

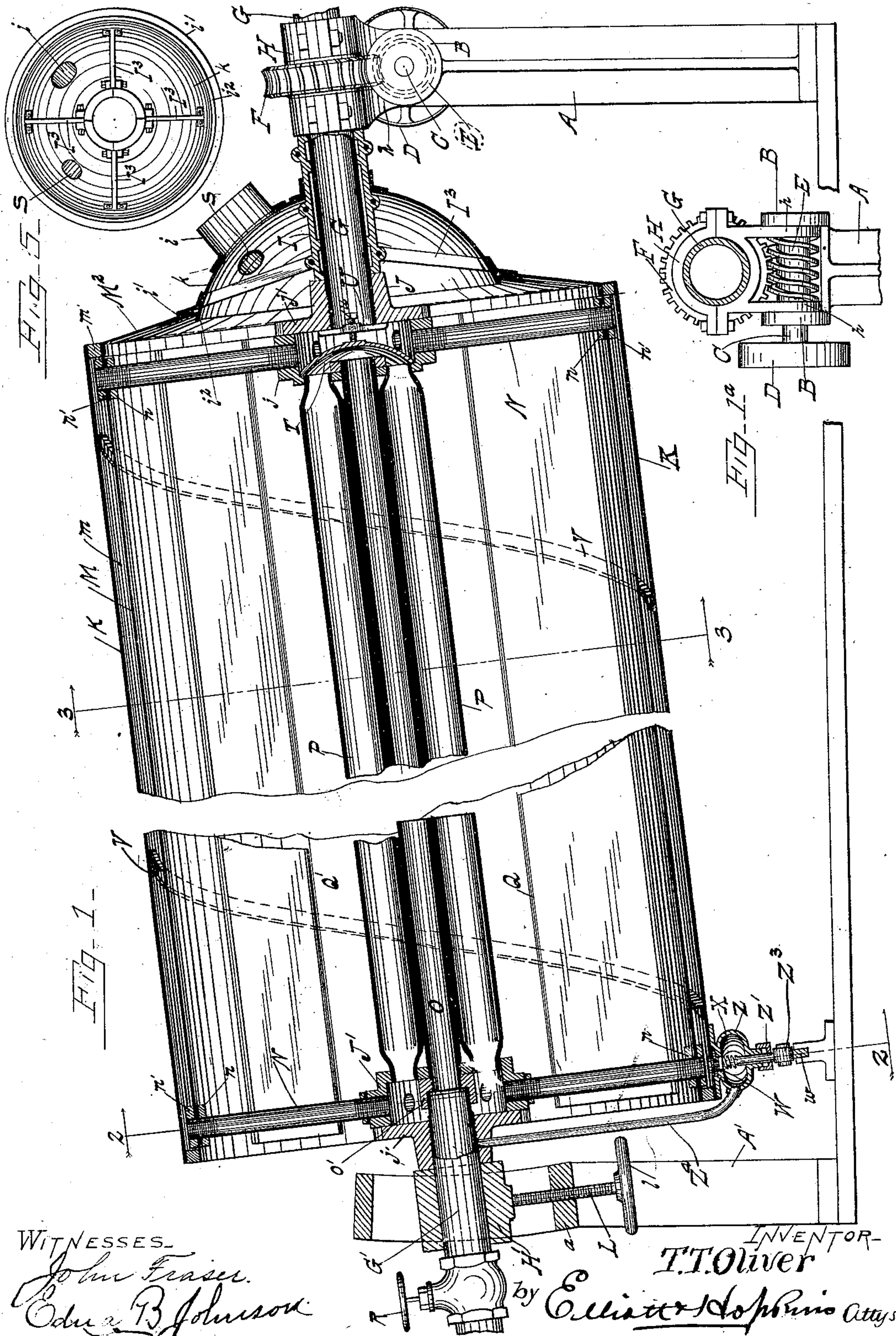
(No Model.)

2 Sheets—Sheet 1.

T. T. OLIVER.
DRIER.

No. 561,175.

Patented June 2, 1896.



WITNESSES.

John Fraser.
Oscar B. Johnson.

