentric chambers, pipes connecting the respective chambers of each header, a supplemental header, pipes connecting the supplemental header with one of the chambers in one header, and a supply and exhaust pipe communicating with the last said chamber.

11. In a device of the class described the combination of a drying-chamber, headers arranged to close the ends thereof, one of said headers being provided with a transverse feed-opening, a plurality of pipes connecting the headers, a supplemental header disposed within the chamber adjacent the opening in the first header, and a plurality of heating-pipes connecting said supplemental header with the other one of the first headers.

12. In a device of the class described, the combination of a drying-chamber, headers arranged to close the ends thereof, one of said headers being provided with a feed-opening therethrough, two series of pipes connecting the headers, one series being located adjacent the wall of the chamber and the other disposed to surround the feed-opening, a supplemental header within the chamber between the second series of pipes and adjacent the feed-opening in the first header, and a series of pipes also surrounded by the second series of pipes, and connecting the supplemental header with the other one of the first headers.

13. In a device of the class described the combination of a drying-chamber, headers arranged to close the ends thereof, one of said headers being provided with a feed-opening therethrough, pipes connecting the two headers, a supplemental header within the chamber disposed adjacent to one of the first headers and across the opening therein, pipes connecting the supplemental header with the other one of the first headers, means for supplying a heating medium to the pipes, and a feed-pipe projecting into the chamber through the opening in the header and discharging into the space between said header and the supplemental header, said feed-pipe being of a diameter smaller than the opening to form a space between the pipe and the wall of the opening.

14. In a device of the class described, the combination of a drying-chamber, headers arranged to close the ends thereof, one of said headers being provided with a feed-opening therethrough, pipes connecting the headers, a supplemental header within the chamber adjacent to one of the first headers and extending across the opening therein, pipes connecting the supplemental header with the other one of the first headers, means for supplying a heating fluid to the pipes and headers, a feed-pipe projecting into the chamber through the feed-opening in the header and discharging into the space between said header and the supplemental header, and of a smaller diameter than the diameter of the opening to form a vapor-outlet, and a vapor-chamber surrounding the supply-pipe with which the outlet communicates.

15. In a device of the class described, the combination of a drying-chamber, headers arranged to close the ends thereof, each of

said headers being provided with an inner and a peripheral chamber arranged concentric and having communicating passages, one of said headers being provided with a feed-opening passing through the inner chamber therein, pipes connecting the respective chambers in the headers, a supplemental header within the chamber adjacent the feed-opening in the first header, pipes connecting the supplemental header with the inner chamber of the second header, the peripheral chamber of the second header being divided into compartments, a fluid-supply discharging into the inner chamber of the second header an exhaust-pipe leading therefrom, and a reduced passage leading from each of the compartments and communicating with the exhaust-pipe.

16. In a device of the class described the combination of a drying-chamber, headers arranged to close the ends thereof, each of said headers being provided with an inner and a peripheral chamber, one of said headers being provided with a feed-opening through the inner chamber, a supplemental header within the chamber adjacent to and extending across the opening, heating-pipes connecting the supplemental header with the inner chamber of the other header, a series of heating-pipes connecting the inner chambers of the two headers, surrounding and in close proximity to the supplemental header, and two series of concentric heating-pipes connecting the peripheral chambers in the headers, the outer series being continuous and the inner series being arranged in groups, spaced from each other and in close proximity to the outer series.

17. In a device of the class described the combination of a drying-chamber, headers arranged to close the ends thereof, each of said headers being provided with an inner and a peripheral chamber, one of said headers being provided with a feed-opening through the inner chamber, a supplemental header within the chamber adjacent to and

extending across the opening, heating-pipes connecting the supplemental header with the inner chamber of the other header, a series of heating-pipes connecting the inner chambers of the two headers, surrounding and in close proximity to the supplemental header, two series of concentric heating-pipes connecting the peripheral chambers in the headers, the outer series being continuous and the inner series being arranged in groups spaced from each other and in close proximity to the outer series, and supports secured to the chamber and surrounding the contiguous pipes of the two outer series intermediate their ends.

18. In a device of the class described, the combination of a drying-chamber, headers arranged to close the ends thereof, each of said headers being provided with an inner and a peripheral chamber, one of said headers being provided with a feed-opening through the inner chamber, a supplemental header within the chamber adjacent to and extending across the opening, heating-pipes connecting the supplemental header with the inner chamber of the other header, a series of heating-pipes connecting the inner chambers of the two headers, surrounding and in close proximity to the supplemental header, two series of concentric heating-pipes connecting the peripheral chambers in the headers, the outer series being continuous and the inner ones being arranged in groups spaced from each other and in close proximity to the outer series, spacing-blocks disposed between the pipes of the two outer series, and a supporting-band surrounding the contiguous pipes of said series and the block, the ends of said band being secured to the chamber-wall.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 20th day of March, A. D. 1906.

JOHN W. BILES.

Witnesses:

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