

No. 786,079.

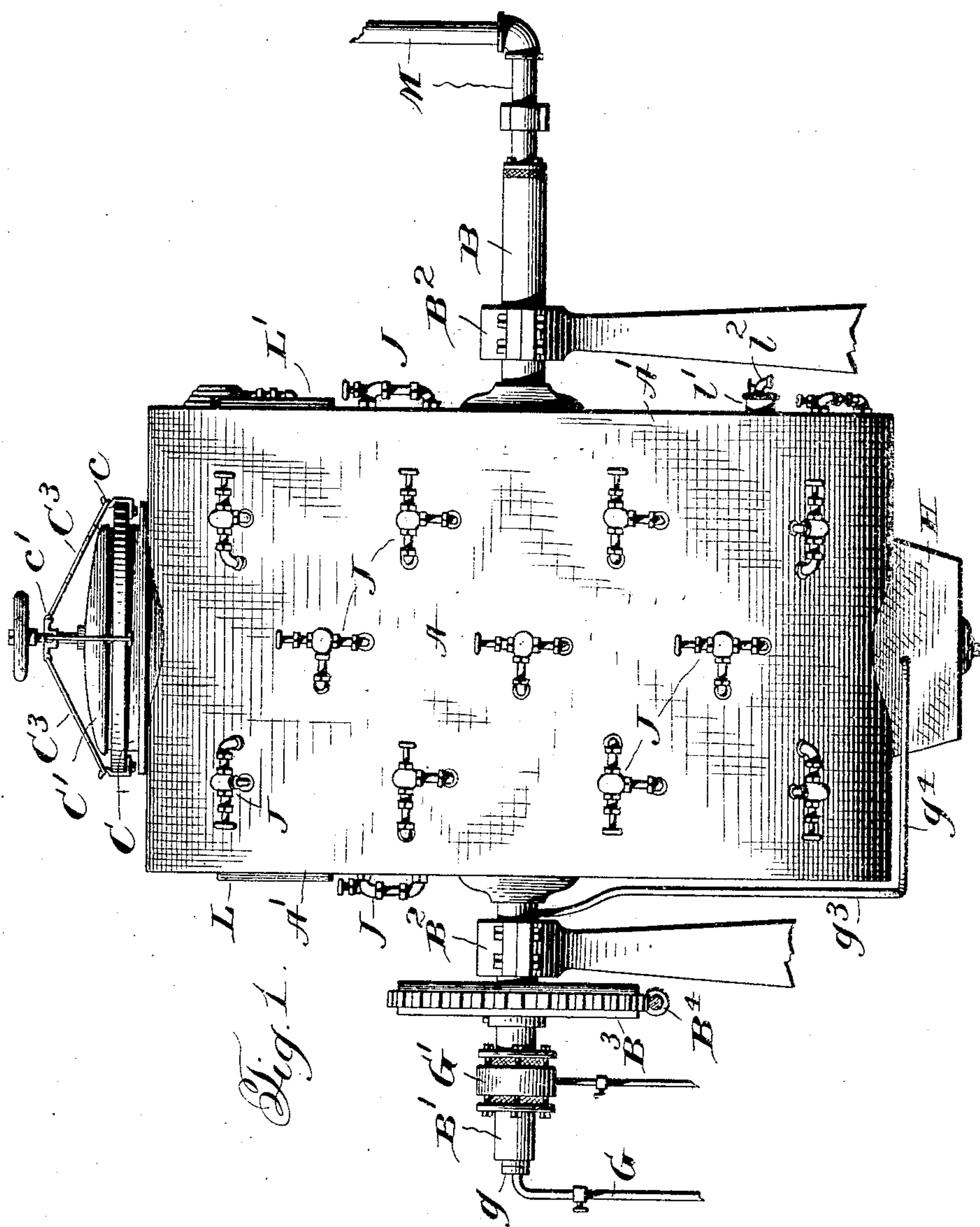
PATENTED MAR. 28, 1905.