INVENTOR-

T.T. Oliver

by E. L. & S. P. R. Attys

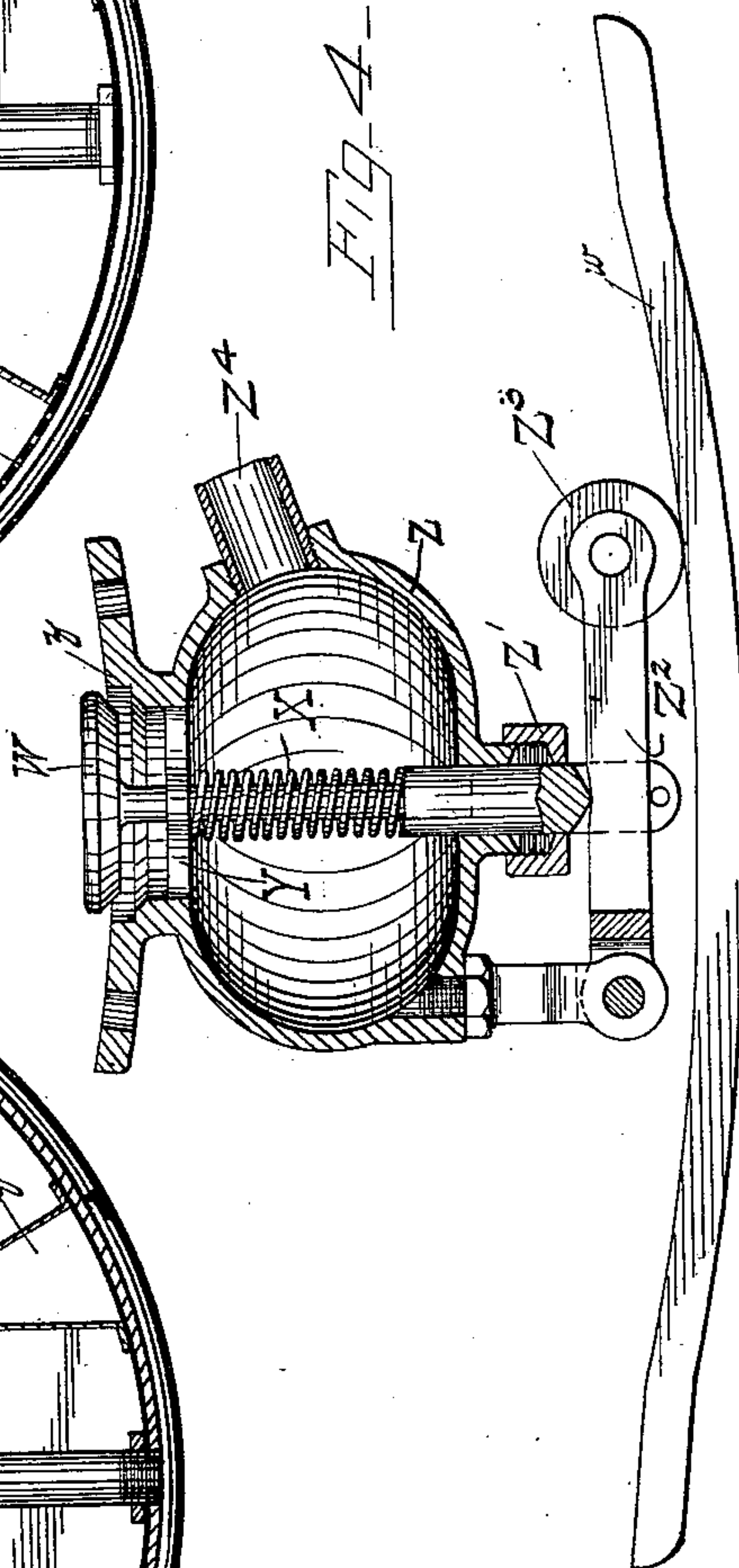
