

July 25, 1944.

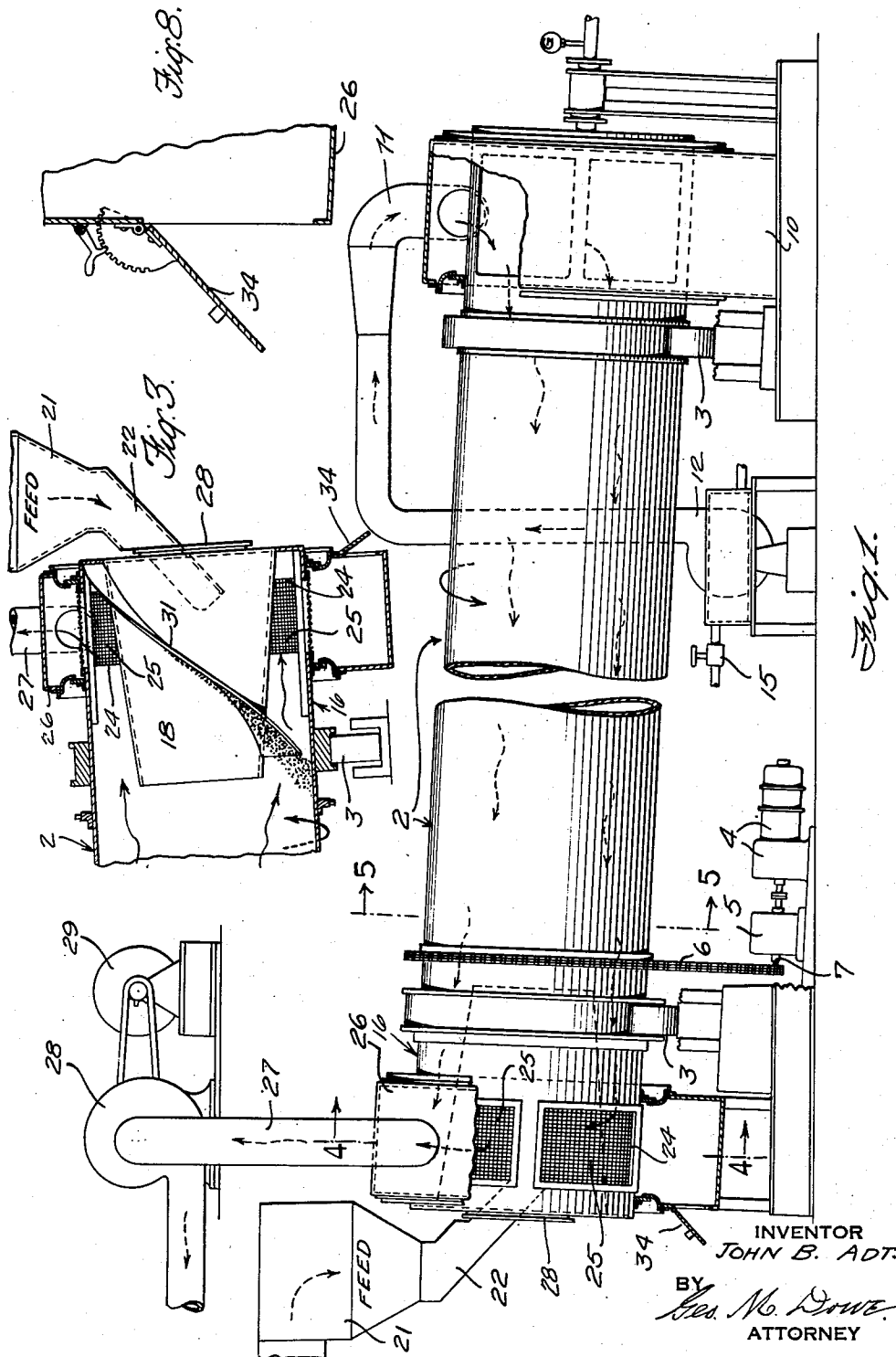
J. B. ADT

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MATERIAL FEEDING AND VAPOR REMOVING MECHANISM FOR ROTARY DRIERS

