

No. 711,027.

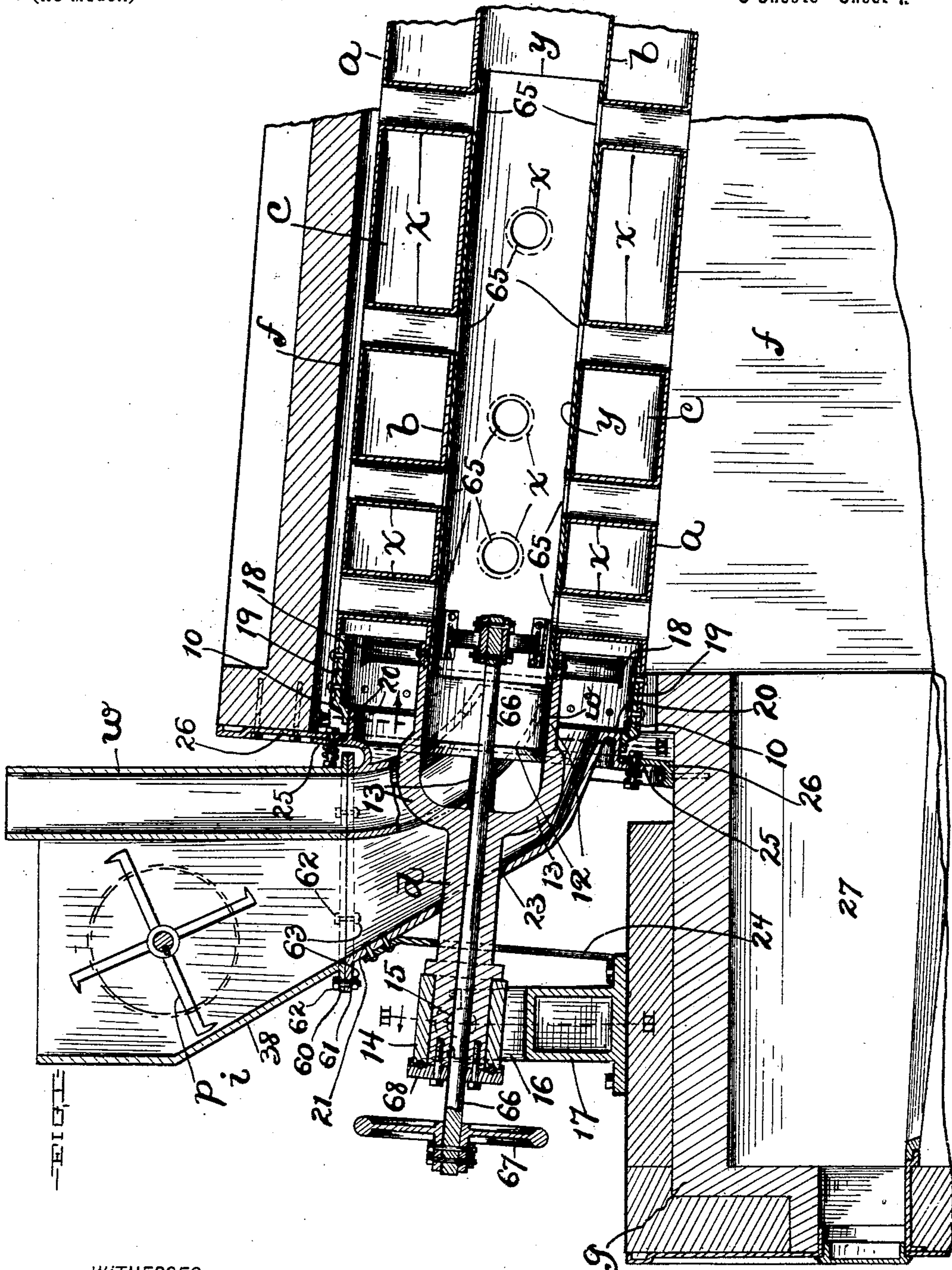
Patented Oct. 14, 1902.

W. W. WALLACE.  
ROTARY MECHANICAL DRIER.

(Application filed Feb. 4, 1902.)

(No Model.)

