

No. 766,868.

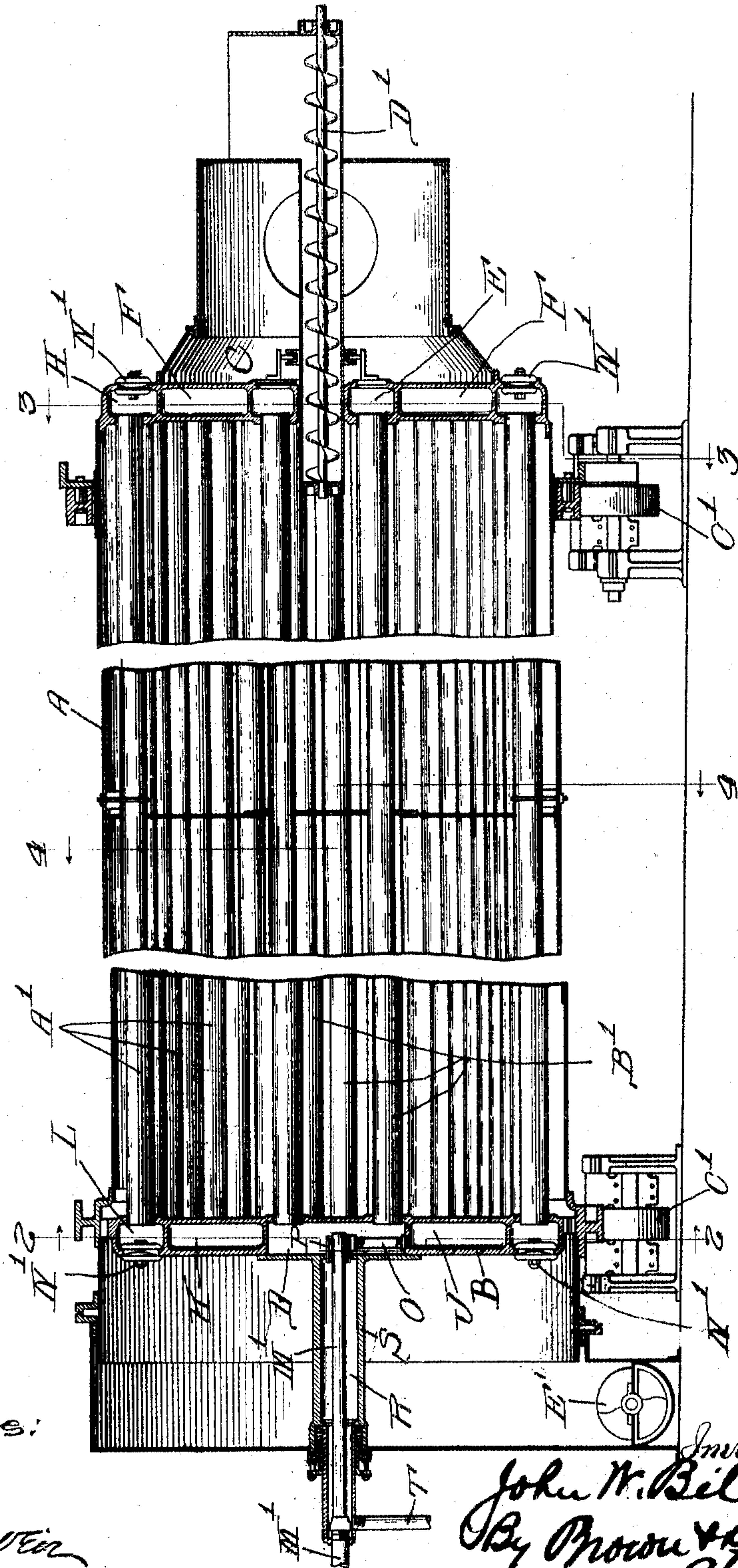
PATENTED AUG. 9, 1904.

J. W. BILES.
ROTARY STEAM DRIER.
APPLICATION FILED MAY 6, 1904.

NO MODEL.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 3.