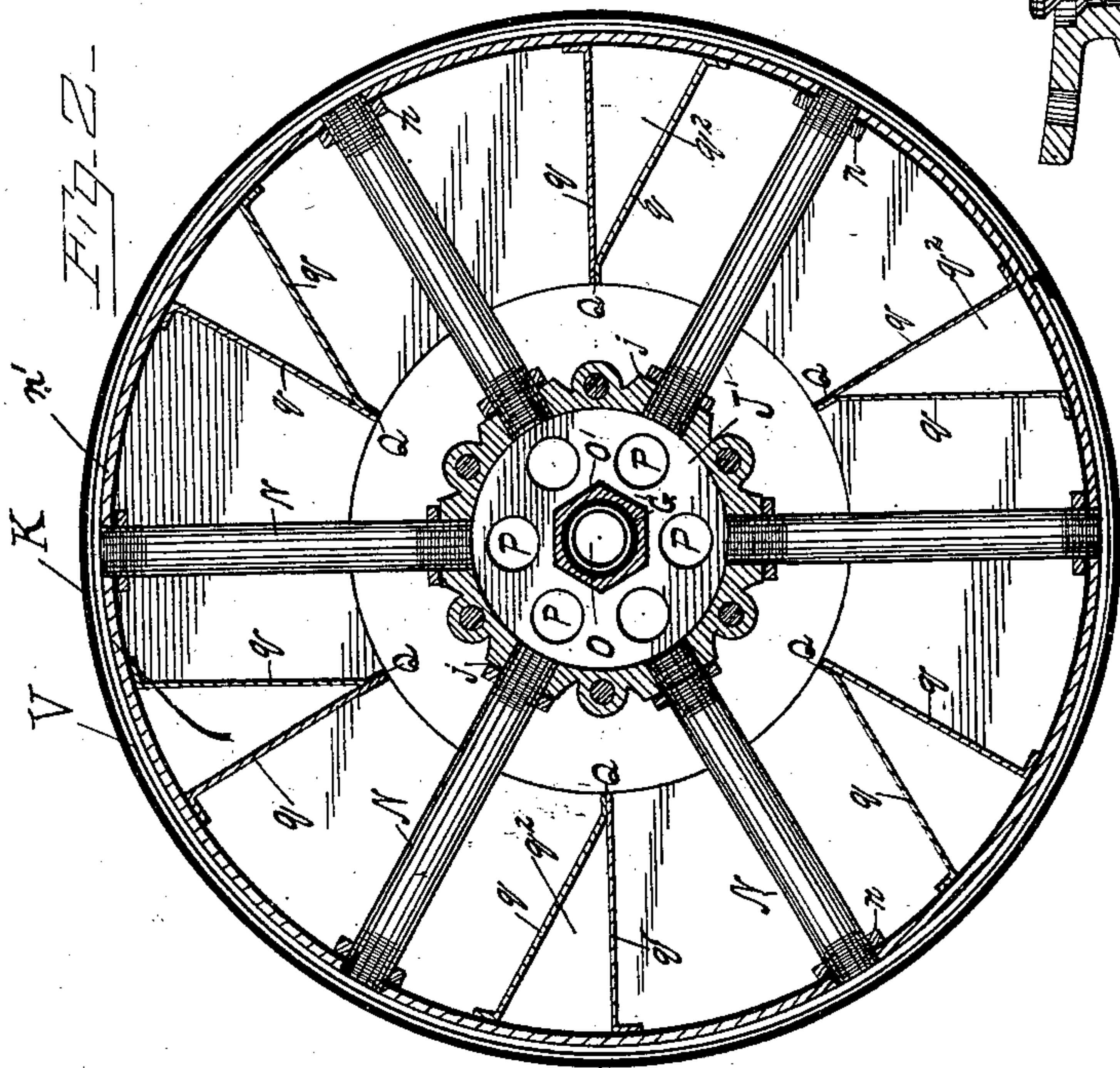
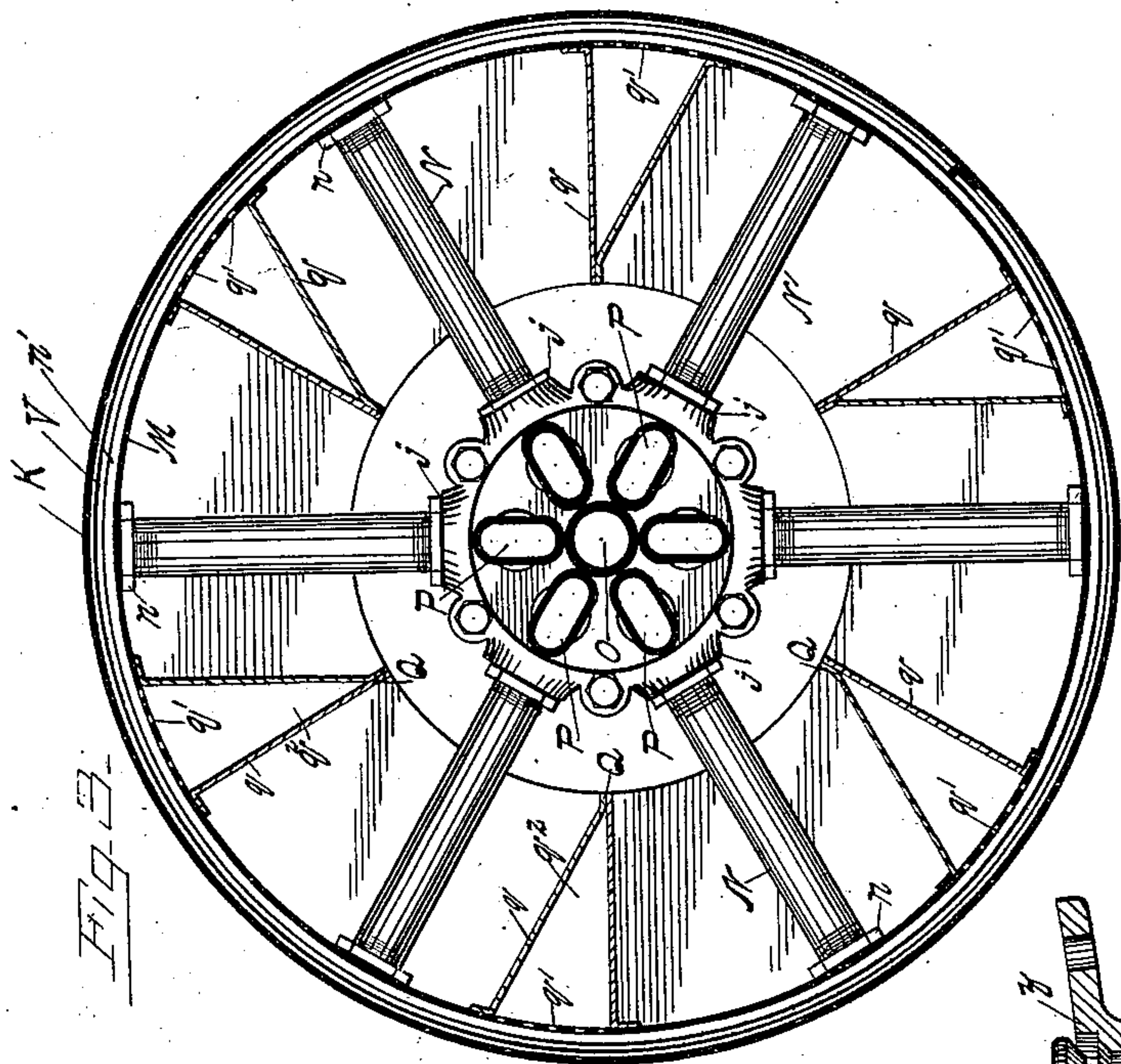
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UNITED STATES PATENT OFFICE.