Filed Dec. 11, 1941

3 Sheets-Sheet 1



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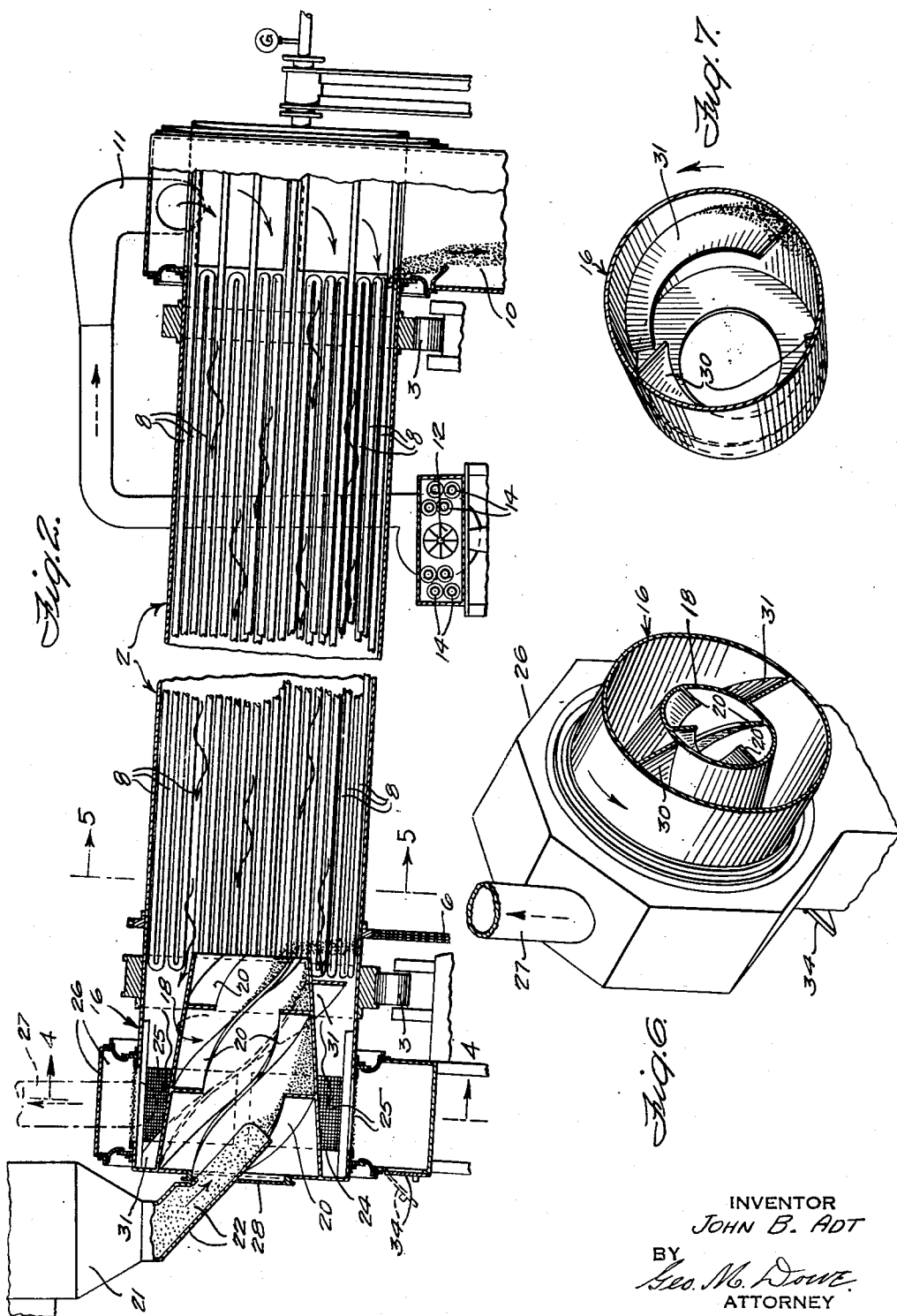
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3 Sheets-Sheet 2