W. J. WELLS.

DRYING APPARATUS.

APPLICATION FILED SEPT. 26, 1904.

3 SHEETS—SHEET 1.



Witnesses:

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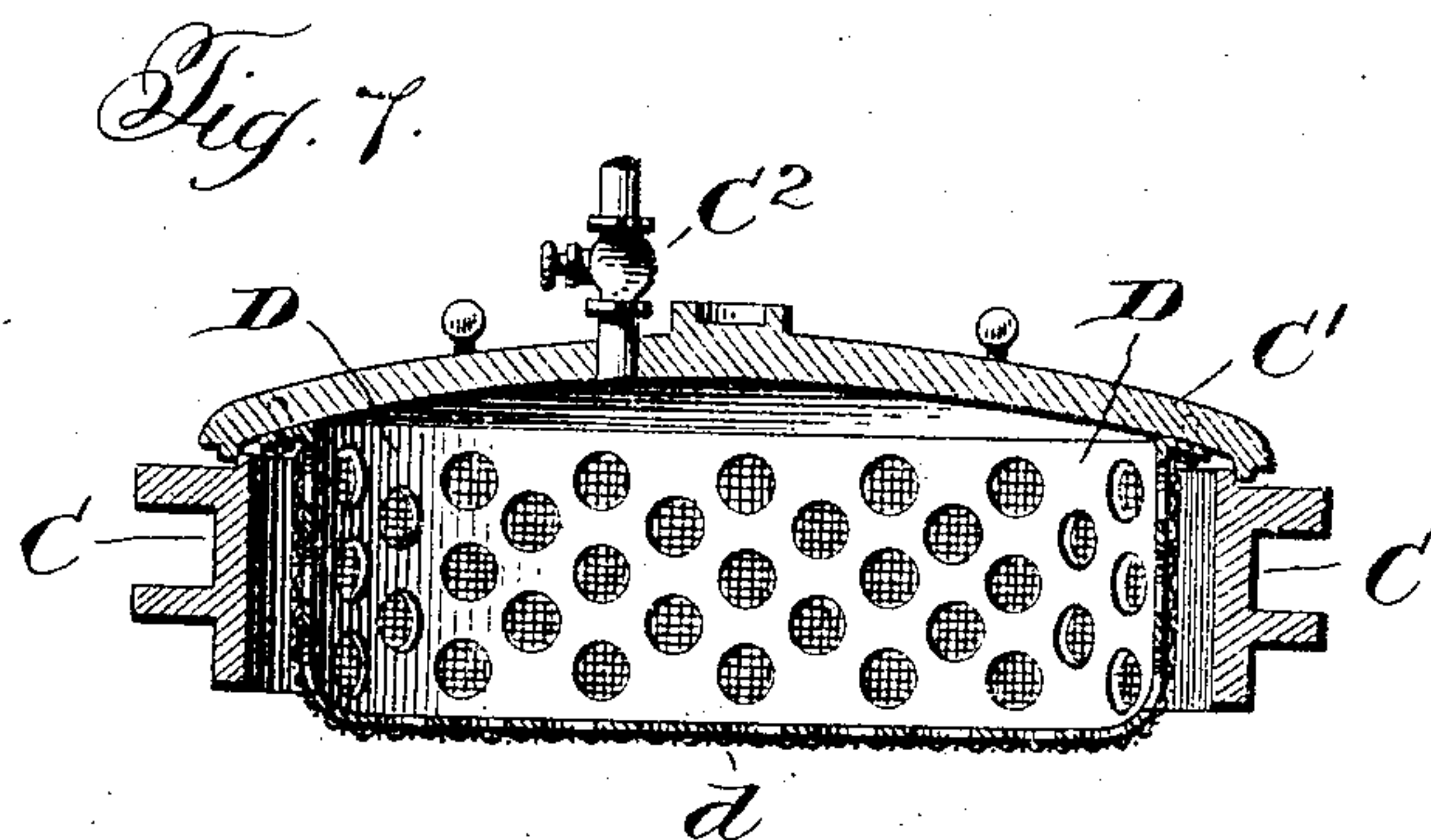
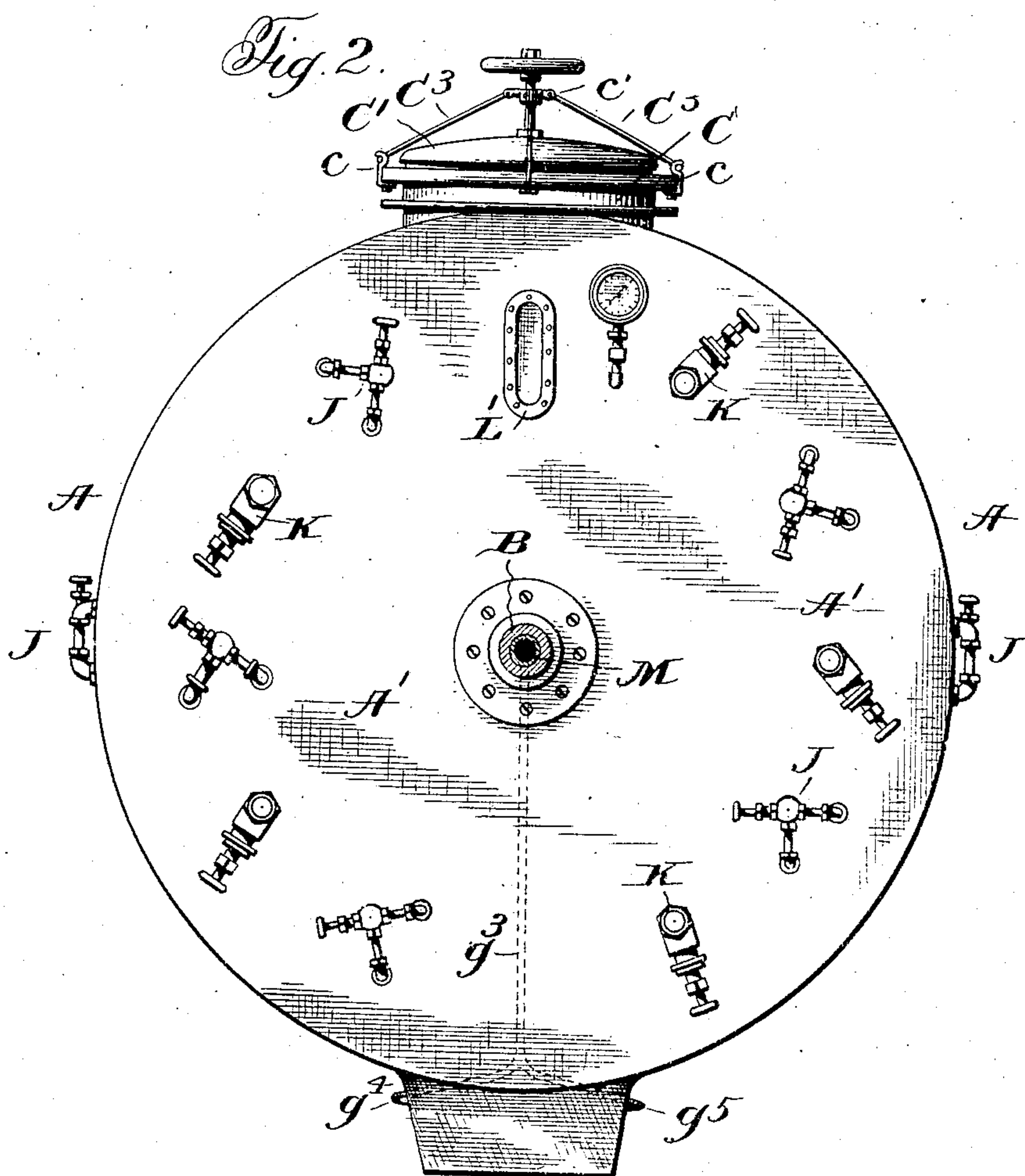
By Macmillan Attorneys

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3 SHEETS—SHEET 2.