3 Sheets—Sheet 1.



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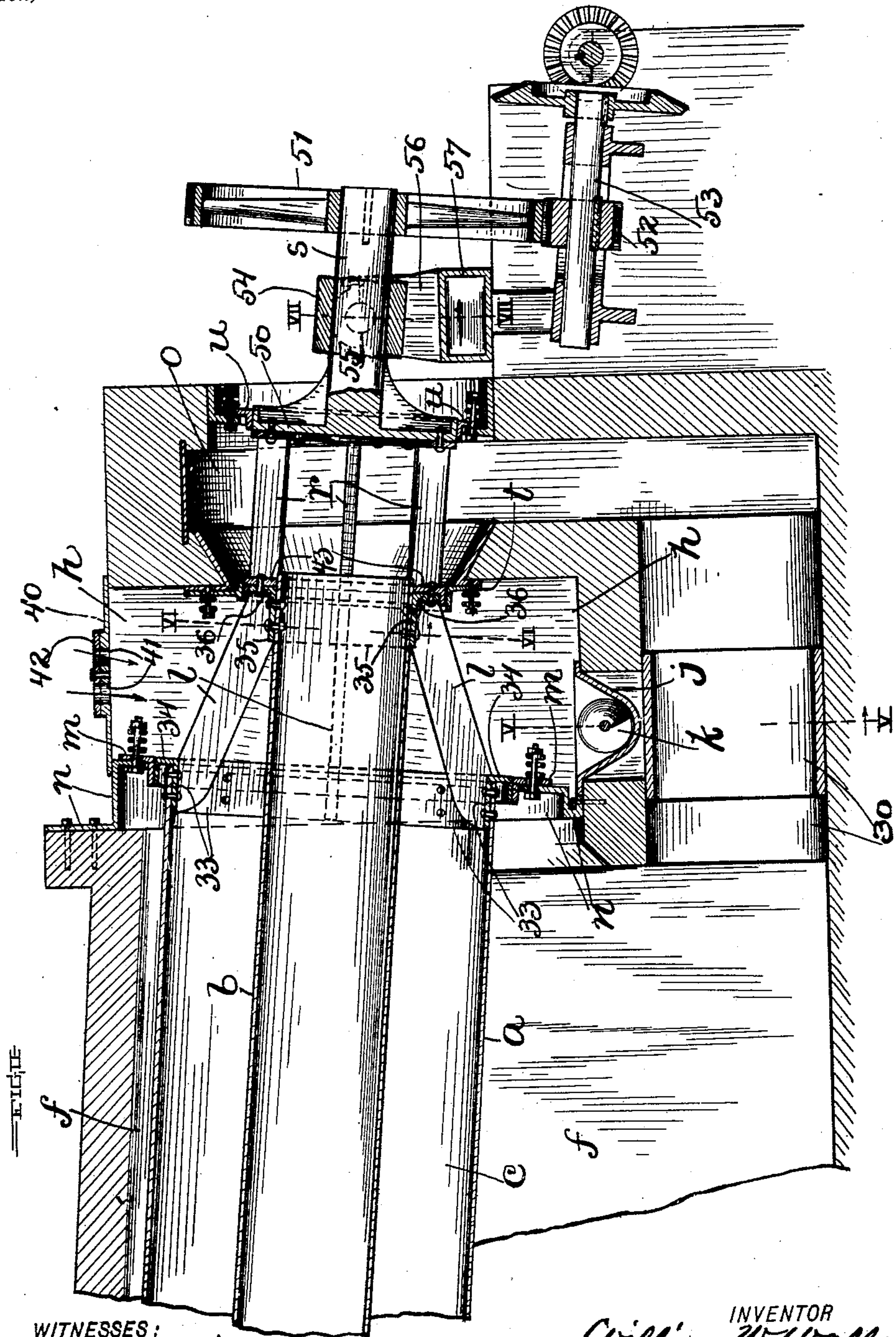
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3 Sheets—Sheet 2.

