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H. A. HATFIELD

DRYING MACHINE

Filed April 23, 1927

2 Sheets-Sheet 1

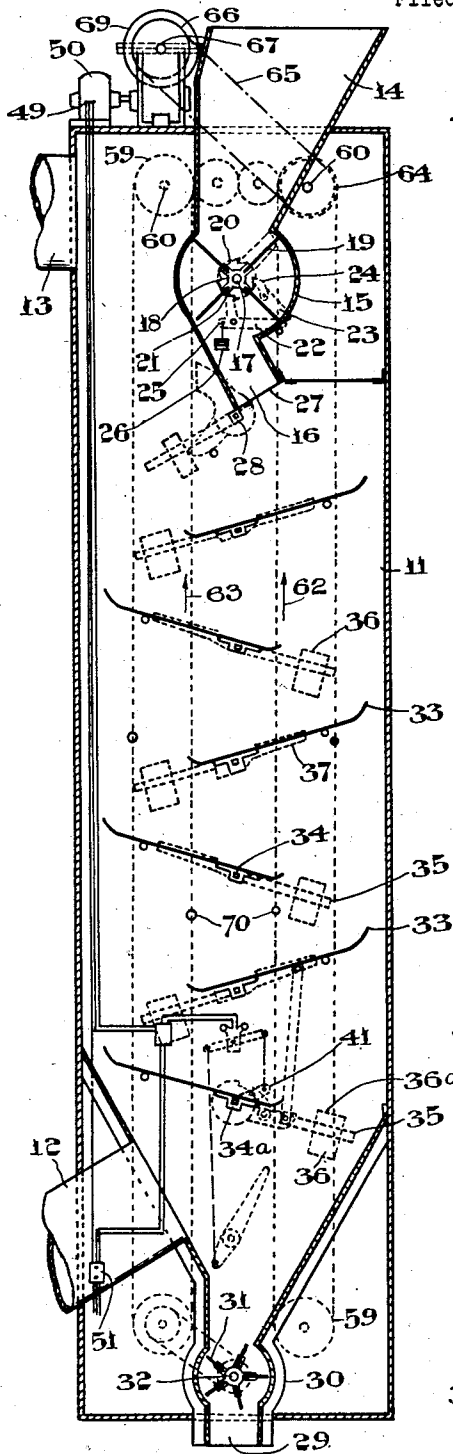


FIG. 1

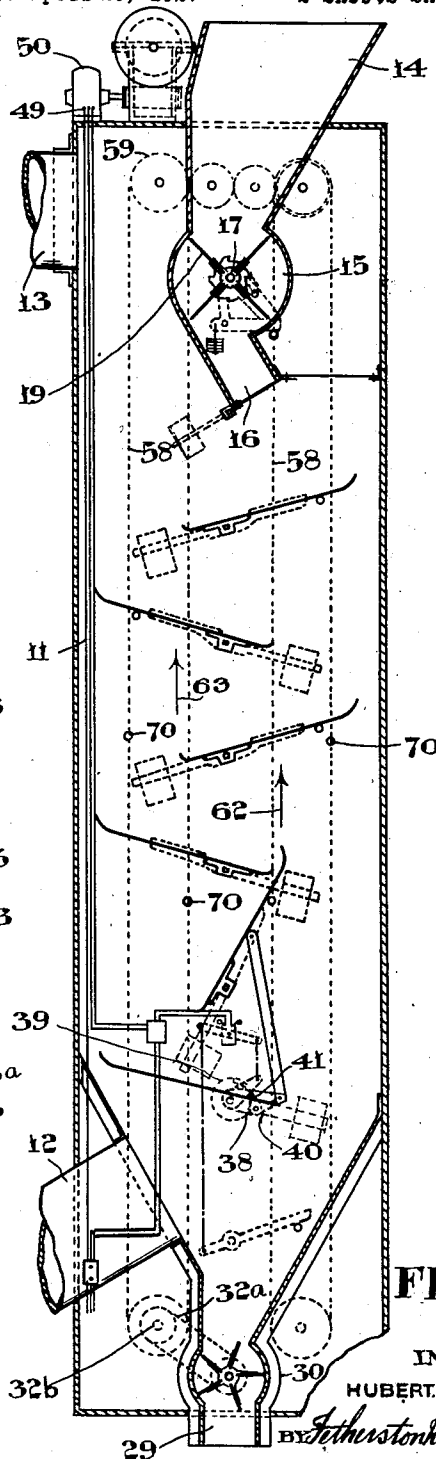


FIG. 2

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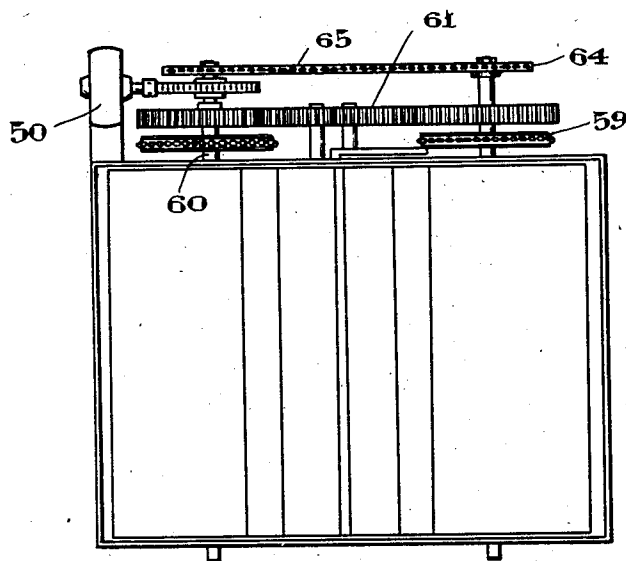


FIG. 3

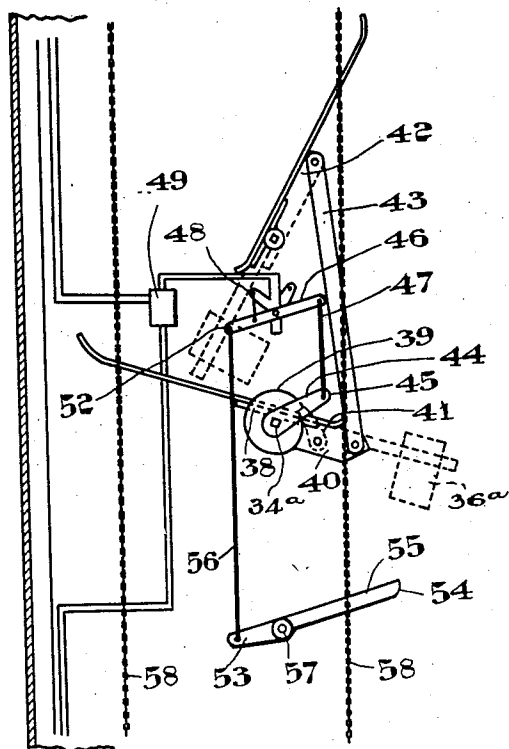


FIG. 4

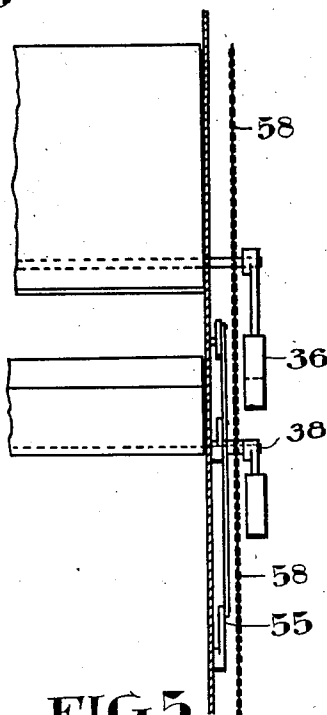


FIG. 5

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DRYING MACHINE.

Application filed April 23, 1927, Serial No. 186,041, and in Canada April 26, 1926.

This invention relates to new and useful improvements in drying machines, and the main object of the invention is to provide a machine which will be automatically controlled by the moisture content of the material passing therethrough.

Another object is to provide a machine of the class stated which will be simple in construction and economical and efficient in operation.

A further object is to provide a drying machine in which the material delivered therefrom will have practically the same moisture content.

In my invention, I provide a drying machine having an inlet pipe for a drying agent which passes upwardly through the machine and an outlet pipe at the top thereof. Pivottally mounted within the frame are a plurality of baffles adapted to hold the material under treatment and retard its passage through the machine. The baffles are provided with adjustable balancing means to allow the machine to be adjusted to suit the class of material under treatment. The lowermost baffle is positioned above the drier outlet and is so balanced that when the material positioned thereon reaches a predetermined stage of dryness, the baffle will tip and in tipping, will operate a switch which completes the circuit of an electrical supply to a motor adapted to operate a pair of endless chains through suitable gearing. The chains are provided with projections, so positioned that they tip all the upper baffles one at a time, and also open the end of a feed chute. The chute is provided with a regulating revolving baffle which is also controlled by the chain projections. A rotating regulating baffle is mounted in the material discharge end of the machine positioned below the lowermost baffle.