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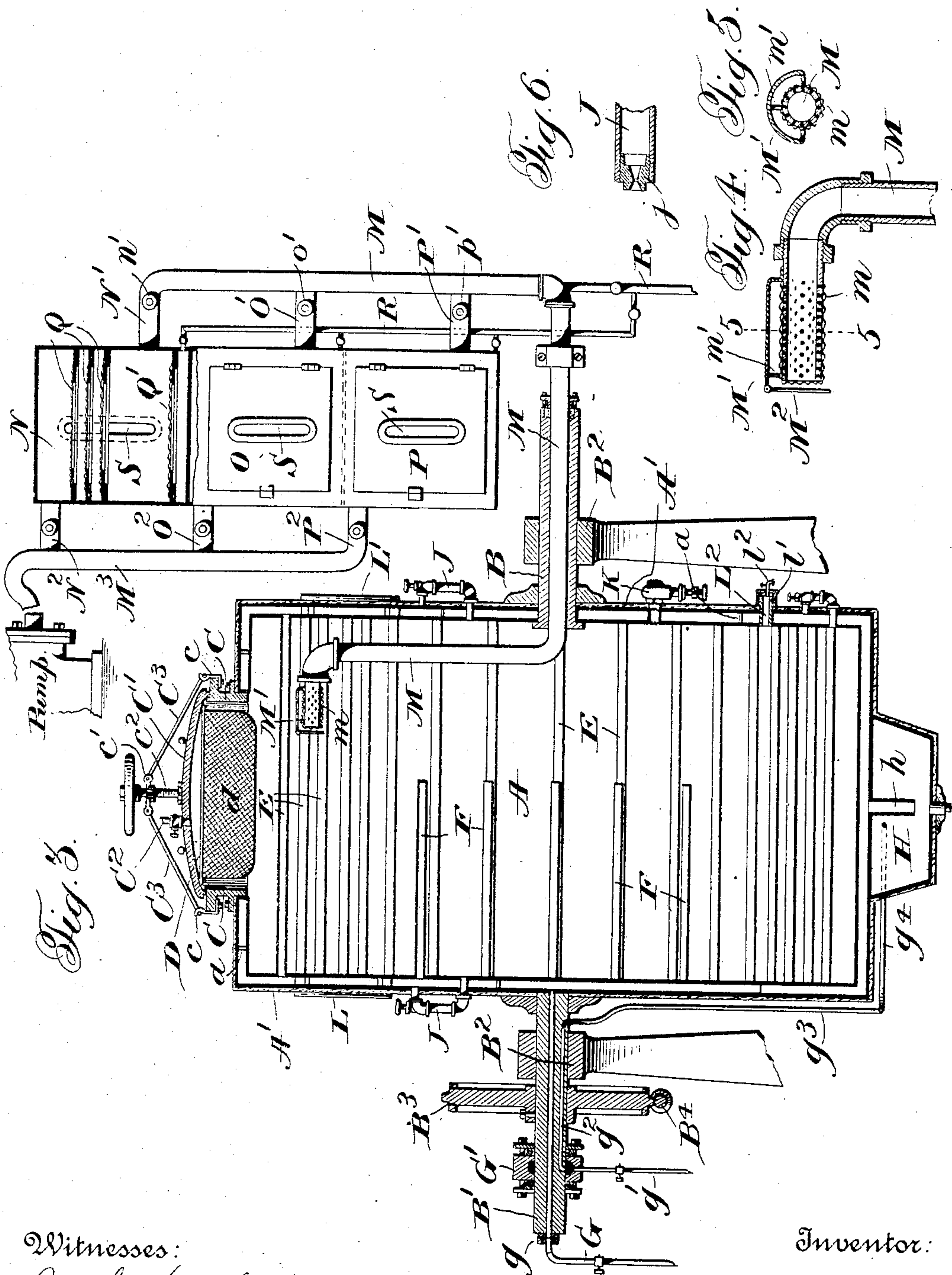
By *Thurman Milam* Attorneys.