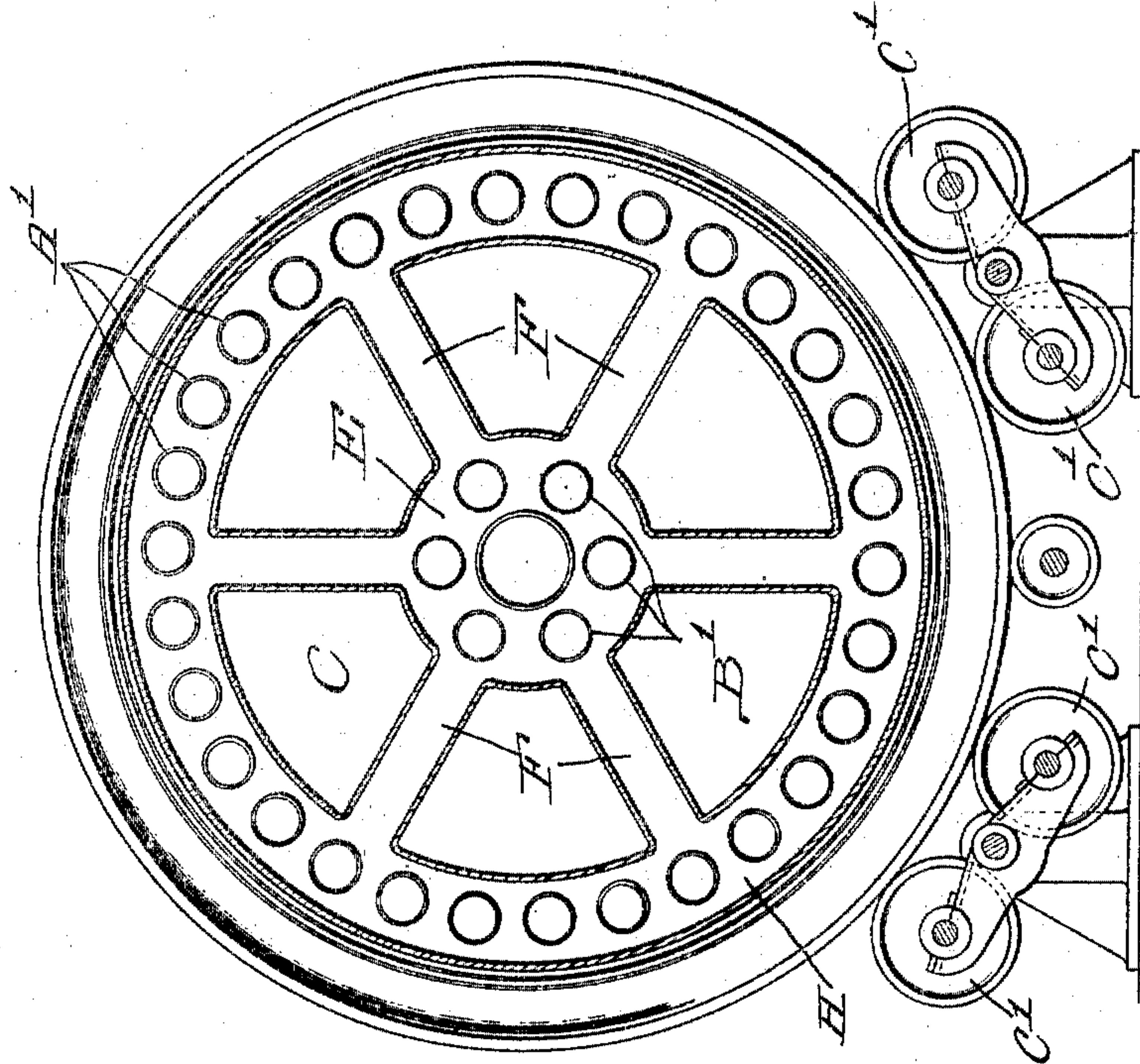