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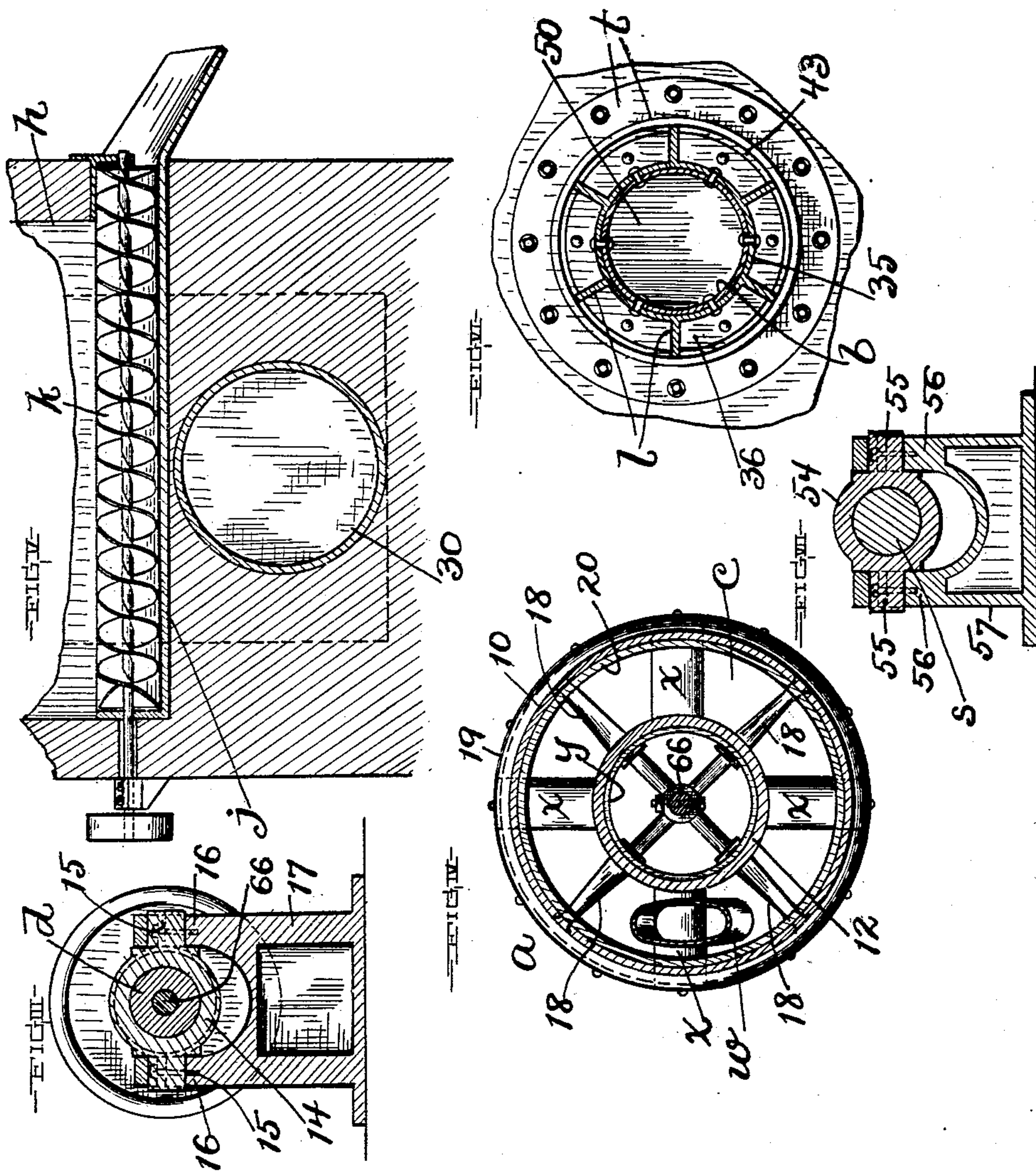
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3 Sheets—Sheet 3.



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# UNITED STATES PATENT OFFICE.

WILLIAM W. WALLACE, OF WILLOUGHBY, OHIO, ASSIGNOR TO THE  
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## ROTARY MECHANICAL DRIER.

SPECIFICATION forming part of Letters Patent No. 711,027, dated October 14, 1902.

Application filed February 4, 1902. Serial No. 92,530. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM W. WALLACE, a citizen of the United States of America, residing at Willoughby, in the county of Lake and State of Ohio, have invented certain new and useful Improvements in Rotary Mechanical Driers; and I hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

This invention relates to improvements in mechanical driers, and pertains more especially to a drier comprising an inclined rotary cylinder arranged within a heating-chamber and consisting of an outer shell externally exposed to the heating agent passing into the said chamber, an inner main flue arranged centrally within and longitudinally of and diametrically smaller than the said outer shell, so as to form an annular chamber around the said flue, and branch flues arranged within and transversely of the chamber of the cylinder and connecting the passage-way formed by and within the main flue with the aforesaid heating-chamber, and means for feeding the material to be dried to the aforesaid chamber of the cylinder at the upper end of the cylinder, and a passage-way establishing open relation between the aforesaid heating-chamber and the aforesaid main flue at the opposite or lower end of the cylinder.

The primary object of this invention is to provide a drier which is well adapted for drying combustible materials—such, for instance, as grain—wherein contact between the material being dried and the products of combustion or heating agent is avoided, wherein some of the heating agent can be diverted from its path leading to the receiving end of the aforesaid main flue into the said flue transversely of the aforesaid chamber of the cylinder at intervals longitudinally of the cylinder between the central portion of the cylinder and the discharging end of the said flue and without bringing the heating agent into contact with the material, so as to reduce the volume of heating agent passing into the receiving end of the said flue, and thereby

avoid burning, scorching, or overheating of the material between the central portion of the cylinder and the discharging end of the said chamber and make the temperature in the cylinder lowest at the discharging end of the chamber of the cylinder and gradually increasing toward the opposite or receiving end of the said chamber, where the material contains moisture enough to protect it from being destroyed or injured by the heat.

With this object in view and to the end of rendering the apparatus simple and durable and convenient and reliable in its operation and to attain other advantages hereinafter appearing, this invention involves certain features of construction and combinations of parts hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure I is a side elevation, largely in central section, of the forward portion of a drier embodying my invention. Fig. II is a side elevation, largely in central section, of the rear portion of the apparatus. Fig. III is a transverse section on line III III, Fig. I, looking outwardly. Fig. IV is a transverse section on line IV IV, Fig. I, looking inwardly. Fig. V is an elevation, largely in vertical section, on line V V, Fig. II, looking outwardly. Fig. VI is a transverse section on line VI VI, Fig. II, looking outwardly. Fig. VII is a transverse section on line VII VII, Fig. II.