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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

WILLIAM J. WELLS, OF DECATUR, ILLINOIS.

DRYING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 786,079, dated March 28, 1905.

Application filed September 26, 1904. Serial No. 226,062.

To all whom it may concern:

Be it known that I, WILLIAM J. WELLS, a citizen of the United States, residing at Decatur, in the county of Macon and State of Illinois, have invented certain new and useful Improvements in Drying Apparatus, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to an improvement in drying apparatus, and is embodied in the construction and arrangement of parts presently to be described, and defined in the claims.

The invention is designed more particularly for drying material from which oil has been extracted, although in its useful application the same may be employed in connection with other materials.

Heretofore in the extraction of oil from materials such as cereals it has been customary to employ a solvent, such as naphtha, for extracting the oils.

The aim of the present invention is the provision of an apparatus whereby the materials after being treated by the solvent is thoroughly dried and rendered useful for other purposes, such as for stock-food if cereals are used, and for other purposes if other materials are used.

In the accompanying drawings I have shown a drying apparatus designed for successful use and which has been successfully used; but it is to be understood that the invention is not limited to the construction shown and that wide latitude as to change of parts and construction can be made without departing from the spirit of the invention.

In the drawings, Figure 1 is a side elevation of the improvement, showing the separator omitted. Fig. 2 is an end view looking to the left of Fig. 1. Fig. 3 is a longitudinal vertical section through the apparatus as a whole. Fig. 4 is an enlarged view of the end of the vent-pipe. Fig. 5 is a section through the line 5 5 of Fig. 4. Fig. 6 is a detailed enlarged view of one of the injector-nozzles, and Fig. 7 is a sectional view through the cup.

The form of apparatus illustrated comprises a cylindrical drum-like structure A, having

hollow or double walls spaced apart in any suitable or convenient manner, conveniently by set-bolts *a*. The outer surface of this drum or cylinder is conveniently coated with a non-heat-conducting cover A'. The cylinder is supported centrally on two hollow trunnions B B', mounted in suitable bearings B². On the trunnion B is mounted a worm-gear B³, with which a worm B⁴ engages, driven from any suitable source of power. At one point in the circumference of the drum-like container is an opening surrounded by a suitable neck C, rigidly secured to the cylinder and which is conveniently provided with attaching-flanges, as shown in Fig. 3, through which suitable bolts are passed.

C' designates a cover of any desired or convenient form, preferably inclined or concave on its inner face. This cover is provided with a suitable supply and discharge pipe C², having a valve therein, said pipe leading through the cover to the interior of the machine. The cover is removably secured in place in any convenient manner, preferably by a series of links, such as C³, detachably connected with hooks *c*, secured to the neck, and their opposite ends being pivotally secured to the nut *c'*, mounted on the vertical stem *c*², the lower end of which rests in a seat on the cover, while the upper end carries a suitable hand-wheel. By this construction the cover can be rigidly secured in place. Fixedly secured to the under side of the cover is a metal cup-shaped support D, having a flanged outer edge and having its body portion projecting into the neck part of the opening and for a short distance into the container. This cup-shaped support is perforated throughout with relatively large perforations and carries on its exposed face a wire-gauze covering *d*, which latter is secured in place by suitable bolts and bands to the flanged part of the cup-shaped support.