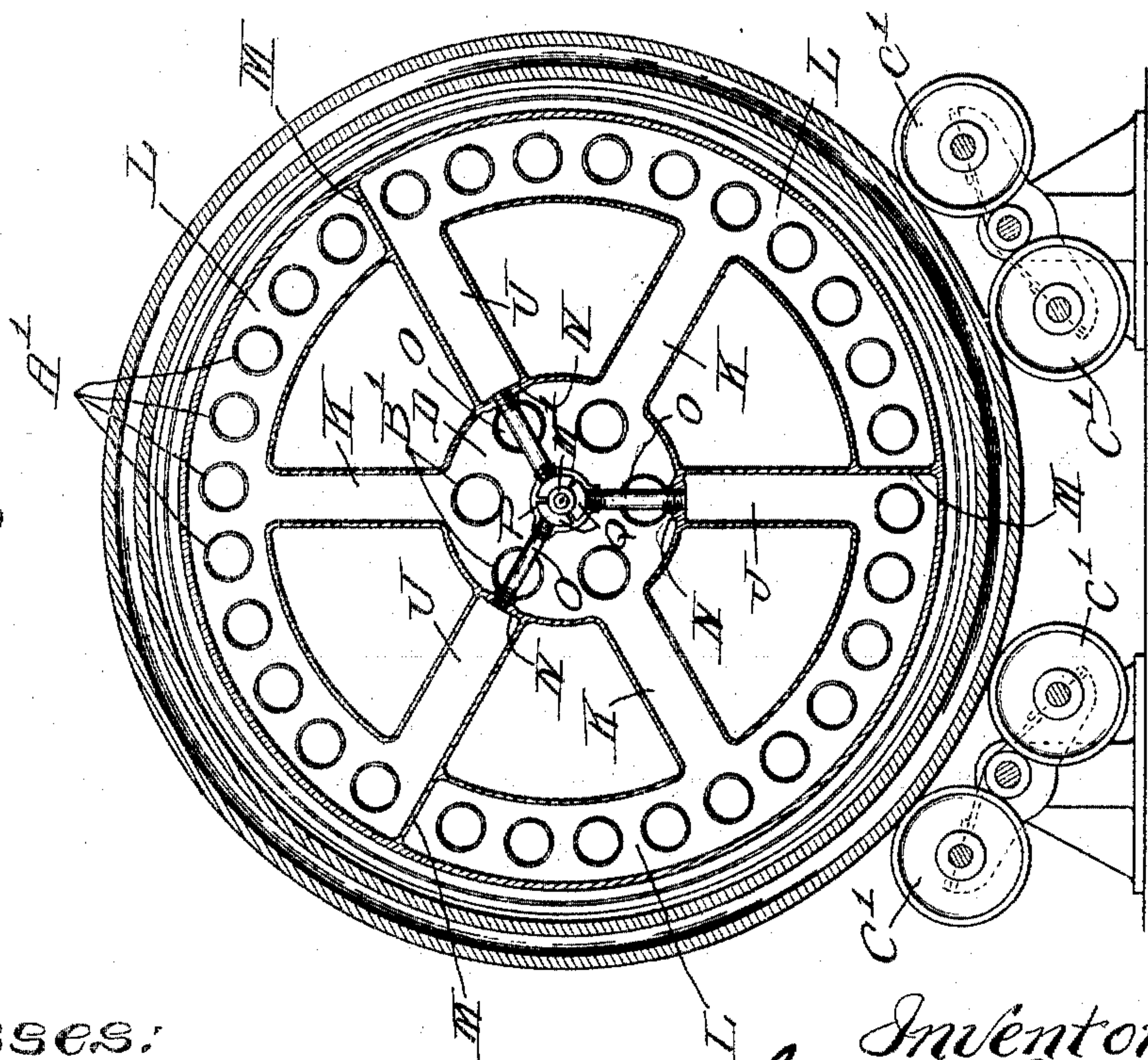