My improved drier comprises a rotary inclined drying-cylinder supported as will hereinafter appear and comprising an outer open-ended shell *a*, arranged parallel with the axial line of the cylinder, and an open-ended flue *b*, arranged centrally within and extending longitudinally of the shell *a*. The forward portion of the said cylinder is shown in Fig. I and IV, and the rear portion of the cylinder is shown in Fig. II. The shell *a* comprises in the main a single cylindrical section which extends approximately from end to end of the cylinder and is applied and supported as will hereinafter appear. An annular chamber is formed, therefore, around the flue *b* and within the shell *a*, and the material which is to be dried is, as will herein-



after appear, fed into the said chamber at the upper end of the cylinder and passes during the drying period rearwardly through the said chamber and is discharged from the  
 5 said chamber at the opposite or lower end of the cylinder, and the products of combustion or heating agent are conducted from a furnace, as will hereinafter also appear, into the flue *b* at the lower end of the cylinder  
 10 and thence pass forwardly through the said flue without coming in contact with material being dried. The flue *b* is preferably cylindrical in cross-section, as shown in Figs. I, II, and VI, and extends a suitable distance  
 15 rearwardly beyond the discharging end of the chamber *c*, as shown in Fig. II. The flue *b* at its forward and discharging end within the upper and material-receiving end of the chamber *c* extends (see Fig. I) into and  
 20 snugly fits internally of a tubular section 12, which extends from the flue *b* forwardly beyond the forward end of the shell *a* and forms a forward extension of the said flue. The section 12 is riveted or otherwise attached to  
 25 the flue *b*. The flue extension 12 is formed upon and integral with arms 13, which are formed upon and integral with and extend inwardly from a trunnion *d*, with which the forward and upper end of the drying-cylinder  
 30 is axially provided. The trunnion *d* has bearing in a box 14, which is provided externally, as shown in Fig. III, with two trunnions 15, which are arranged at opposite sides, respectively, of the box and in a horizontal plane and in line at right angles to the  
 35 axial line of the trunnion *d* and have bearing in upwardly-projecting arms 16 of a suitably-applied standard 17. The box 14 is obviously capable of oscillating and accommodating itself to the inclination of the trunnion *d*.

The flue extension 12 is provided at its inner end and externally with any suitable number of laterally and outwardly projecting  
 45 and radially-arranged arms 18, which terminate at their outer ends in an annular rim 19, which forms a portion of the shell *a*, and is riveted or otherwise attached to the remaining portion of the said shell *a*. The rim  
 50 19 is provided at its outer end with an internal annular flange 10, which loosely embraces the externally-circular inner end portion 20 of the lower section 21 of a smoke-box or breeching *i*, which section 21 has its chamber  
 55 in open relation with the chamber *c* of the drying-cylinder, and the said section 21 is apertured, as at 23, to accommodate the location and operation of the trunnion *d*. The smoke-box or breeching *i* is supported in any  
 60 approved manner, having its lower section 21 braced, as at 24, from the standard 17 and provided with an external annular flange 25, which overlaps and is held against the outer side of a head 26, which is attached to the  
 65 casing of a heating-chamber *f*, and the said head 26 and the said flange 25 close the said chamber at the forward end of the drying-

cylinder and above the fuel-chamber 27 of the furnace *g*, as shown in Fig. I. The chamber *f* extends longitudinally of and surrounds the drying-cylinder and has its lower  
 70 portion below the upper and forward end of the said cylinder in open relation with the said chamber 27 of the furnace.

The trunnion *d*, its arms 13, the flue extension 12 and its arms 18, and the rim 19 are composed, preferably, of a single casting. 75

By the construction hereinbefore described it will be observed that the flue extension 12, the rim 19, and the intervening arms 18 form  
 80 a strong and durable connection between the flue *b* and the shell *a* at the forward and material-receiving end of the chamber *c*, and the shell *a* is consequently adequately supported at the forward end of the drying-cylinder. 85

A duct 30 is provided below the lower and rear end of the drying-cylinder and extends a suitable distance rearwardly below the material-receiving chamber *h*, which extends  
 90 around the flue *b* at the discharging end of the chamber *c* of the cylinder and is arranged to receive the dried material discharged from the said chamber *c*, and a trough *j* is arranged at the bottom of the chamber *h* below the drying-cylinder and in position to receive the  
 95 material discharged, as aforesaid, from the chamber *c* of the cylinder and extends laterally and discharges outside of the drier, as shown in Fig. V. A suitably-operated screw conveyer *k* is arranged within and longitudinally of the said trough *j* and adapted to convey material from the said trough. The duct 30 is connected by a suitably-formed passage-way with the passage-way formed within and  
 100 by the flue *b* at the rear and receiving end of the said flue. 105