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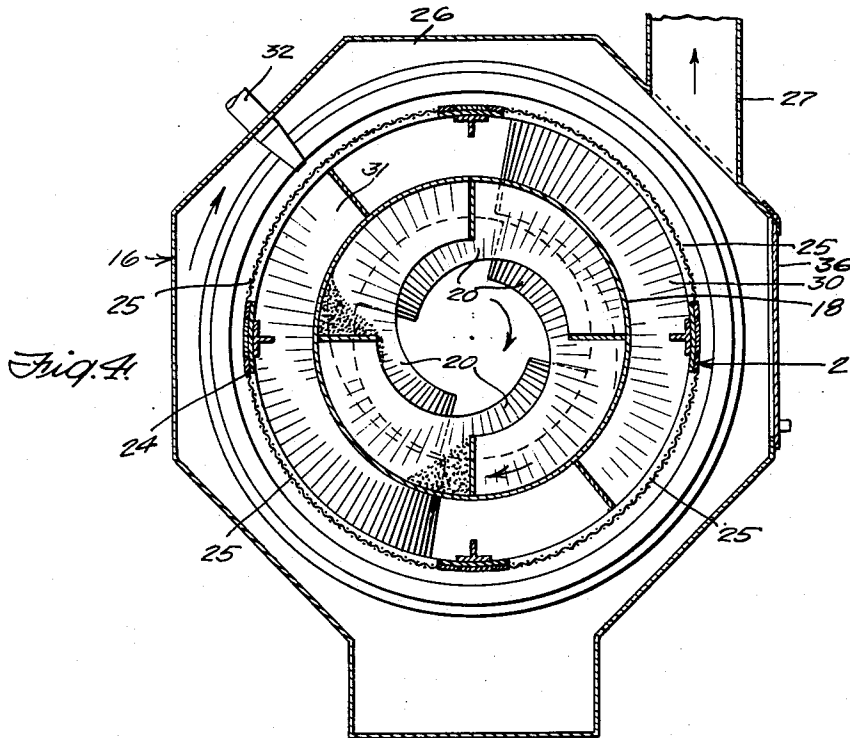
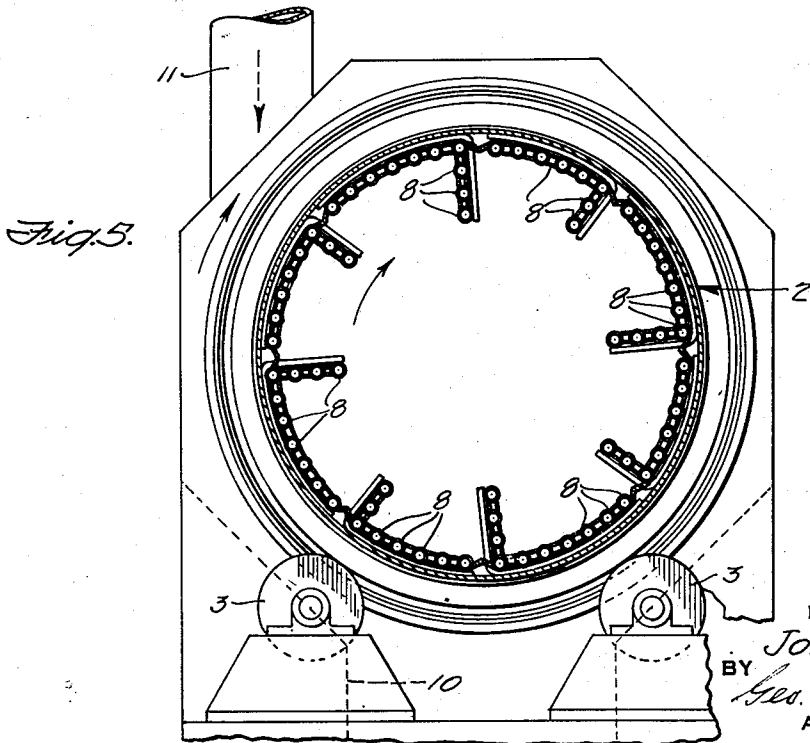
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3 Sheets-Sheet 3