Extending at intervals transversely across the interior of the container are a series of hollow pipes E, the same being located adjacent the periphery, as shown in Fig. 3, and communicating at opposite ends with the hollow walls of the container, while projecting

out from one end wall of the container, adjacent the center, are a series of hollow spurs F, closed at their outer ends.

G designates a steam-supply pipe entering through the hollow trunnion B' and communicating with the interior of the hollow walls of the container A. This pipe is provided with a loose joint at g , so that the section located in the trunnion may be turned without breaking the joint with the stationary part of the pipe.

Surrounding the trunnion B' is a hollow collecting-box G', the interior of which is annular and has leading therefrom a drip-pipe g' . Into the hollow annular chamber of the block G' leads a passage g^2 , with which the drip-pipe g^3 communicates. The end of the drip-pipe is branched into complementary branches g^4 g^5 , the same leading into and terminating in a collecting-basin H, secured to the container conveniently opposite the opening therein and having sloping walls. This collecting-basin has a drip-stem h leading from the interior of the hollow walls of the container and terminating a short distance below the ends of the branch pipes g^4 g^5 and in proximity to the lower end of the basin, as shown in Fig. 3. In this connection it may be noted that as the steam is introduced into the hollow walls of the container the water of condensation will find escape through the drip-stem h and be received in the basin H. Thereafter as the container is rotated the water of condensation will pass through one of the branches of the pipe g^3 as the basin is moving upward and thence through the other branch while the basin is descending during the rotation of the container. The drip is carried off through the pipe g^3 , passage g^2 , and drip g' .

Interspersed through the sides and ends of the container are a series of valve-stem inlet-pipes J, one end of which communicates with the space between the inner walls of the container, while the other end is carried through the walls and communicates with the interior of the container. By this means steam is permitted to escape forcibly from the interior of the hollow walls directly into the container, and to provide for a spraying effect a suitable spraying-nozzle is located in the end of the pipe J that leads into the container. This nozzle is shown in Fig. 6 and consists conveniently of the plug j , having oppositely-arranged tapered recesses communicating with each other, the plug being secured in the end of the pipe J.

K designates a series of air-inlet ports in the form of ordinary gate-valves, which control openings leading directly into the container. It is to be understood that any desirable form of device can be employed for admitting air from the outside to the interior of the container, as well as for admitting steam into the container.

It is often desirable to inspect the contents

of the container, and for that purpose I have provided an inspection-opening L L' on opposite sides, the same being suitably glazed. It is also desirable to have means for testing the conditions of the material by extracting small quantities or by the insertion of a thermometer to ascertain the heat. This is permitted by inserting through the walls of the container at one or more points a test-opening L³, capped by a suitable removable cap l' , which cap is conveniently provided with a blow-cock l^2 , as shown in Fig. 3.

M designates the vent-pipe, passing through the hollow trunnion B and secured by any suitable means against rotation. This pipe is extended upward within the container, its upper end being turned at an angle and provided with a series of perforations. Surrounding the perforations of the vent is a wire-gauze covering m , while above the same is a deflecting-hood M'. This hood extends down conveniently to a point at or near the center of the tube and is secured to the tube or pipe rigidly at one end and loosely supported at the other end by a stud or post m' . The outer end of the hood M' is provided with a hinged deflector M². This construction of inlet for the vent-pipe prevents the accumulation of any mass of material on the pipe, the sieve and perforations permitting a free ventage, but preventing any large mass of material entering thereinto, while the hood prevents the material descending forcibly onto the pipe and clogging the same or forcing itself through the perforations. The deflector is designed more particularly to intercept any steam-jets and prevent the steam from being projected directly into the vent. These features of the invention, while being desirable, are not necessarily indispensable.