Fig. 2.



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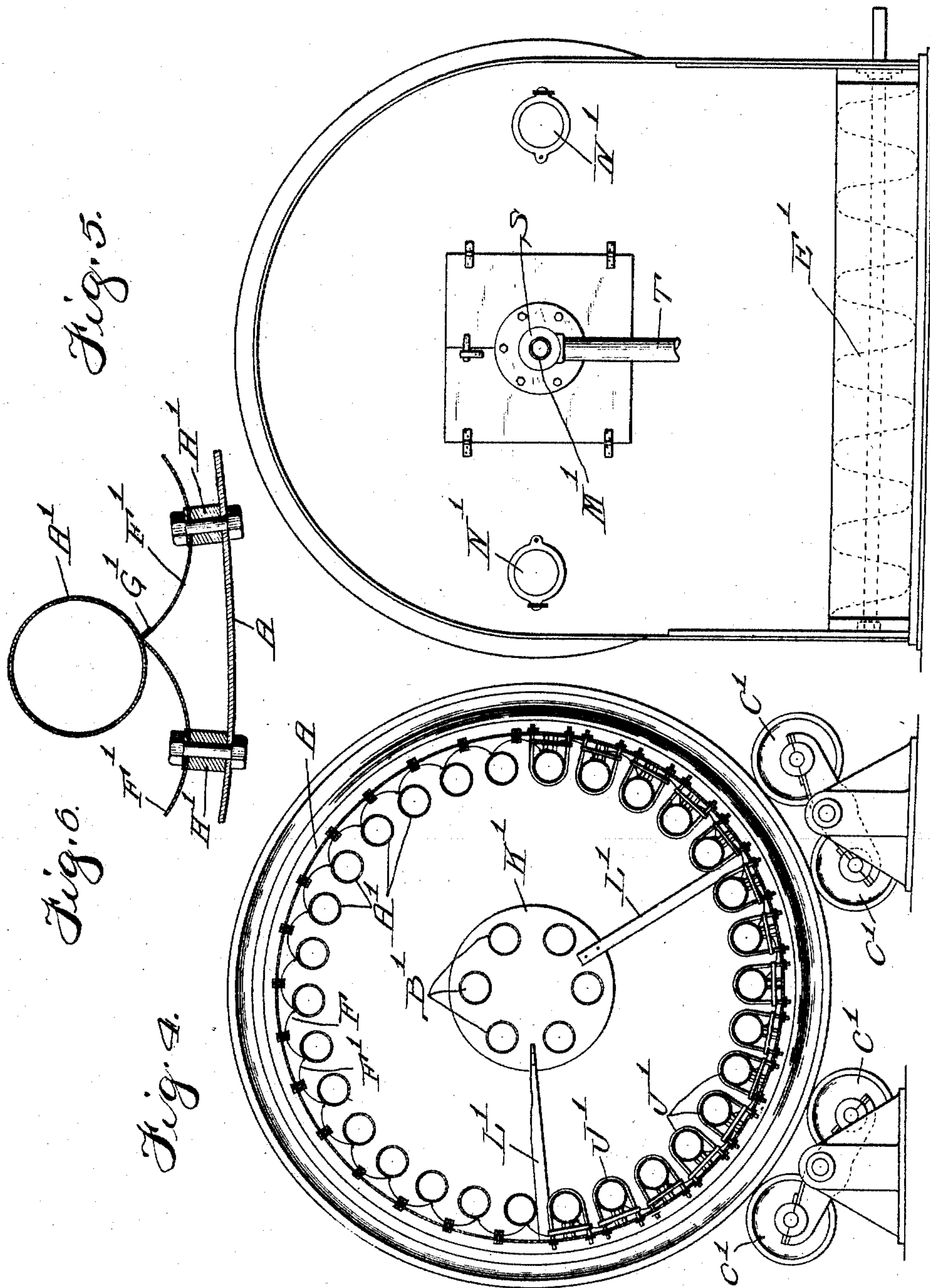
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3 SHEETS—SHEET 3.