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2,354,567

MATERIAL FEEDING AND VAPOR REMOVING MECHANISM FOR ROTARY DRIERS

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Application December 11, 1941, Serial No. 422,494

15 Claims. (Cl. 34—134)

The present invention relates to a feeding and vapor removal mechanism for driers using counter current air and vapor flow.

The invention has for its object the improvement in driers generally but more particularly in driers used in the drying of smoking tobacco and tobacco for the making of cigarettes.

In driers heretofore generally used for this purpose the material to be dried was fed into a chute at the forward end of the drier and the exhaust vapors were discharged through the same opening, which vapors therefore, came into direct contact with the incoming material.

In the case of tobacco and other relatively light material this method of feeding and vapor removal has a number of disadvantages, especially in view of the more exacting requirements in modern quantity production.

These disadvantages were largely due to the restricted opening for the passage of the discharged vapors, resulting in a decrease in drying capacity, condensation of some of the vapors and a contamination of the incoming material by undesirable ingredients carried along in the discharging air stream. In the case of tobacco, corrosion of contacting surfaces has also resulted due to the raising of the humidity of the exhausting vapors.

A feature of the present invention resides in the separation of the exhausting vapors from the incoming material.

Another feature resides in the provision of a greater area for the exhausting vapors.

Another feature resides in the rapid feeding of the material to be dried into the drying cylinder and directly onto the steam heated pipes.

A further feature resides in the provision of a casing into which the exhaust vapors are drawn by a suitable fan, there being openings in the feeding end of the drying cylinder through which the vapors pass to the casing and are thence removed.

A still further feature resides in the provision of an adjustable door in said casing-venting, said casing to the outside, or room air, and serving as a means of control for the drier.

Other features and advantages will become apparent from the following detailed description and claims, when taken in connection with the accompanying drawings in which:

Fig. 1 is a right side elevation with the control portion broken away;

Fig. 2 is a longitudinal section;

Fig. 3 is a detail of the feeding end of the drier with the cylinder broken away;

Fig. 4 is a section on the line 4—4, Figs. 1 or 2; Fig. 5 is a section on the line 5—5, Figs. 1 or 2; Fig. 6 is a perspective view of the feeding head of the drier;

Fig. 7 is a perspective view of a portion of the feeding head with the inner tubular member omitted, to better show the flights between the tubular member and the inner surface of the cylinder, and

Fig. 8 is a detail of the adjustable door in the casing.

The drier herein shown is similar in general construction to the drier forming the subject matter of my application Serial Number 250,293, filed January 11, 1939 (now Patent No. 2,267,259).

It includes a cylinder 2, suitably supported on ball-bearing rollers 3, and rotated by a motor 4 through reduction gearing housed in a gear box 5. A driving chain 6 forms the connection between the cylinder and the shaft 7, Fig. 1.

Within the cylinder are located gangs of steam conducting pipes 8, some of which are shown in Fig. 2. These pipes extend along the cylinder wall and inwardly therefrom as clearly shown in Fig. 5. Steam is supplied to and exhausted from the pipes 8 in the manner shown and described in my patent above referred to and also in Fig. 4 of the patent to John B. Adt, 1,057,912, April 1, 1913.

The material to be dried passes along the cylinder from left to right, as the apparatus is viewed in Fig. 2, and emerges through a delivery chute 10, Fig. 2, of conventional character.