The shell *a* of the drying-cylinder at its discharging end snugly embraces and is riveted or otherwise attached to the annular inner end portion 33 of the frame *l*, which is arranged within the chamber *h* externally and  
 110 longitudinally of the flue *b*, and has an outer annular end portion 35, which snugly embraces and is riveted or otherwise attached to the flue *b*. The inner end portion 33 of the  
 115 frame *l* at the adjacent extremity and outside of the shell *a* has an external annular flange 34, which is embraced by a packing-ring *m*, which overlaps and is suitably held against the outer side of metal head *n*, attached to  
 120 the casing of the heating-chamber *f* and surrounding the drying-cylinder and instrumental in forming the inner end wall of the chamber *h*, and the packing-ring *m* prevents leakage between the chambers *h* and *f*, and  
 125 consequently the products of combustion or heating agent circulating around the drying-cylinder during the operation of the apparatus cannot pass from the chamber *f* into the discharging end of the chamber *c* of the  
 130 cylinder.

The passage-way establishing open relation between the duct 30 and the receiving end of the flue *b* comprises a chamber *o*, which is



formed at the said end of the said flue *b*, as shown in Fig. II, and consequently products of combustion or heating agent pass from the chamber *f* through the duct 30 to the chamber *o* and thence through the flue *b* to the smoke-box or breeching *i*, and a suitably-operated and suitably-applied fan or suction-creating device *p* (see Fig. I) is arranged within the upper section 38 of the breeching *i* and is instrumental during its operation of creating suction within the said breeching, and thereby facilitating the passage of the products of combustion or heating agent from the furnace into and through the flue *b*.

The chamber *h* (see Fig. II) is closed at the top by a cover 40, which has air-inlets 41, controlled by a suitably-applied damper 42.

The wall between the chambers *o* and *h* avoids communication between the said chambers, and consequently between the said chamber *o* and the chamber *c* of the drying-cylinder, and hence it will be observed that the products of combustion are not passed through or into contact with the stream or body of material which during the operation of the apparatus passes through and is dried within the said chamber *c*.

The annular outer end portion 35 of the frame *l* is provided at its outer end, as shown in Fig. II, with an external annular flange 36, which abuts against and is riveted or otherwise attached to the annular inner end portion 43 of a frame *r*, which extends rearwardly from the receiving end of the flue *b* and connects the frame *l*, and consequently the shell *a* and the flue *b*, with the circular head 50, which is formed upon and integral with the inner end of the trunnion *s*, with which the drying-cylinder is axially provided adjacent to the receiving end of the flue *b* at the rear end of the drier. The frame *r* is rigidly secured to the head 50, and the wall between the chambers *o* and *h* is suitably apertured to accommodate the location of the connection between the trunnion *s* and the shell *a* and flue *b*. The member 43 of the frame *r* and the member 35 of the frame *l* form an annular head embracing the receiving end of the flue *b*. The trunnion *s* has bearing in a box 54, provided externally with two trunnions 55, which are arranged in a horizontal plane and in line at right angles to the axial line of the trunnion *s* at opposite sides, respectively, of the said box, as shown in Fig. VII, and have bearing in upwardly-projecting arms 56 of a suitably-applied standard 57. The box 54 is obviously capable of oscillating to accommodate itself to the inclination of the trunnion *s*. The trunnion *s* is operatively provided with a spur-gear 51, which is in mesh with a pinion 52, operatively mounted upon a suitably-supported shaft 53, to which power is applied in any approved manner.

The annular inner end portion 43 of the frame *r* is embraced by a packing-ring *t*, which is supported in any approved manner

and prevents leakage between the chambers *o* and *h* around the flue *b*.

The head 50 of the trunnion *s* forms the central and main portion of the outer end wall of the chamber *o* and is embraced by a packing-ring *u*, which prevents leakage at the periphery of the said head and is supported from the remaining and stationary portion of the said wall in any approved manner.

The frames *l* and *r* form a durable framework, which adequately supports the shell *a* and the flue *b* of the drying-cylinder from the trunnion *s*.

The upper section 38 of the breeching or smoke-box (see Fig. I) is provided at its lower end and externally with a flange 60, which rests upon a corresponding flange 61, formed upon and externally of the upper end of the lower section 21 of the said breeching, and the upper section 38 is removably secured to the lower section 21 by bolts 62, which extend through the said flanges 60 and 61 and nuts 63 upon the said bolts.

The material to be dried is introduced into the receiving end of the chamber *c* of the drying-cylinder through a feed-spout *w*, which is composed of two sections, (see Fig. I,) with its upper section integral with the upper section of the breeching and outside of the drying-cylinder and with its lower section integral with the lower section of the breeching and curving from the upper section of the feed-spout downwardly and inwardly into the receiving end of the chamber *c* of the drying-cylinder and terminating and discharging into the said chamber at the outer side of the path of the arms 18, which are preferably arranged at the extreme inner end of the flue extension 12, so as to accommodate the extension of the lower section of the feed-spout far enough into the chamber *c* of the drying-cylinder to prevent material discharged from the said spout from obtaining ingress to the discharging end of the flue *b* and to be out of the way of the products of combustion passing into the breeching and to avoid interference with the location and operation of the arms 18, which also operate to stir the material received within the said chamber *c* from the spout.