Witnesses:
J. W. Biles
Robert W. Biles

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UNITED STATES PATENT OFFICE.

JOHN W. BILES, OF LOUISVILLE, KENTUCKY.

ROTARY STEAM-DRIER.

SPECIFICATION forming part of Letters Patent No. 766,868, dated August 9, 1904.

Application filed May 6, 1904. Serial No. 206,665. (No model.)

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 a new and useful Rotary Steam-Drier, of which the following is a specification.

This invention relates to rotary steam-driers.

The object of the invention is to provide a rotary steam-drier of improved construction and which is simple and efficient in operation.

A further object of the invention is to provide improved means in a rotary steam-drier for drawing off the water of condensation.

A further object of the invention is to provide means for protecting the inner wall of the casing against corrosion during the operation of the device.

A further object of the invention is to provide means permitting longitudinal expansion and contraction of the steam-pipes.

Other objects of the invention will appear more fully hereinafter.

The invention consists, substantially, in the construction, combination, location, and arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally pointed out in the appended claims.

Referring to the accompanying drawings, and to the various views and reference-signs appearing thereon, Figure 1 is a view in vertical central longitudinal section of a rotary steam-drier embodying the principles of my invention. Fig. 2 is a view in transverse section on the line 2 2 of Fig. 1 looking in the direction of the arrows. Fig. 3 is a view in transverse section on the line 3 3 of Fig. 1 looking in the direction of the arrows. Fig. 4 is a view in transverse section on the line 4 4 of Fig. 1 looking in the direction of the arrows. Fig. 5 is a view in end elevation looking toward the left-hand end of the apparatus. Fig. 6 is a broken detail view in transverse section, showing the means for supporting and arranging the protective lining for the casing of the drying-chamber.

The same part is designated by the same reference-sign wherever it occurs throughout the several views.

In the practical operation of rotary steam-driers wherein a rotary casing is employed into one end of which the material to be dried is fed and from the other end of which the dried material is delivered and wherein steam is employed as the drying or heating medium it is important that any condensation which takes place within the heating-pipes may be readily withdrawn and removed from the system of heating-pipes. It is also important and desirable to provide means for protecting the shell of the drying-chamber against corrosion or the corrosive action of acids contained in the material to be dried, and in the construction of rotary steam-driers employing headers at each end, which headers are connected by steam-pipes for circulation of the heating medium, it is desirable to provide means whereby the heating-pipes are permitted longitudinal expansion or contraction. The attainment of these desirable objects is among the special purposes of the present invention.

In carrying out my invention I employ a rotary cylinder or casing A, constituting the drying-chamber, and I arrange at the respective ends of said casing headers, which I shall designate generally by reference-signs B and C, and each comprising a central chambered hub, the chamber thereof being indicated by reference-signs D and E, respectively. Radiating from the chambered hub E of header C are hollow arms or spokes, the channels of which are indicated by reference-sign F, (see Figs. 1 and 3,) and which open into an annular chamber H at the periphery of said header. Similarly the chamber D of the hub of header B is provided with radiating spokes having passages J and K, the chambers of passages K forming a communication between the chamber D and chambers L. (See Figs. 1 and 2.) Formed at the periphery of the header B, and which I will call "annular" chambers, the passages J alternate with the passages K, each of the passages J communicating with one of the annular chambers L, the annular chambers L being divided or separated from each other by the partitions M, which are arranged to form end walls of the chambers L and on the right-hand side of each of the cham-