Air in counter flow to the feeding movement, is introduced at 11, by means of a blower 12. Preferably this air is heated by passing it over steam heated pipes 14 provided with aerofins. The steam pressure is regulated by a reducing valve 15, Fig. 1, thereby giving a very quick control of the temperature of the air entering the drier and consequently of the humidity within the drier.

My improved feeding and vapor removal mechanism is shown as associated with a drier of the general type above described, although it may be likewise used with advantage with other types of driers.

As stated, one of the features of the present invention resides in the separation of the exhausting vapors from the incoming material. To this end the forward portion of the cylinder constitutes a feeding head indicated generally by the reference character 16. Within said head and rotating with the cylinder is a tubular member 18 spaced from the cylinder wall and having

its inner end terminating beyond the beginning of the steam conducting pipes 8. Within the tubular member are flights 20 which extend part way across the member, these flights being relatively steep and serving to deliver the material to be dried directly onto the steam conducting pipes. The material to be dried is fed from a hopper 21 and passes along a chute 22 directly onto the flights 20. At its forward end the feeding head is provided with openings indicated at 24 Fig. 3 and these openings are preferably provided with screens 25.

A casing 26 Figs. 2 and 6 surrounds said openings and from said casing a conduit 27 leads to an exhaust fan 28 suitably driven from a motor 29, Fig. 1.

With this construction, the exhaust gases from the drier passing in counter-flow to the movement of the material through the drier passes around the tubular member 18 and through the openings 24 into the casing 26 from which they are exhausted by the fan 28.

From this construction, it will be noted that the exhaust vapors are separated from the in-flowing material passing along the flights 20 and therefore have a free passage to the exhaust conduit 27.

In the construction shown in my former application above referred to, there was shown in Fig. 1, a chute 18 corresponding to the chute 22 of the present application, through which chute 18, material to be dried was fed directly into the drying cylinder and onto the steam conducting pipes. The exhaust gases were delivered into the same chute through which the material was fed resulting in a number of disadvantages.

Since the incoming material partly filled the chute, a greatly restricted passage was offered for the discharge vapors thereby limiting the volume or weight of air or vapor which could be discharged thereby limiting the capacity of the drier. With the former type of drier increasing the velocity of the air entering the drier had a tendency to cause particles of lighter material to be picked up by the air current and either lost by being discharged with the outgoing vapors or else acting to choke the feed to a more or less extent.

Other difficulties arose from the tendency of the restricted air flow to raise the humidity of the exhausted vapors thereby tending to approach the dew point, at which point condensation would occur, resulting in a portion of the discharge moisture being re-absorbed by the incoming material. In some cases, particularly with tobacco, the high humidity of the exhausting vapors tends to corrode contacting surfaces.

With the present construction, due to the much greater area allowed for the exhausting vapors, a very much larger quantity of air can be used without unduly increasing its velocity.

The material feeding through the tubular member 18 does not come in contact with the exhausting vapors until well within the drier and since the left hand end of the drier, as viewed in Fig. 2, is closed, there is less tendency to force small particles of material back into the feeding head. The closure is effected by a plate 28 secured to the chute 22.

To take care of loose material which may be blown back into the feeding head, the space between the tubular member 18 and the inner cylinder wall is provided with two spiral flights 30 and 31 Figs. 2, 3, 6, and 7. These flights are of high pitch and tend to cause any small par-

ticles of tobacco or other material which are blown back into the feeding head to be returned into the drying cylinder.