It often occurs in drying material, especially with the injection of the dry material and in the event of the use of a suction-pump, that particles will be drawn through the vent-pipe, and to recover these particles, as well as to render the escaping vapor relatively pure for future distillation and recovery, I provide a separator, into which the vent-pipe leads. This separator, as shown in Fig. 3, consists conveniently of a casing having three separate compartments N O P, conveniently imperforate and provided with doors at their sides. Each compartment is segregated from the other and provided with a series of removable sieves Q of varying degrees of fineness and are also provided with a removable collecting perforated pan Q' in their lower portions. These pans and the sieves rest on suitable ledges or flanges secured to the sides of the compartments. The pipe M is carried up and is provided with branches N' O' P', leading, respectively, into the compartments of the separator at a point below the sieves Q and above the collecting-pans Q', each of said branches being provided with a damper or cut-off valve

p' o' n'. Leading from the upper rear side of the compartments of the separator are branch pipes $N^2 O^2 P^2$, which are provided with suitable dampers and communicate with the main trunk-pipe M^3 , which terminates in a suction-pump, as shown. Leading from the bottoms of the respective compartments below the pans Q' is a drip-pipe R , having suitable valved branches entering the various compartments. This drip-pipe extends downward and is coupled to a main drip-pipe R' , leading from the horizontal portion of the main exhaust or vent pipe M , the purpose of these drip-pipes being that of carrying off any condensed liquids that may accumulate during the passage of the escaping vapors through the pipe M and the collecting-chamber. For the convenience of examining the various sieves suitable windows S may be placed in the separator-compartments, as shown.

In stating the operation of the machine I would first suggest that the machine is loaded with the material and naphtha or a solvent introduced through the pipe C^2 until the material becomes thoroughly saturated. During this interval the container is rotated, while the escape or ventage from the pipe M is prevented by a closure of the valves to the separator. After the material has been thoroughly saturated with the solvent the container is turned so the top will be downward and the solvent, with the extracted oil, permitted to escape through the pipe C^2 . The valve of the pipe C^2 is then closed. Steam is admitted into the hollow walls of the container, passing through the various crossover pipes and into the spurs, thereby rapidly heating the contents, and thus vaporizing quickly the volatile fluid. The valves controlling the vent-pipe are then opened, and the gas or vapor under its expansive force will escape through the vent-pipe. The steam-supply pipes J are then opened at the various points, resulting in the mass being impregnated by the hot steam forcibly at points throughout, and as the container is continued to revolve the various particles of material being treated are subjected to the action of the steam. This results in driving off the remaining volatile fluids, creating a pressure in the container, and forcing the gases out through the vent-pipe into the separator. The suction-pump may then be operated to accelerate the movement of the gases, and as the sieves Q are interposed between the inlet to the separating-chambers and the outlets any particles of material carried over by the vapors are caught on the sieves and prevented from escaping. As the sieves in one of the compartments becomes clogged with the escaping material it is only necessary to shut or cut off that compartment and turn the flow into one of the other compartments of the separator. Therefore I have found it convenient to employ three separate

compartments, all communicating independently with the vent-pipe and the suction-pump, thereby resulting in a continuous operation of the machine during the drying interval, and so without interrupting the escape of the gases. After the volatile fluid has been driven off by the heated steam the steam-pipes J are closed and the air-inlet ports K are opened. The suction-pump operating causes a current of air to issue into the container, and as the material is still rotated or in motion and as the mass is broken up by the crossover-pipes and the spurs, as well as by the falling of the mass during rotation, the air impregnates the entire mass, carrying off all the moisture therein contained into and through the separator and discharges the same. In this connection it may be stated that suitable sieves may be placed over the ends of the air-ports to prevent the accidental escape of the material. The result of the above operation is that upon the removal of material from the container through the neck it will be found to be dry throughout, all particles of solvent being driven off and the material otherwise rendered useful for future use.

In using the apparatus in connection with the germs of corn recovered from hominy-mills it will be found that a very valuable stock-food results from the product produced by the above-described apparatus and method.