bers J when looking from the left-hand side of Fig. 1 toward the end of the apparatus. At their inner ends the passages J are closed to chamber D at the hub of header B by bridges or partition-plates N. A short section of pipe O is tapped through each of these partitions or bridges N, each of said short sections of pipe being tapped through the shell P of a cylinder-chamber, which is divided into three segmental portions Q, (see Fig. 2,) each pipe-section O delivering into a segmental chamber of said cylinder-casing P, said segmental chambers being closed at their inner ends and opening at their outer ends into the interior chamber R of a neck S, with which communicates a drain-pipe T. The headers B C are connected by two series of pipes, one series (designated by reference-sign A') being located closely adjacent to the inner wall of the casing A and the other series being indicated by reference-sign B' and being located or nested together in cylindrical form at the axial center of casing A. The pipes B' communicate, respectively, with the hub-chambers D and E of the headers B C, while the peripheral pipes A' communicate, respectively, with the annular passages L and H of headers B C, respectively. The header C is rigidly secured to the shell or casing A, while the header B is mounted to move longitudinally of the axis of casing A, thereby permitting of expansion and contraction of the heating-pipes.

In practice devices of driers of the class and type to which the present invention relates are mounted somewhat in inclined position from one end toward the other to revolve axially. Any suitable means for supporting the drier shell or casing and for imparting rotative movement thereto may be employed. I have shown means which are common in the art for accomplishing this purpose and comprising rollers C', arranged in supporting relation with respect to the respective ends of the casing.

The material to be dried may be delivered into the interior of casing A from the feed end thereof and in any convenient manner. I have shown a common form of feeding mechanism comprising a screw conveyer D', arranged to deliver into the casing A through the hub of header C, and this end of the casing or apparatus I will call the "feed" end. The material may be discharged from the casing A at the opposite end of the apparatus and the dried material conveyed from the apparatus in any suitable or convenient manner. I have indicated in Figs. 1 and 5 a conventional arrangement well known in the art for accomplishing the desired object and comprising a rotary screw conveyer E', to which the material is delivered from the casing A through the space between the radiating spokes of header B. In practice to secure the inclination of the drier the cylindrical casing

A is elevated or raised higher at the feed end than at the discharge end.

In order to protect the inner wall of the shell or casing A against corroding or the corrosive effect of acids contained in the material to be dried during the operation of the device, I propose to provide the inner wall of the casing with a removable lining. Linings for driers of the type to which this invention relates have been difficult of application and use in the devices of prior construction by reason of the difficulty of replacing or renewing the lining on account of the limited space or area between the inner wall of the casing A and the peripheral series of heater-tubes A'. In order to overcome this difficulty, I propose to employ a lining made up of sections F', each section being preferably curved to the segment of a circle of sufficient radius to enable such sections to be introduced into the space between the series of peripheral pipes A' and the inner wall or surface of casing A by slipping the same edgewise between adjacent pipes A'. One edge of each of the segmental sections of lining is provided with a turned-over flange G', arranged to overlap the proximate edge of the adjacent segmental section, as clearly shown in Fig. 6, thereby preventing the material being treated from gaining access to the space between the lining and the casing A. In order to prevent undue radiation of the heat within the casing A, I propose to offset the lining from the inner wall or surface of casing A, thereby forming practically a dead-air space between the lining and the casing. To accomplish this result, I propose to bolt the segmental lining-sections to the casing A and to interpose between said casing and lining-sections a block or washer H', as clearly shown in Fig. 6.

The peripheral series of pipes A' may be supported in any convenient manner and at any convenient point intermediate the ends thereof—as, for instance, by means of straps J', (see Fig. 4,)—in a well-understood and well-known manner, and similarly the cylindrical nest of central pipes B' may be supported intermediate the ends thereof in any convenient manner—as, for instance, by means of a plate K', through which said pipes pass, said supporting-plate K' being connected by arms L' to the casing A.

The heating medium—as, for instance, steam (but in this respect I do not desire to be limited)—is supplied to the drier in any convenient manner—as, for instance, through a supply-pipe M'—the end of which is arranged to project through the cylindrical casing P; so as to deliver the heating medium into the hub-chamber D of header B, whence the heating medium reaches and circulates through the central nest of pipes B' and also through the radial passages K, reaches annular chambers L, thence circulating through

the peripheral series of pipes A' to header C at the opposite end of the apparatus.