It will be noted from Figs. 4 and 6 that the exhaust conduit 27 is on the right side of the casing 26 and the two spiral flights 30 and 31 bear such relation to the position of this conduit that either flight is in the position to discharge material into the cylinder at the left side of the casing or that portion removed from the conduit 27, since the air flow is less in that region than near the conduit 27. The position of the flight 31 in Fig. 3 illustrates this action, the flight 31 being shown as discharging its material into the cylinder as it moves upwardly, the cylinder being rotated clockwise as viewed from the feeding end. This situation is also illustrated in Fig. 7 in which figure the tubular member 18 has been omitted in order to make it clear how the flights 30 and 31 act. Under the conditions shown in Fig. 7 the flight 30 has discharged any material which it may have borne, while the flight 31 is in the act of discharging its material into the cylinder.

It is a matter of experience that the chamber or space between the tubular member 18 and the surface of the cylinder practically clears itself at each revolution of the cylinder. The tendency is for the small particles of tobacco to be carried out with the air and vapors at that location near the conduit 27. Due to the screens which are preferably of 24 wire mesh, these small particles are stopped, but as the cylinder revolves the small particles which are held, pass by the lowest point at the bottom of the cylinder and are caught by the spiral flights 30 and 31 and rapidly conveyed back into the main drying cylinder by the time they are elevated to the topmost part. Thus each compartment is practically clear at the high point where most of the exhausting vapors are passing.

In the operation of the present invention, it is preferred that the velocity of the fan 12 be substantially constant and that any variation in the drying capacity within the cylinder be regulated by increasing or decreasing the temperature of the admitted air. It has already been explained that this temperature can readily be varied by the admission of higher or lower pressure steam through the reducing valve 15.

When the flow of incoming air is substantially constant, the fan 28 may be so regulated as to exhaust the air at the optimum velocity, in which case the screens are maintained substantially clear. Should it be necessary to clean the screens a conventional air nozzle 32 is shown in Fig. 4. This nozzle is placed within the casing 26 on the opposite side of the vapor passage conduit 27 and acts to clean the screens as the cylinder rotates.

As stated, it is preferred that there be such a balance between the fans 12 and 28 that in the ordinary operation of the drier, there would be no clogging of the screens due to excess pressure from either fan. As a further aid in maintaining this balance, there is provided a small door 34, Figs. 2 and 8, at the lower part of the casing and opening out into the room. As shown in Fig. 8, this door is adjustable to admit more or less air into the casing, or let air out.

It has been found that a current of room air if allowed to enter into the casing at this point and flow against the screens, probably some of it also going through the screens, has resulted in an improvement in the flow of the exhaust vapors

through the conduit 27. This door also acts somewhat as a relief valve where an excess of hot air has been introduced into the drier at the discharge end and not exhausted sufficiently at the feed end through the vapor discharge. Under these circumstances, there occurs a slight pressure in the drier and this door serves to release such excess of air. The pressure so built up, however, is not usually so very great and the relief of the pressure may only last for a few seconds.

Doors for observation and cleaning are indicated at 36 Fig. 4.

In addition to the generally lower humidity which the arrangement of the present invention makes possible, the thermometer readings, both dry and wet bulb, taken in the vapor exhaust line, are very constant, varying probably never more than one degree over a limited period. With the older type of dryer, variations as much as six degrees within two or three minutes have been observed.

While it is preferable to use the screens 25, these are not necessary, although they serve the purpose of holding back small quantities of tobacco which are useable. Obviously the escape of small particles of tobacco in the exhaust vapors may be prevented otherwise than by use of screens 25 over the openings in the cylinder. With the old type of drier, most of this material was exhausted to the outside and lost.

While the invention has been shown in the preferred form, nevertheless, it is to be understood that variations may be resorted to within the scope of the invention without departing from the spirit thereof and some of the features may be used without others.

What I claim is:

1. In a mechanism for feeding material to a rotary drier, said drier including a rotary cylinder through which the material passes during the drying operation, said cylinder having gangs of steam conducting pipes attached to the inner wall thereof and revoluble therewith, said cylinder having a feeding head forming a part thereof and rotatable therewith, a tubular member within said head rotatable with said cylinder and spaced from the wall thereof, the inner end of which extends inwardly beyond the beginning of said gangs of steam conducting pipes and means for feeding the material to be dried into said tubular member and conveying it there-through and onto the steam conducting pipes.