While I have described the invention as applicable for certain material, it is to be understood that any material can be dried therein, the steam being employed to open the pores and drive off solvent gases, while the forced air serves to eliminate the natural moisture, as well as the moisture of the steam. I therefore do not confine myself to any particular use for the apparatus or drier.

I desire it understood that the proportions of the various parts are not illustrated as being exact, but rather diagrammatical. In use the proper relative proportions of the pipes and other parts will be employed.

In Figs. 2 and 3 I have shown the structure with the duplicated steam-inlet pipes omitted for the purpose of simplifying the structure.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is—

1. In an apparatus of the character described, the combination with a hollow-walled rotary container, means for introducing steam into the hollow walls, a drip-trap outside the container communicating with the interior of the hollow wall, and a discharge leading from the drip-trap, substantially as described.

2. In a drier, the combination with a rotary container having hollow walls, of a drip-trap communicating with the interior of the hollow walls and located outside of the container, and a pipe leading from said trap, substantially as described.

3. In a drier, the combination with a rotary

container having hollow walls, of a drip-collecting receptacle carried by the outer wall of the container, a steam-pipe leading from the interior of the hollow walls into the receptacle, and a discharge-pipe leading from the receptacle.

4. In a drier, the combination with a rotary container having hollow walls, of a drip-collecting receptacle carried by the container, a steam-pipe leading from the interior of the hollow walls into the receptacle, and a discharge-pipe having branches leading from opposite sides of the receptacle.

5. In a drying apparatus the combination with a rotary container having a series of air-inlet openings interspersed at different points in its walls, means for governing the openings, means for causing currents of air to forcibly enter the container through the openings during the rotation of the container, and means whereby the contents of the container can be heated.

6. In a rotary drier, the combination with a container, having a hollow wall, a steam-passage to the hollow wall, steam-inlets to the container, a series of valved air-inlets arranged at different points in the walls of the container, and means for causing currents of air to forcibly enter the container through the air-inlets.

7. In a rotary drier, the combination with a rotary container having a fixed upwardly-extending vent-pipe leading therefrom and a series of air-inlet openings, valves for the openings, means for heating the interior of the container, and a suction device connected with the vent.

8. In a drier, the combination with a rotary container, of valve-controlled means for supplying steam to the interior of the container during rotation, air-inlet valves located at various points in the container, and means for creating a suction communicating with the interior of the container and operating during the rotation.

9. In a drier, the combination with a rotary container, of a series of air-inlet valves in the walls thereof, means for heating the container, and a suction-pump for creating a suction within the container during the rotation thereof.

10. In a rotary drier, the combination with a container, of a separator comprising a plurality of independent chambers, a vent communicating with the interior of the container and having valve communications with the separators, a valve drip-pipe communicating with the separator, and valve discharge-openings for the respective separators.

11. In a rotary drier, the combination with a container, of a vent-pipe leading therefrom having a perforated end, a hood over the perforated end, and a baffle extension at the end of the hood, and means for ejecting steam into the container.

12. In a rotary drier, the combination with a container having an opening therein, of a cover therefor, and a cup-shaped disk carried by the cover having a netted covering thereon.

13. The combination with a casing having hollow walls, of means for introducing steam into the walls, a drip-stem leading from the space within the walls, a collecting-compartment into which the drip-stem leads, a discharge leading therefrom, and means for rotating the casing.

14. In a drier, the combination with a rotary container, of a vent-pipe therefor, means for introducing air into the container, means for creating a suction through the pipe, and a series of separators interposed between the suction means and the container provided with means for cutting off circulation therethrough, and each having removable separating means therein.

15. In a drier, the combination with a rotary container, of a vent-pipe therefor, means for introducing steam and air into the container, means for creating a suction through the pipe, and a series of separators interposed between the suction means and the container provided with means for cutting off circulation therethrough, and each having removable separating means therein.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM J. WELLS.

Witnesses:

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JAS. T. WHITLEY.