If desired, suitable manholes may be provided for each of the headers B C, as indicated at N'.

A drier constructed in accordance with the principles of my invention is well adapted for use in drying any kind of material requiring the use of a drier. I do not desire, therefore, to be limited in respect to the use to which my invention is to be put or to the character of the material to be employed.

The operation of the apparatus is as follows: The material to be dried is delivered into the feed end of the casing A by the feeding apparatus employed, such material falling into the raised or upper end of the casing. By reason of the downward inclination of casing A toward the discharge end and the rotations imparted to said casing the material to be dried falling upon the lowermost point of the cylindrical casing at the feed-in end thereof is caught by the ridges formed by the lining-sections at the junction of the edges thereof and by and between the peripheral pipes A' and are thereby carried with the revolving casing as the rotation thereof continues until it is raised to a sufficient height to spill or fall over the supporting ledges or ridges formed by the lining-sections and pipes A' and falling down and spreading over and through the central nest of pipes B', being progressed spirally in this manner lengthwise through the casing A, being finally delivered from the casing in dried condition and carried away or removed by a conveyer E' or otherwise. Thus it will be seen that the lining performs a triple function. Being offset from the inner wall of the casing, it serves to prevent undue radiation of the heat, and being in the form of arc-shaped sections they perform the further function of ledges or flights for receiving and carrying upwardly the material to be dried during the rotative movement of the casing, and in addition they serve to protect the casing A against corroding or the corrosive effect of any acids contained in the material to be dried. The water of condensation forming within the heating tubes or pipes A' B', where steam is employed as the heating medium, drains toward the header B by reason of the inclination of said pipes and is delivered into the annular passages L, collecting in the lowermost portions of said annular passages, where such condensation is caught by the partitions M, thereby being deflected or guided down the alternate radiating passages J and thence through the short pipe-sections O into the compartments Q of cylindrical casing P, thence being delivered into the passage R of neck S and through the drain-pipe T.

By employing only each alternate radiating passage J to carry off the condensation I am enabled to employ pipe-sections O of large

area, thereby avoiding the possibility of clogging due to a failure of the drain to take care of all of the condensation formed during the operation of the device, and this I regard as a most important feature of my invention. By mounting the header B for movement in the direction of the axis of rotation of casing A provision is made for expansion and contraction of the tubes or pipes A' B', connecting the headers.

The moisture which is driven off by the steam for heat furnished through the heating-pipes while the material is passing through the cylinder may be carried off from the casing in any convenient manner. In practice this moisture may be drained off by means of a blower or fan (not shown) through the open spaces between the radiating hollow spokes of header C.

It is obvious that many variations and changes in the details of construction and arrangement would readily occur to persons skilled in the art and still fall within the spirit and scope of my invention. I do not desire to be limited or restricted, therefore, to the exact details shown and above described; but,

Having now set forth the object and nature of my invention and a construction embodying the principles thereof, what I claim as new and useful and of my own invention, and desire to secure by Letters Patent, is—

1. In a rotary drier of the type described, the combination with a drum or casing, headers arranged at the ends thereof, heating-pipes connecting said headers, means for supplying a heating medium to said pipes, in combination with a lining applied to the inner wall of said casing, said lining made in removable sections, for the purpose set forth.

2. In a drier, a drum or casing, headers arranged at the ends thereof, heating-pipes connecting said headers, in combination with a lining for the inner wall of said casing, said lining made in removable sections, said sections being offset from the inner surface of said casing, for the purpose set forth.

3. In a drier, a drum or casing, heating-pipes arranged therein and adjacent to the inner periphery of said casing, in combination with a lining applied to the inner wall of said casing and between said heating-pipes and said inner wall, said lining having longitudinally-extending ridges on the inner surface thereof, for the purpose set forth.

4. In a drier, a drum or casing, heating-pipes arranged therein and adjacent the surface of the wall thereof, in combination with a lining for the inner wall of said casing, comprising segmental sections forming longitudinal ridges at the abutting edges thereof, and means for connecting said lining-sections to the casing, for the purpose set forth.