As already indicated, my improved drier is more especially designed for drying combustible material—such, for instance, as grain—which is easily burned or scorched and which must not be brought into contact with the products of combustion passing from the furnace. I have found that material of the character indicated can only be successfully dried without liability of scorching or overheating the material within the rear portion of the drying-cylinder by providing means whereby some of the products of combustion passing from the furnace can be diverted from the forward portion of the heating-chamber *f* into the flue *b* without bringing such diverted products of combustion into contact with the material being dried, and the best



results are attainable by thus diverting the products of combustion from the chamber *f* into the flue *b* at intervals longitudinally of the forward portion of the said flue, with the said intervals spaced gradually closer in the direction of the receiving or forward end of the chamber *c* of the drying-cylinder. The means preferably employed for diverting products of combustion from the chamber *f* comprises branch flues *x*, with which the flue *b* is provided and which extend transversely of the chamber *c* from the shell *a* to the flue *b* and are arranged radially of the drying-cylinder, as shown in Figs. II and IV, and connect the passage-way formed by the flue *b* with the chamber *f*. The said branch flues *x* are preferably arranged in four series between the central portion of the drying-cylinder and the receiving end of the chamber *c* of the cylinder, with the flues of each series arranged at suitable intervals longitudinally of the cylinder, with the four series of flues arranged at equal intervals circumferentially of the cylinder and with the flues of each series of flues alternating with the flues of the adjacent series of flues. The flues of each series of flues *x* are preferably so spaced that the intervals between them increase toward the receiving end of the chamber *c* of the drying-cylinder, so that more heat is diverted into the flue *b* from the chamber *f* toward the said end of the said chamber *c*, and, obviously, as the moisture contained in the material undergoing treatment within the said chamber is found to be gradually greater in the direction of the receiving end of the chamber the heat diverted from the chamber *f* into the flue *b*, as hereinbefore described, operates to the best advantage and not only facilitates the drying process, but decreases the temperature along the rear portion of the drying-cylinder sufficiently to avoid burning, scorching, or overheating of the material passing through the last-mentioned portion of the cylinder. It will be observed also that the flues *x* operate to stir the material passing through the chamber *c* of the cylinder.

Means for controlling and regulating the passage of products of combustion or heating agent from the flues *x* into the passage-way extending through the main flue *b* is provided, and comprises, preferably, an endwise-shiftable valve-forming cylindrical tube *y*, which is arranged within and conforms to and extends longitudinally of the flue *b* and has as many lateral apertures 65 as there are flues *x*, with the said apertures so arranged relative to the said flues *x* that all of the flues are capable of being simultaneously closed or opened or partially closed or partially opened, according as the said valve-forming tube is shifted to the required extent in the one direction or the other, or according as the said tube is turned within the flue *b* in the one or the other direction. The means for operating the tube comprises, preferably, a cylindrical shaft or stem 66, with which the tube

*y* is operatively connected in any approved manner. The stem or shaft 66 extends forwardly, centrally, and longitudinally through the trunnion *d* of the drying-cylinder and has bearing in the said trunnion. The shaft or stem 66 has its outer end provided with a wheel 67 for manipulating it. Obviously, therefore, the turning of the shaft or stem results in the turning of the tube *y*, and the said tube is shifted endwise in the one direction or the other, according as the said shaft or stem is slid in the one or the other direction.

The forward trunnion *d* of the drying-cylinder is provided at the outer end of the box 14 with a disk 68, which is fixed to the said trunnion and is large enough diametrically to overlap the outer end of the said box, as shown in Fig. I, and thereby prevent rearward endwise displacement of the said trunnion and the connected cylinder.

What I claim is—

1. A drier comprising a suitably-supported rotary cylinder having an outer shell extending longitudinally of the cylinder, a flue arranged centrally and longitudinally of the said shell so as to form a chamber surrounding the flue; a heating-chamber extending around and externally of the cylinder; means for feeding material to be dried into the aforesaid chamber of the cylinder at one end of the cylinder; a passage-way connecting the aforesaid heating-chamber with the aforesaid flue at the opposite end of the cylinder, and means for conducting heating agent from the said heating-chamber into the said flue between the central portion of the cylinder and the discharging end of the flue without contact with material passing through the chamber of the cylinder.

2. A drier comprising a rotary cylinder having an outer shell extending longitudinally of the cylinder, a flue arranged centrally and longitudinally of the said shell so as to form a chamber surrounding the flue; a heating-chamber around and externally of the cylinder; means for feeding material to be dried to the aforesaid chamber of the cylinder at one end of the cylinder; a passage-way connecting the aforesaid heating-chamber with the aforesaid flue at the opposite end of the cylinder; means for supporting the cylinder, and means for conducting heating agent from the aforesaid heating-chamber into the aforesaid flue between the central portion of the cylinder and the discharging end of the flue at intervals longitudinally of the cylinder without contact with material passing through the chamber of the cylinder.