THOMAS T. OLIVER, OF CHICAGO, ILLINOIS.

DRIER.

SPECIFICATION forming part of Letters Patent No. 561,175, dated June 2, 1896.

Application filed April 9, 1894. Renewed September 25, 1895. Serial No. 563,663. (No model.)

To all whom it may concern:

Be it known that I, THOMAS T. OLIVER, a citizen of the United States, residing at 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 relates to rotary drying apparatus, but more particularly to that class of driers used for drying granular or semigranular substances, and in which steam, hot air, or other heated fluid is employed for raising the temperature of the heating-surfaces with which the substance to be dried comes in contact.

The primary object of my invention is to greatly increase the superficial area of the drying-surfaces without thereby increasing the bulk or exterior dimensions of the apparatus.

Another object of my invention is to greatly prolong the passage of the steam or other heating medium through the drier without thereby increasing its dimensions; and a still further object is to provide improved means for automatically discharging the waters of condensation and conducting the same away from the machine; and my invention has for its object, finally, to improve and simplify the general construction and arrangement of the parts of rotary driers.

With these ends in view my invention consists in certain features of novelty in the construction, combination, and arrangement of parts by which the said objects and certain other objects hereinafter described are accomplished, as fully explained with reference to the accompanying drawings, and more particularly pointed out in the claims.

In the said drawings, Figure 1 is a vertical longitudinal section of my improved drier, the driving-gear being shown in elevation. Fig. 1^a is a detail view of the driving-gears. Fig. 2 is a transverse section of the rotary cylinder, taken on the line 2 2, Fig. 1. Fig. 3 is a similar section taken on the line 3 3, Fig. 1. Fig. 4 is an enlarged detail view of the valve and operating mechanism, and Fig. 5 is a detail view hereinafter described.

In the drawings, wherein like signs of reference indicate like parts throughout the several views, A is a post or standard or other

suitable frame, in which is journaled in suitable bearings B a horizontal shaft C, provided at one end with a suitable pulley D, by means of which power may be transmitted to such shaft for rotating the drier, as will be hereinafter explained. Mounted upon and secured to the shaft C is a worm or screw E, with which engages a worm-wheel F, secured to a shaft G, which forms one end of the axis of the rotary drier. The shaft G is journaled or mounted in a suitable sleeve or journal-bearing H, which is provided on its under side with an inverted-U-shaped yoke h, through whose depending ends or ears the shaft C passes and between which ends or ears the worm E is mounted. The journal-bearing H, if desired, may be in two parts, like an ordinary journal-box, as shown in Fig. 1, and immediately above the worm E it is cut away to receive the worm-wheel F. The shaft G passes through a suitable sleeve I, formed on or secured to the bearing H at its outer end, while at its inner end it is secured to a hub J, upon which the outer cylinder or jacket K is mounted at one end, while the other end is mounted on a similar hub J', from which latter projects a shaft G', which is coincident with the shaft G and constitutes the outer end of the axis of the drier.

The shaft G' is mounted on an adjustable bearing or collar H', provided with any suitable means for restricting it to a vertical movement and changing its altitude. I have shown in the drawings and I prefer to use a slotted standard or post A', in which the bearing or collar H' fits with capability of sliding up and down throughout the length of the slot in such standard, and the said standard at a suitable point below the bearing or collar H' is provided with a cross-bar a, in which is threaded an upwardly-projecting screw L, whose upper end supports the bearing H' and whose lower end is provided with a suitable knob or hand-wheel l, by means of which the screw may be turned and the bearing or collar H' adjusted to the proper elevation. Thus it will be seen that by the manipulation of the adjusting-screw L the inclination of the drier may be quickly and conveniently varied without interrupting the operation of the apparatus, inasmuch as the journal-bearing H is pivoted with capability of rotating concentrically.

trically about the axis of the worm E, and consequently holds the wheel F in engagement with the worm E at all times, however high or low the rising-and-falling end of the apparatus might be.

The head M^2 at the upper end of the apparatus is provided with an opening in which is fitted a hood k , having flanges $i' i^2$ embracing the edge of the opening in the head M^2 , and thus forming a tight joint, while permitting the rotation of the head. This hood k may be provided in one side with an opening i for the admission of the air-blast and in the other side with an opening S, through which the material to be dried is fed to the machine. The sleeve I passes through a suitable opening in the hood k and is provided with a number of supporting-arms I^3 , secured thereto and also to the inner side of the hood, whereby the latter is firmly supported independently of the head M^2 .

Arranged within the cylinder or jacket K is a second cylinder or lining M, which is arranged, preferably, concentrically therein and secured thereto at its ends so as to form between the two cylinders a closed space or annular chamber m for steam or other heating medium. As a convenient manner of securing the two cylinders together I arrange between the two cylinders, at each end, a ring m' , to which the cylinders are suitably secured.

Both of the hubs J J' are hollow, and each is provided with radial spokes or arms N, which are also hollow and which support the cylinders K M on the hubs and at the same time serve to place the annular space or chamber m and the hollow hubs J J' in communication. The hubs J J' may be provided at suitable intervals on their peripheries with hollow interiorly-threaded bosses j , into which the threaded inner ends of the spokes N are screwed, while the outer ends of such spokes may be threaded and passed through openings in the lining or cylinder M and held therein by jam-nuts n , threaded upon the spokes N and bearing upon the inner periphery of the lining M, while the extreme ends of such spokes are threaded in bands or rings n' , which encircle the said lining, thereby firmly clamping the parts together and constituting a steam-tight joint.