2. In a mechanism for feeding material to and removing vapors from a rotary drier, said drier including a rotary cylinder through which the material passes during the drying operation, said cylinder having gangs of steam conducting pipes attached to the inner wall thereof and revoluble therewith, said cylinder having a feeding head forming a part thereof and rotatable therewith, a tubular member rotatable with said head and spaced from the walls thereof, the inner end of which member terminates beyond the beginning of said gangs of steam conducting pipes, means for feeding the material to be dried into said tubular member and conveying it there-through and onto the steam conducting pipes, means for forcing air through said drier in counterflow to the flow of the material into the drier and means for exhausting the vapor between the wall of said feeding head and the tubular member.

3. In a mechanism for feeding material to and removing vapors from a drier, said drier includ-

ing a rotary cylinder through which the material passes during the drying operation, said cylinder having gangs of steam conducting pipes attached to the inner walls thereof and revoluble therewith, said cylinder having a feeding head forming a part thereof and rotatable therewith, said head having openings therein, a tubular member rotatable with said head and spaced from the walls thereof, the inner end of which member terminates beyond the beginning of said gangs of steam conducting pipes, means for feeding the material to be dried into said tubular member and conveying it therethrough and onto the steam conducting pipes, means for forcing air through said drier in counter-flow to the flow of the material into the drier and means for exhausting the vapors between the wall of said feeding head and the tubular member and through the openings in the feeding head.

4. In a feeding mechanism for a rotary drier, said drier including a rotary cylinder through which the material passes during the drying operation, the forward part of said cylinder constituting a feeding head, a tubular member extending into said head and spaced from the inner surface of the head, means including flights in said tubular member for conveying the material into the cylinder and means including flights in the space between the tubular member and the inner cylindrical surface of the feeding head for conveying back into the drier, any material which may get into the space between the tubular member and the wall of the feeding head.

5. In a mechanism for feeding material to and removing vapors from a rotary drier, said drier including a rotary cylinder through which the material passes during the drying operation, an inner tubular member at the receiving end of the cylinder and rotatable therewith and spaced from the inner surface thereof, means for feeding the material to be dried through said tubular member and into the cylinder and means for exhausting the vapors around the outside of said tubular member.

6. In a mechanism for feeding material to and removing from a rotary drier vapors produced in the drying operation, said drier including a rotary cylinder through which the material passes during the drying operation, said cylinder having openings at its receiving end, an inner tubular member coaxial with said cylinder in receiving end thereof and spaced from the inner surface thereof, said member extending inwardly beyond said openings, means for feeding the material to be dried through said tubular member and into the cylinder and means for exhausting the vapors around the outside of said tubular member and through said openings in said cylinder.

7. In a mechanism for feeding material to and removing vapors from a rotary drier, said drier including a rotary cylinder through which the material passes during the drying operation, said cylinder having openings at its receiving end, a casing surrounding said openings, an inner tubular member at the receiving end of the cylinder and coaxial therewith, said member extending into the cylinder and inwardly beyond said openings, means for feeding the material to be dried through said tubular member and into the cylinder and means for exhausting the vapors around the outside of said tubular member and through said openings in said cylinder and into said casing.

8. In a mechanism for feeding material to and

removing vapors from a rotary drier, said drier including a rotary cylinder through which the material passes during the drying operation, said cylinder having openings at its receiving end, a casing surrounding said openings, an inner tubular member at the receiving end of the cylinder, said member coaxial with and extending into the cylinder and inwardly beyond said openings, means for feeding the material to be dried through said tubular member and into the cylinder and means for exhausting the vapors around the outside of said tubular member and through said openings in said cylinder and into said casing, and screens covering the openings in said cylinder.