In the drawings which show a form of my invention;

Figure 1 is a sectional side elevation of the drier in position before the material is tipped from the bottom baffle.

Figure 2 is a side elevation of the drier with the side of the drier removed and the lowermost baffle tipped and placed back in position by the second lowermost baffle.

Figure 3 is a plan view of the drier with the top of the drier and the hopper removed.

Figure 4 is an enlarged side elevation of

the lowermost baffle and switch mechanism operated thereby.

Figure 5 is a partial side elevation of the mechanism shown in Figure 4.

Referring more particularly to the drawings, 11 designates the drier column or frame, which is preferably, but not necessarily, made in the form of a rectangular column, having an inlet pipe 12 in one side and near the bottom thereof, for introducing or feeding a drying agent into the frame. The drying agent passes upwardly through the frame and through an outlet pipe 13 positioned near the top thereof. Leading into and passing through the top of the frame is the hopper 14 which is provided with an expanded portion 15 positioned near its outlet or discharge end 16. A shaft 17 extends from side to side of the frame and positioned approximately in the centre portion of the expanded portion. The shaft 17 is rotatably mounted in suitable bearings 18 and secured to the shaft are a plurality of vanes or baffles 19, adapted to regulate the passage of material through the drier feed chute. In the drawing, I have shown four such baffles, but this number may be increased or decreased according to the class of material under treatment, and the quantity it is desired to pass through the machine. The shaft 17 extends through one side of the frame and secured to this extension is the ratchet toothed wheel 20, the teeth of which engage with the end 21 of a pivottally mounted lever 22. Rotatably mounted on the shaft 17 is the arm 23, and pivottally mounted on the arm is the ratchet wheel turning pawl 24 adapted to engage with the ratchet teeth. The arm engages with an extension 25 of the lever 22 to hold the end 21 in position. A counterbalance weight 26 may be provided on one end of the extension 25, to hold the end 21 out of engagement with the teeth, during a certain period of the operation of the machine. The end of the chute is closed by a hinged door 27, which is provided with a counterbalance weight to hold it in the closed position supporting a predetermined quantity of material within the chute and between the discharge end and the expanded portion 15. Secured to the spindle 28 supporting the door is an outwardly extending lever for opening the door in the manner hereinafter described. The lower end of the

frame is provided with a discharge hopper 29, near the discharge end of which an expanded portion 30 is formed, and within said expanded portion is mounted a plurality of baffles 31, secured by any suitable means to a shaft 32, extending from side to side of the frame. The baffles are so arranged that they prevent cold air from passing into the frame and yet allow free passage of the dried material from the frame. The shaft 32 is rotated by means of sprockets and chain driving means 32^a, driven from one of the tipping chain spindles 32^b, hereinafter described. Between the feed hopper and the discharge hopper are a plurality of baffles 33 secured to shafts 34 extending from side to side of the frame and rotatably mounted in bearings formed in or secured to the sides of the frame. It will be observed that each baffle extends from a point in close proximity to one side of the frame to a point on the opposite side, but in close proximity to the shaft 34. The baffles are arranged in zig-zag formation, so that they retard the passage of the gases or drying agent through the machine and are also positioned so that the material tipped from one baffle will be received by the baffle immediately below it. Secured to each of the shafts 34 and positioned without the frame, are the counterbalance levers 35, and adjustable weights 36, which assist in counterbalancing the weight of each baffle so that less power will be required to operate the baffles. Tipping arms 37 are secured to each shaft 34 and are so positioned that when they are raised by means, hereinafter described, they will raise the baffle to the position shown in Figure 2, see the second lowermost baffle. The lowermost or controlling baffle is not provided with a tipping arm, but is so constructed that the counter balance weight 36^a will tip the baffle when the material held thereon has reached a predetermined state of dryness. The lowermost baffle is secured to a shaft 34^a which extends from one side of the machine and through the other side, and secured to the part 38 is the one-toothed ratchet wheel, or cam, 39. Rotatably mounted on the part 38 is the ratchet operating arm 40 which is provided with a pivotally mounted pawl 41. The free end of the arm 40 is secured to a lever 42 secured to the shaft directly above it, by means of the link 43. Also secured to the shaft extension 38 is the lever 44, the free end 45 of which is secured to one end of a rocker arm, 46, by means of a flexible tension member 47. The rocker arm operates a switch 48 which closes the circuit to a magnetically operated switch 49 positioned in the wiring of the motor 50. A main switch 51 may also be provided in the circuit to the motor, the circuit being shown diagrammatically in Figures 1 and 2. The other end 52 of the rocker arm is connected to one end 53 of a pivotally mounted lever 55, by means of a flexible tension member 56. The other end 54 of the lever 55 is positioned on the opposite side of the pivot 57 from the end 53. Extending from top to bottom of the frame and positioned on each side of the centre line of the frame and at one side thereof, are the endless chains 58, which pass around pulleys 59 secured to the spindles 60 and 32^b. The two uppermost spindles are connected together by means of a suitable train of gears 61, so that when one chain is driven in the direction shown by arrow 62, the other chain will move in the direction shown by arrow 63. Secured to one of the spindles 60 is the sprocket toothed wheel 64, which is driven by a chain 65 passing around said wheel 64 and, similarly, toothed wheel 66 secured to a shaft 67 driven by a worm 68 and worm wheel 69 operated by the motor aforementioned. Each chain is provided with two projecting operating pins 70 positioned half the length of the chain from one another. Many modifications from that detailed herein may be made in the construction of the device without departing from the spirit of the invention.