The shaft G is hollow and constitutes the inlet-pipe for steam or other suitable heating medium and to which source of heating medium it may be connected in any convenient manner, and the shaft or journal G' is also hollow and constitutes the outlet or exit for the heating medium after it has passed through its various channels and passages in the drier.

The hubs J J' are connected together by a pipe or tube O, which is preferably in axial alinement with the shaft G' and constitutes a continuation of the latter and has its one end secured in the inner end of the hub J by means of a suitable ring or nut o or equivalent

device, while its other end is secured in a nut o' , which also constitutes a coupling for the shaft G'. The pipe or tube O is preferably round or cylindrical and arranged around and preferably in contact with this cylindrical pipe O. With their ends screwed or otherwise secured into the inner ends of the hubs J J' are a number of tubes or pipes P, which, however, are flat in cross-section throughout their length between the hubs and are so arranged as to form flat radial wings or drying-blades, as more clearly shown in Fig. 3. For the sake of convenience in securing these flat tubes P in the hubs J J' the ends of such tubes may be left cylindrical and expanded or otherwise secured in the complementary holes in the hubs. The outer ends of the hubs J J', if desired, may be provided with removable heads j' , held in place in any convenient manner.

The purpose of flattening the pipes P is to increase their superficial areas, so as to present a larger heating-surface for contact with the material agitated within the rotating cylinder M, and also to form flat wings or blades, which will be capable of catching the material as it falls upon them and conveying it upward, causing it in its ascent to first come in contact with the central pipe O, and then to shift onto the next lowest pipe or blade P, from which it will slide back into the cylinder.

In ordinary rotary driers it is common to employ on the interior of the cylinder a number of wings or agitators, which catch the material as the cylinder rotates and carry it upward, it being cast in its course from one of such agitators to another, and thus a more thorough agitation of the material is effected than could possibly be accomplished by means of the cylinder alone. Such wings or agitators as these might be used in conjunction with my improved hollow blades P and pipe O, which also constitute agitators; but in order that the superficial heating-surfaces of the drier may be still further increased I use instead of such plain wings or agitators a series of hollow wings or agitators, which have communication with the annular chamber m , whereby the steam or other heating medium circulating in such chamber will also enter and heat the hollow wings and thus greatly expedite the drying of the material as it is agitated and carried around by them. These wings may be constructed in any of many ways which will readily suggest themselves to the ordinary mechanic. A convenient and simple construction consists of two longitudinal plates q , secured together at their inner edges at an angle and fastened at their outer edges to the lining M, the lining M being provided with perforations or openings q' , through which the steam or heating medium enters the wings or agitators Q. The ends of the hollow wings are of course closed by suitable sheets or plates q^2 , so as to prevent the escape of the steam or heating medium into the interior of the apparatus where the substance

undergoing the drying process is situated. If desired, one of the plates q of each wing may be arranged on the diameter of the cylinder so as to be radial to its axis, whereby the wings will hold the material throughout a greater range of their travel.

In order that the steam or other heating medium as it enters the apparatus through the pipe G may not rush directly through the tubes $O P$, but may be compelled to pervade the chamber m and the hollow agitators Q , as well as the tubes $O P$, I arrange over the upper ends of the tubes $O P$ a shield or deflector T , which closes direct communication between the shaft G and such tubes without cutting off communication between the tubes themselves, the deflector being concaved or cup shape, as shown in Fig. 1, thus constituting a direct passage through the machine. This deflector may be conveniently held in place by resting its edge against the inner side of the hollow hub J around the outer edges of the tubes P and providing the end of the hollow shaft G , or the opening in the hub J through which such shaft enters, with a spider or cross-bar U , between which and the shield T bears a set-screw w , which may be threaded in the spider, as shown in Fig. 1, thus forcing the spider and shield in opposite directions and holding the two in place. It will now be understood that when the steam or other heating medium is turned on through the hollow shaft G it will enter the hub J and striking the shield T will be deflected into the chamber m via the hollow spokes N , leading to the hub J' . From the hub J' its only course of escape is through the tubes or drying-blades P back again toward the hub J , because the shaft G' does not communicate with the hub J' , but is connected directly with the tube O . After entering the drying-blades P it passes between the shield T and the ends of the tubes into the tube O and finally passes off via the exit or shaft G' , having in its course pervaded the various pipes and passages of the drier and heated the drying-surfaces to a high degree. In order, however, that the temperature of the drier may be regulated, I provide the exit G' with a regulating-valve R , by means of which the steam or heating medium may be compelled to discharge less freely, and hence caused to more thoroughly pervade the apparatus, and in so doing raise the temperature to a greater degree than would be attained were the heating medium allowed to escape as freely as it entered. When it is desired to reduce the temperature, it is only necessary to open the valve R and permit the free escape of the steam.