3. A drier comprising a rotary cylinder having a main flue arranged centrally and longitudinally of the cylinder and extending from end to end of the cylinder, a chamber which surrounds the said flue and extends from end to end of the cylinder, and branch flues arranged transversely of the said chamber between the central portion of the cylinder and the material-receiving and forward end of



the said chamber and connecting at one end, respectively, with the passage-way formed by the aforesaid main flue and open at their opposite ends; means for supporting the cylinder; a heating-chamber around and externally of the cylinder, and a passage-way connecting the said heating-chamber with the main flue at the discharging end of the chamber of the cylinder.

4. A drier comprising a rotary cylinder having an open-ended flue arranged centrally and longitudinally of the cylinder and extending from end to end of the cylinder, a chamber surrounding the said flue, and a series of branch flues arranged transversely of the said chamber, at intervals longitudinally of the cylinder, between the central portion of the cylinder and the material-receiving or forward end of the aforesaid chamber and connecting at one end, respectively, with the passage-way formed by the aforesaid main flue and open at their opposite ends; means for supporting the cylinder; a heating-chamber surrounding the cylinder, and a passage-way connecting the said heating-chamber with the main flue at the discharging end of the chamber of the cylinder.

5. A drier comprising a suitably-supported rotary cylinder having an open-ended main flue arranged centrally and longitudinally of the cylinder and extending from end to end of the cylinder, an open-ended chamber formed around the said flue and extending from end to end of the cylinder, and a series of branch flues extending transversely of the said chamber between the central portion of the cylinder and the material-receiving or forward end of the chamber of the cylinder and with the said branch flues arranged at intervals longitudinally of the cylinder and spaced nearer together toward the forward or receiving end of the chamber of the cylinder; a heating-chamber externally of the cylinder, and a passage-way connecting the said heating-chamber with the main flue at the discharging end of the chamber of the cylinder, and the aforesaid branch flues being arranged as required to render them capable of conducting heating agent from the said heating-chamber into the main flue.

6. A drier comprising a suitably-supported inclined rotary cylinder having an outer open-ended shell extending longitudinally of the cylinder, an open-ended main flue arranged centrally and longitudinally of the said shell and extending from end to end of the cylinder, and several series of transversely-arranged branch flues arranged between the central portion and the upper end of the cylinder with the flues of each series of flues spaced longitudinally of the cylinder and with the flues of each series of flues alternating with the flues of the adjacent series of flues; a heating-chamber externally of the cylinder; means for feeding the material to be dried into the aforesaid chamber of the cylinder at

the upper end of the cylinder, and a passage-way connecting the said heating-chamber with the main flue at the lower end of the cylinder, and the aforesaid branch flues being arranged as required to render them capable of diverting heating agent from the said heating-chamber into the main flue.

7. A drier comprising an inclined rotary cylinder having an open-ended outer shell extending longitudinally of and parallel with the axial line of the cylinder, an open-ended main flue arranged centrally and longitudinally of the cylinder, and several series of branch flues between the central portion and the upper end of the cylinder with the flues of each series of flues arranged at intervals longitudinally of the cylinder and spaced nearer together toward the upper end of the cylinder; a breeching or smoke-box in open relation with the main flue at the upper end of the cylinder; a feed-spout extending into the aforesaid chamber of the cylinder; a furnace arranged with the fuel-chamber adjacent but below the upper end of the cylinder; means for supporting the cylinder; a heating-chamber surrounding the cylinder and in open relation with the aforesaid fuel-chamber, and a passage-way connecting with and extending from the said heating-chamber below the lower end of the cylinder and discharging into the aforesaid main flue at the lower end of the cylinder, and the aforesaid branch flues having the arrangement required to render them capable of diverting heating agent from the said heating-chamber into the main flue.

8. A drier comprising a suitably-supported rotary cylinder having an open-ended heating-agent-conducting main flue arranged centrally and longitudinally of the cylinder and extending from end to end of the cylinder, an open-ended chamber formed around the said flue and extending from end to end of the cylinder and having one end thereof adapted to receive the material to be dried, and branch flues located between the central portion of the cylinder and the material-receiving or forward end of the chamber of the cylinder and arranged to conduct heating agent into the main flue, and means for controlling and regulating the passage of heating agent through the branch flues into the main flue.

9. A drier comprising a suitably-supported rotary cylinder having an open-ended heating-agent-conducting main flue arranged centrally and longitudinally of the cylinder and extending from end to end of the cylinder, an open-ended chamber formed around the said flue and extending from end to end of the cylinder and adapted, at one end, to receive the material to be dried, and branch flues located between the central portion of the cylinder and the material-receiving or forward end of the chamber of the cylinder and extending transversely of the said chamber and arranged to conduct heating agent



into the main flue, and a movable valve-forming tube arranged within the main flue and having lateral apertures arranged as required to render them capable of being brought into registry with the branch flues by the actuation of the said tube in the direction and to the extent required.