In operation all the baffles are in the position shown in Figure 1, with the material to be treated mounted thereon. The door from the feed hopper is closed and supports a quantity of material equal to the amount held by the upper baffle and the feed chute regulating vanes prevent material from passing therethrough. A heated, or any other form of drying agent is then fed into the machine through the inlet pipe at the bottom of the drier and through which it passes to an outlet positioned at the top, its progress being retarded therethrough by the zig-zag mounting of the baffles, so that material mounted thereon may be subject to a maximum exposure to such drying agent. When the material on the lowermost baffle reaches a predetermined stage of dryness, the counterbalance weight overcomes the combined weight of the material on said baffle and also the baffle itself, and tips the material into the discharge hopper which is provided with a rotating regulating device which controls the passage of material therethrough and, also, prevents entry into the drier of cold air or moisture which would decrease the efficiency of the drier. The baffle, in tipping, turns the shaft on which it is mounted and to which is secured the switch operating arm which closes the circuit to the motor through the relay or magnetic switch. The shaft, in turning, also carries the tooth of the ratchet wheel to contact with the pawl secured to the arm which is link connected to the baffle immediately above it. The circuit, being closed to the motor, causes same to move the chains in the

directions indicated by the arrows. The chains carrying the projections move upwardly and, contacting with the second lowermost baffle operating arm, tip the baffle and in so doing cause the pawl to press against the tooth of the cam to return the lowermost baffle to its normal or load receiving position at the same speed that the second lowermost baffle is being tipped. This arrangement ensures a positive return of the lowermost baffle to its material receiving position. The chains carry projections which, in moving upwardly, contact with the baffle operating levers in such a manner that one is tipped and returned to its material receiving position, before the one above it is tipped. When the uppermost baffle has been tipped and returned to its position, the door from the feed hopper opens and deposits its load on the uppermost baffle. When the door has closed, the feed control baffle is revolved to deposit a predetermined quantity of the material on the door. The rotating vanes are operated in the following manner:—The ratchet wheel is first released by the raising of the lever 22 and pulling the end out of engagement with the ratchet teeth. The arm to which the pawl is attached is then raised and the vanes are thus rotated. The rotating baffle or vanes in the discharge hopper is operated by the tipping chains. When the projection on the chain passes the last mentioned arm it drops back on to the extension 25 of the lever 22 and throws the end 21 into engagement with the teeth. The foregoing part of the operation has been performed by the movement of one projection on each of the operating chains. The other projection on the chain at the right hand side of the machine shown in the drawings, then comes in contact with the lever 25 and pulls on the rocker arm to break the circuit to the motor.

It will be seen from the foregoing, that a machine constructed and automatically controlled in the manner herein described provides a means for delivering material from the machine in such a manner that its moisture content remains constant. This machine may be used for drying wood chips, bark, sawdust, wastes from all plants in pulp and paper and also the lumber business. It may also be used for drying tan bark, bagasse, sugar cane refuse, sugar, peat, and other classes of high moisture fuels.

The device is very simple in construction and may be operated with the minimum amount of labour. It is economical in that it can be repaired with the minimum amount of trouble, as all the main parts of the machine are exposed and accessible.

In the drawings I have shown one type of measuring and feeding means which may be employed, and it will be readily understood that any type of apparatus which will

be easily regulated to feed a predetermined amount of material at intervals to the drier may be employed. The discharge controlling mechanism may also be modified to suit the class of material under treatment.