The material to be dried, as it is fed into the machine through the feed chute or pipe S , drops into the apparatus, and during the revolution of the latter, caused by the rotation of the worm E , as explained, such material is caught by the agitators Q and carried aloft and scattered upon and between the pipe O and blades P , whence it spills back into the

cylinder, and throughout its course it is subjected to the combined drying influence of the heated surfaces and the air from the blast-pipe i , which may be hot or cold and which serves to carry off the moisture as it evaporates from the material. The air and material of course discharge from the lower end of the apparatus, which is open as usual.

Inasmuch as the cylinders $K M$ are constructed preferably of thin material and are of great length, it is desirable to reinforce or stiffen them in order that they may not sag or bend. To accomplish this and at the same time still further prolong the course of the steam or heating medium through the chamber m , and also to compel it to enter the hollow agitators Q , I arrange between the two cylinders an angle-iron or rib V , which takes a spiral course around the inner cylinder and is of sufficient width to fill the cross-section of the chamber m , thus constituting a spiral passage for the steam within the chamber m and preventing it from passing directly from the upper to the lower spokes, and also compelling it to enter the hollow agitators in order to pass the angle-iron or rib.

In order to permit the passage of the waters of condensation from the chamber m without at the same time permitting the steam to escape, I provide the outer cylinder K at its lower end with an opening, which is guarded by a valve W , held normally closed by a spring X , sleeved on the valve-stem and bearing between a shoulder thereon and the spider Y . The said opening in the cylinder K is in communication via the valve with a chamber Z , which may be conveniently formed in one piece with the valve-seat z , as shown in Fig. 4. The valve-stem projects through a suitable stuffing-box Z'' on the chamber Z , and is engaged by a lever Z^2 , one end of which is pivoted in any suitable manner, as shown in Fig. 4, to a support on the chamber Z , while its other end is provided with an antifriction-roller Z^3 , whereby when the lever Z^2 is forced upward the valve W will be opened and any water contained in the chamber m permitted to escape into the chamber Z . In order that this opening of the valve may be effected automatically when the valve comes to a low position, as shown in Fig. 1, I provide a shoe w , which is arranged under the drier in a position to be struck by the antifriction-roller Z^3 , and thus force the valve W open.

In order that the water may be carried off from the chamber Z , I connect the latter, by means of a tube Z^4 , with the pipe G' , as shown in Fig. 1, so that when the chamber Z reaches an upward position the water will gravitate through such tube into the pipe G' , the tube or duct Z^4 being connected to the chamber Z at a point between the valve W and the exit-pipe G' , and the latter pipe being inclined, and the discharge end of the pipe Z^4 being attached to the pipe G' at a point beyond the hub and the heating-chamber, so that the point of communication between the tube Z^4

and the pipe G' is lower than the point of communication between the said pipe G' and the hollow spokes, the water will not run back into the latter or the hollow hub.

5 Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. A rotary drier, having agitators arranged upon its inner side, in combination with flat
10 hollow drying-blades arranged together at the center of the drier and adapted to catch and hold the substance operated upon, substantially as set forth.

2. A rotary drier having hollow agitators
15 arranged around its inner side in combination with centrally-arranged drying-blades, and means for conducting a heating medium to said blades and agitators, substantially as set forth.

20 3. In a rotary drier, the combination of a casing having agitators therein, of hollow hubs upon which said casing is supported, flat hollow blades extending between said hubs, and means for admitting a heating medium
25 to said hubs and blades, substantially as set forth.

4. In a rotary drier, the combination with a casing having agitators, of hollow hubs upon which said casing is supported, a tube or pipe
30 extending between said hubs, flat hollow blades communicating with said hubs and arranged radially around the said tube and in juxtaposition thereto, and a steam-inlet for one and an outlet for the other of said hubs, substantially as set forth.