10. A drier comprising a suitably-supported rotary cylinder provided with axial trunnions and having an open-ended main flue arranged centrally and longitudinally of the cylinder and a chamber formed around the said flue and adapted, at one end, to receive the material to be dried, and branch flues located between the central portion of the cylinder and the material-receiving or forward end of the chamber of the cylinder and extending transversely of the said chamber and arranged to discharge into the main flue, and a movable laterally-apertured valve-forming tube arranged to control and regulate communication between the branch flues and the main flue and having a shaft or stem extending through one of the aforesaid trunnions.

11. A drier comprising an inclined rotary cylinder having a flue arranged centrally and longitudinally of and extending from end to end of the cylinder and an outer shell surrounding and diametrically larger and extending from end to end of the cylinder so as to form a chamber around the aforesaid flue; a heating-chamber extending around the cylinder; a passage-way establishing open relation between the said heating-chamber and the aforesaid flue at the lower end of the cylinder; means for supporting the cylinder at the said last-mentioned end; a tubular section rigid with and forming an extension of the aforesaid flue at the upper end of the cylinder and provided externally with laterally-projecting arms terminating at their outer ends in a rim rigid with the aforesaid outer shell of the cylinder; a smoke-box or breeching in open relation with the last-mentioned end of the said flue and having its lower portion extending around the outer end of the flue extension; a feed-spout extending into the aforesaid chamber of the cylinder, and a trunnion supporting the cylinder at the upper end of the cylinder and having arms carrying the aforesaid flue extension.

12. A drier comprising an inclined rotary cylinder having a cylindrical open-ended flue arranged centrally and longitudinally and extending from end to end of the cylinder, and an outer cylindrical shell surrounding and diametrically larger than the flue and extending from end to end of the cylinder so as to form an annular chamber surrounding the flue; a heating-chamber surrounding the cylinder; a passage-way arranged to conduct the heating agent from the heating-chamber to the flue at the lower end of the cylinder; means for supporting the cylinder at the lower end; a suitably-applied trunnion car-

rying the cylinder at the upper end and having inwardly-extending arms integral with the trunnion; an annular tubular section rigid with and forming an extension of the flue at the upper end of the cylinder and integral with the said arms of the trunnion and provided externally with arms connecting with and bearing the aforesaid shell of the cylinder; a smoke-box or breeching in open relation with the flue extension at the upper end of the cylinder, and a feed-spout extending into the aforesaid annular chamber of the cylinder externally of the aforesaid flue extension.

13. A drier comprising an inclined rotary cylinder having an open-ended shell arranged longitudinally of the cylinder and an open-ended flue arranged centrally and longitudinally of the cylinder and diametrically smaller than the said shell so as to form a chamber surrounding the flue within the said shell which flue extends beyond the aforesaid shell at the lower end of the cylinder; a connection between the aforesaid shell and the flue at the upper end of the cylinder; means for supporting the cylinder; a rear chamber surrounding the flue's end portion which extends as aforesaid beyond the aforesaid shell and having open relation with the chamber of the cylinder; means for conveying material from the said rear chamber; a heating-chamber surrounding the cylinder; means for preventing communication between the said heating-chamber and the aforesaid rear chamber around the lower end of the cylinder; a passage-way establishing open relation between the said heating-chamber and the aforesaid flue at the lower end of the cylinder at the rear and outside of the aforesaid rear chamber, and means for preventing communication between the said passage-way and the rear chamber around the aforesaid flue.

14. A drier comprising an inclined rotary cylinder having an open-ended flue arranged centrally and longitudinally of the cylinder and diametrically smaller than the said shell so as to form a chamber surrounding the flue within the said shell, which flue extends rearwardly beyond the aforesaid shell at the lower end of the cylinder; a connection between the aforesaid shell and the flue at the upper end of the cylinder; means for supporting the cylinder at the said end; a heating-chamber surrounding the cylinder; a rear chamber rearward of the said heating-chamber and surrounding the aforesaid flue rearward of the heating-chamber; means for conveying material from the said rear chamber; means for preventing leakage between the said rear chamber and the heating-chamber around the cylinder; a passage-way establishing open relation between the heating-chamber and the rear end of the flue outside of the aforesaid rear chamber; means for preventing leakage between the said passage-way and the rear



chamber around the flue; a suitably-applied  
trunnion carrying the cylinder and the lower  
end of the cylinder, and a framework or con-  
nection between the said trunnion and the  
5 flue and outer shell of the cylinder.

In testimony whereof I sign the foregoing  
specification, in the presence of two witnesses,

this 14th day of January, 1902, at Cleveland,  
Ohio.

WILLIAM W. WALLACE.

Witnesses:

C. H. DORER,

VICTOR C. LYNCH.