Having thus described my invention, what I claim is:—

1. A drying machine comprising a frame, means for feeding material thereto, means for discharging material therefrom, means for feeding a drying agent thereto, an outlet for the drying agent, and means within the dryer to control the passage of material in a vertical direction through the dryer, said means being automatically controlled by the change in weight of the material as it is being discharged from the bottom of the machine.

2. A drying machine comprising a frame, means for feeding material to the dryer, means for discharging the material from the frame, means for conducting a drying agent to the frame, an outlet for said drying agent, a plurality of baffles adapted to retard the passage of the drying agent through the machine, said baffles being adapted to support the material thereon, and automatically controlled means for regulating the passage of material through the machine according to the change in weight of the material as it is discharged from the bottom of the machine.

3. In a drying machine having means for feeding material thereto and discharging material therefrom, an inlet and an outlet for a drying agent, baffle means to retard the progress of the drying agent through the machine, and also adapted to support the material to be dried thereon, a baffle pivotally mounted above the material discharging means, and means operating in conjunction with the last mentioned baffle to tip the material thereon when the material reaches a predetermined state of dryness and means operated by the movement of the baffle to feed material into and through the machine.

4. In a drier, a frame, a feed hopper, a discharge hopper, a plurality of baffles pivotally mounted in the frame one above the other, an inlet and an outlet for a drying agent, a control baffle pivotally mounted in the frame adapted to be tipped by a weight when the material thereon reaches a predetermined state of dryness, and means operated by the movement of the control baffles to successively tip the baffle above the control baffle and to open the feed chute.

5. In a drier, a frame, a feed hopper, a regulating device within the feed hopper to control the passage therethrough of the material to be dried, an outlet from the hopper, a plurality of pivotally mounted baffles positioned below the feed hopper outlet and adapted to receive and retard the passage of material therethrough, an inlet and an out-

let for a drying agent, a discharge hopper at the bottom of the frame, said discharge having means to prevent cold or damp air from passing into the frame, a pivotally mounted control baffle positioned above the discharge hopper, means to automatically tip said baffle when the material thereon has reached a predetermined state of dryness, and means operated by the movement of the control baffle to successively tip each baffle so that the material thereon will fall on to the baffle below it, said last mentioned means being adapted to first open the feed hopper and then operate the regulating device therein.

6. A drier according to claim 5, in which the feed hopper controlling device comprises a plurality of vanes secured to and projecting outwardly from a shaft rotatably mounted in the hopper, and means secured to the shaft to rotate same when operated by the baffle tipping means.

7. A drier comprising a frame, a feed hopper secured to said frame, ratchet controlled feed regulating means within the hopper, a plurality of pivotally mounted baffles positioned below the outlet from the hopper and arranged one below the other in zig-zag formation within the frame, a control baffle positioned below the lowermost aforementioned baffle, means to tip the control baffle according to the state of the material under treatment, and supported thereby, means connecting the second lowermost and the control baffle to allow free tipping movement of the control baffle but to bring said control baffle back to material receiving position on tipping of the second lowermost baffle, means controlled by the movement of the control baffle to successively tip all the baffles above it and to operate the feed regulating means in the feed hopper, and an inlet for a drying agent at the bottom of the

drier and an outlet for a drying agent at the top of the frame.

8. A dryer according to claim 7, having the baffle tipping means comprising a plurality of endless chains driven by a motor through suitable gearing, a plurality of projections on said chains adapted to contact with levers moving in unison with the baffles and switches in the circuit to the motor to close same by the tipping movement of the control baffle and means operated by the chain to open the circuit to the motor.

9. In a device of the class described, a frame having baffle means to regulate and retard the passage of material therethrough, a control baffle adapted to tip when the material contained thereon reaches a predetermined weight due to the drying out of the moisture in the material, means operated by the control baffle to operate the first mentioned means, means for feeding a drying agent to the machine, means for discharging the spent drying agent from the machine, and baffle means for discharging the treated material from the machine.

10. A method of controlling a drying machine consisting of regulating the vertical flow of material therethrough by the change in weight of the material being discharged from the bottom of the machine.

11. A method of drying material consisting of feeding material to a machine, passing a drying agent through the machine, regulating the passage of the material in a substantially vertical manner through the machine, so that it passes through successive stages of drying and automatically controlling the movement of said material in the dryer by the change in weight of the material being discharged from the machine.

In witness whereof, I have hereunto set my hand.

HUBERT A. HATFIELD.