35 5. In a drier, the combination with a casing having agitators, of hollow hubs having a steam inlet and outlet respectively, and flat hollow blades, extending between said hubs, and having rounded ends secured therein,
40 substantially as set forth.

6. In a rotary drier, the combination of two casings, arranged one within the other and forming a closed heating-chamber, and an
45 open drying-chamber disconnected with said heating-chamber, a continuous passage extending through said casings, and having connection at one end with a source of heated fluid, a valve at the other end of said passage
50 for regulating the exit therefrom, and pipes connecting said passage with said heating-chamber, whereby the exit from said passage and heating-chamber may be controlled by the one valve, substantially as set forth.

55 7. In a drying-machine, the combination with a drying-chamber, and a heating-chamber disconnected with, but arranged in juxtaposition to said drying-chamber, of a continuous passage connected with said heating-
60 chamber, and being arranged within but disconnected with said drying-chamber, the said passage and heating-chamber having an inlet and an outlet for the heating medium, and said outlet being provided with means for
65 checking the exit of the heating medium from the heating-chamber and the said passage whereby the heating medium may be caused

to accumulate in the said heating-chamber and passage, substantially as set forth.

8. In a rotary drier, the combination with
70 a drying-chamber, and a heating-chamber disconnected with but arranged in juxtaposition to said drying-chamber, of hollow drying-blades arranged within but disconnected with
75 said drying-chamber, said blades and heating-chamber having a common exit for the heating medium, and means for checking the escape of the heating medium from the said
80 blades, and thereby forcing the same into the heating-chamber, substantially as set forth.

9. In a rotary drier, the combination with
85 a drying-chamber and a heating-chamber arranged in juxtaposition to said drying-chamber, of a pipe or passage passing through said drying-chamber, tubes arranged around
90 said pipe or passage and communicating therewith, said heating-chamber and tubes having a common exit for the heating medium, and means for controlling said exit whereby the heating medium may be caused
95 to more thoroughly pervade the said tubes and heating-chamber, substantially as set forth.

10. In a rotary drier, the combination with
95 a drying and a heating chamber, having an inlet for the heating medium, of a number of tubes arranged within said drying-chamber, the ends of said tubes adjacent to said inlet being in direct communication with each
100 other but cut off from said inlet, some of said tubes at their other ends being in communication with the said heating-chamber while one of said tubes at the last said end is shut
105 off from the others and communicates with the exit, substantially as set forth.

11. In a drier, the combination of a heating-chamber and a drying-chamber, of hollow
110 hubs in communication with said heating-chamber, an inlet leading to one and an exit leading from the other of said hubs, a number of tubes connecting said hubs together, a shield interposed between the ends of said
115 tubes and said inlet at one end and one of the said tubes at the other end having direct communication with the exit and being cut off from the said hub at that end, substantially as set forth.

12. In a rotary drier, the combination with
120 a drying-chamber and a heating-chamber having an exit for the heating medium and a drain-aperture, of a normally-closed valve for said drain-aperture, a chamber communicating with said drain-aperture, means for opening said valve as the drier rotates, and
125 a tube connecting said second chamber with the said exit, the point of communication between the discharge end of said tube and said exit being below the point of communication between the exit and the heating-chamber,
130 substantially as set forth.

13. In a rotary drier, the combination with
a drying-chamber and a heating-chamber provided with a drain-aperture, an inlet to said
chamber for the heating medium, a hollow

inclined shaft supporting said chamber at one end and constituting an exit for the heating medium, and a normally-closed valve for said drain-aperture, of a chamber communicating with said drain-aperture, and being in connection with said hollow shaft at a point below the point of communication between the shaft and the heating-chamber, and means for forcing said valve open as the drier rotates, substantially as set forth.

14. In a rotary drier the combination with rotary drying and heating chambers, said heating-chamber having an inlet and an out-

let for heating medium and a drain-aperture, of a valve for closing said aperture, a water-chamber into which said drain-aperture discharges and a pipe or duct connecting said water-chamber with said exit, the said pipe being attached to the water-chamber at a point between the discharge side of the valve and the exit, substantially as set forth.

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Witnesses:

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