9. In a mechanism for feeding material to and removing vapors from a rotary drier, said drier including a rotary cylinder through which the material passes during the drying operation, said cylinder having openings at its forward end, a casing surrounding said openings, an inner tubular member at the receiving end of the cylinder rotatable therewith and spaced from the inner surface thereof, said member extending into the cylinder and inwardly beyond said openings, means for feeding the material to be dried through said tubular member and into the cylinder, means including a fan located at one side of said casing for exhausting vapors from said cylinder while preventing withdrawal of material, said tubular member having flights between its outer surface and the inner surface of said cylinder, said flights being so arranged as to pick up any material between the tubular member and said cylinder and cause it to flow back in said cylinder to a location remote from the connection between the exhaust fan and said casing.

10. In a drier including a cylinder through which the material passes to be dried, said cylinder having openings in its cylindrical surface at its forward or feeding end, means for preventing material fed into said feeding end from escaping through said openings, a casing surrounding said openings and means for exhausting the vapors from said cylinder through said openings and into said casing, an outlet near the top of said casing through which the vapors pass to the outside air and a controllable passage in the wall of said casing near its bottom to assist in controlling the discharge of the exhaust vapors.

11. In a drier including a cylinder through which the material passes to be dried, said cylinder having openings in its cylindrical surface at its forward or feeding end, screens covering said openings, a casing surrounding said openings and screens, means for exhausting the vapors from said cylinder through said openings and into said casing, an outlet near the top of said casing, and a controllable device near the bottom of said casing and in proximity of said screens to control the flow of the exhaust vapors through said outlet.

12. In a drier including a cylinder through which the material passes to be dried, means for introducing heated air into said cylinder at its discharge end and in counter flow to the material passing through the cylinder, said cylinder having openings in its cylindrical surface at its forward or feeding end, means for preventing ma-

terial fed into said feeding end from escaping through said openings, a casing surrounding said openings, means for exhausting the vapors from said cylinder through said openings and near the top of said casing, an outlet into said casing for discharge of said vapors to the outside air, and means including an adjustable door at the lower part of said casing for controlling the passage of vapors through said outlet.

13. In a drier including a cylinder through which the material passes to be dried, said cylinder having openings at its receiving end, a casing surrounding said openings, an inner tubular member at the receiving end of the cylinder, said member extending into said cylinder and inwardly beyond said openings, means for feeding the material to be dried through said tubular member and into the cylinder, means for exhausting the vapors around the outside of said tubular member and through said openings in the cylinder and into said casing, screens covering the openings in said cylinder of such mesh as to permit passage of the vapors but to prevent passage of the material to be dried and means for returning to the part of the cylinder at the inner end of said tubular member such material carried along by the vapors.

14. In a drier including a cylinder through which the material passes to be dried, said cylinder having openings at its receiving end, a casing surrounding said openings, an inner tubular member at the receiving end of the cylinder, said member extending into said cylinder and inwardly beyond said openings, means for feeding the material to be dried through said tubular member and into the cylinder, means for exhausting the vapors around the outside of said tubular member and through said openings in the cylinder and into said casing, screens covering the openings in said cylinder of such mesh as to permit passage of the vapors but to prevent passage of the material to be dried and means associated with said tubular member for returning to the part of the cylinder at the inner end of said tubular member such material carried along by the vapors.

15. In a drier including a cylinder through which the material passes to be dried, said cylinder having openings at its receiving end, a casing surrounding said openings, an inner tubular member at the receiving end of the cylinder, said member extending into said cylinder and inwardly beyond said openings, means for feeding the material to be dried through said tubular member and into the cylinder, means for exhausting the vapors around the outside of said tubular member and through said openings in the cylinder and into said casing, screens covering the openings in said cylinder of such mesh as to permit passage of the vapors but to prevent passage of the material to be dried and flights carried by said tubular member between the outer surface thereof and the inner surface of the cylinder for returning to the part of the cylinder at the inner end of said tubular member such material carried along by the vapors.

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