5. In a drier, a drum or casing, means for heating the same, and a lining for said casing,

said lining comprising removable segmental-shaped sections arranged edge to edge, for the purpose set forth.

6. In a drier, a drum or casing, and means for heating the same, in combination with a lining for said drum or casing, said lining being offset from the inner surface of said wall or casing to provide a dead-air space therebetween, for the purpose set forth.

7. In a rotary drier, a rotatively-mounted drum or casing, heating-pipes extending longitudinally therethrough and arranged adjacent the inner surface thereof, in combination with a lining interposed between said heating-pipes and the inner wall of said casing, said lining composed of curved segmental plates, and means for removably attaching said plates to the inner surface of said casing, for the purpose set forth.

8. In a rotary drier, a rotatively-mounted drum or casing, heating-pipes extending longitudinally therethrough and arranged adjacent to the inner surface of said casing, in combination with a lining interposed between said pipes and the inner surface of said casing, said lining comprising detachable sections, each section having a bent flange at one edge thereof arranged to engage over the proximate edge of the adjacent sections, for the purpose set forth.

9. In a drier, the combination of a drum or casing rotatively mounted, and headers arranged at the ends thereof, heating-pipes connecting said headers, said headers provided with hub-chambers and annular chambers and a plurality of centrally-located exhaust-chambers and radiating hollow spokes, the alternate hollow spokes forming communication between said hub and annular chambers, and drain-pipes communicating with each intermediate radiating passage of one of said headers and delivering to an exhaust-chamber, for the purpose set forth.

10. In a rotary steam-drier, a rotatively-mounted casing or drum, headers arranged at the respective ends thereof and including annular and hub chambers, pipes communicating between said headers, radiating spokes, each having a single passage formed in said headers, the passage of each alternate spoke of one of said headers arranged to open communication between the annular and hub chambers of the same header, the passage of each intermediate spoke of said header being closed to said hub-chamber, a cylindrical casing arranged at the center of said hub-chamber and communicating with an exhaust-pipe, and pipe-sections communicating between said intermediate

spoke-passages and said central cylindrical casing, for the purpose set forth.

11. In a rotary steam-drier, a rotatively-mounted drum or casing, a header arranged at each end thereof and each having an annular chamber and a central hub-chamber, radial hollow spokes formed in each of said headers, and each having a single passage therethrough to open communication between the annular and hub chambers of their corresponding headers, only the alternate spoke-passages of one of said headers forming such communication between the annular and hub chambers of said headers, a casing centrally mounted in said last-mentioned header and having a plurality of compartments closed to the hub-chamber of said header, the single passage of each intermediate radial spoke being also closed to said hub-chamber, and a pipe-section communicating between the single closed passage of each of said intermediate radial spokes and a corresponding compartment of said central casing, and a drain-pipe communicating with said central casing.

12. In a rotary steam-drier, a rotatively-mounted drum or casing, pipes arranged therein, headers receiving the ends of said pipes, each header including an annular and a hub chamber, radiating spokes, each having a passage therethrough, formed in one of said headers to open communication between the annular and hub chambers thereof, similar radiating spokes, each having a single passage therethrough, formed in the other of said headers, partition-plates arranged to separate the annular chamber of said last-mentioned header into sections, the hollow passage of each alternate radiating spoke of said header opening communication between a section of the annular chamber and the hub-chamber of said header, a casing having a plurality of compartments centrally located with respect to said header, said compartments being closed to the hub-chamber thereof, the single passage of each intermediate spoke being closed to said hub-chamber but communicating with a section of said annular chamber, and a pipe connection between the single passage of each of said intermediate spokes and a central casing-compartment, and a drain-pipe communicating with said central casing-compartment.

In witness whereof I have hereunto set my hand, this 3d day of May, 1904, in the presence of the subscribing witnesses.

JOHN W. BILES.

Witnesses:

A. G. RONALD,
A. E. RICHARDS.