Sept. 25, 1928. 1,685,338

O. W. RANDOLPH

DRYING

Filed Jan. 28, 1925 3 Sheets-Sheet 1

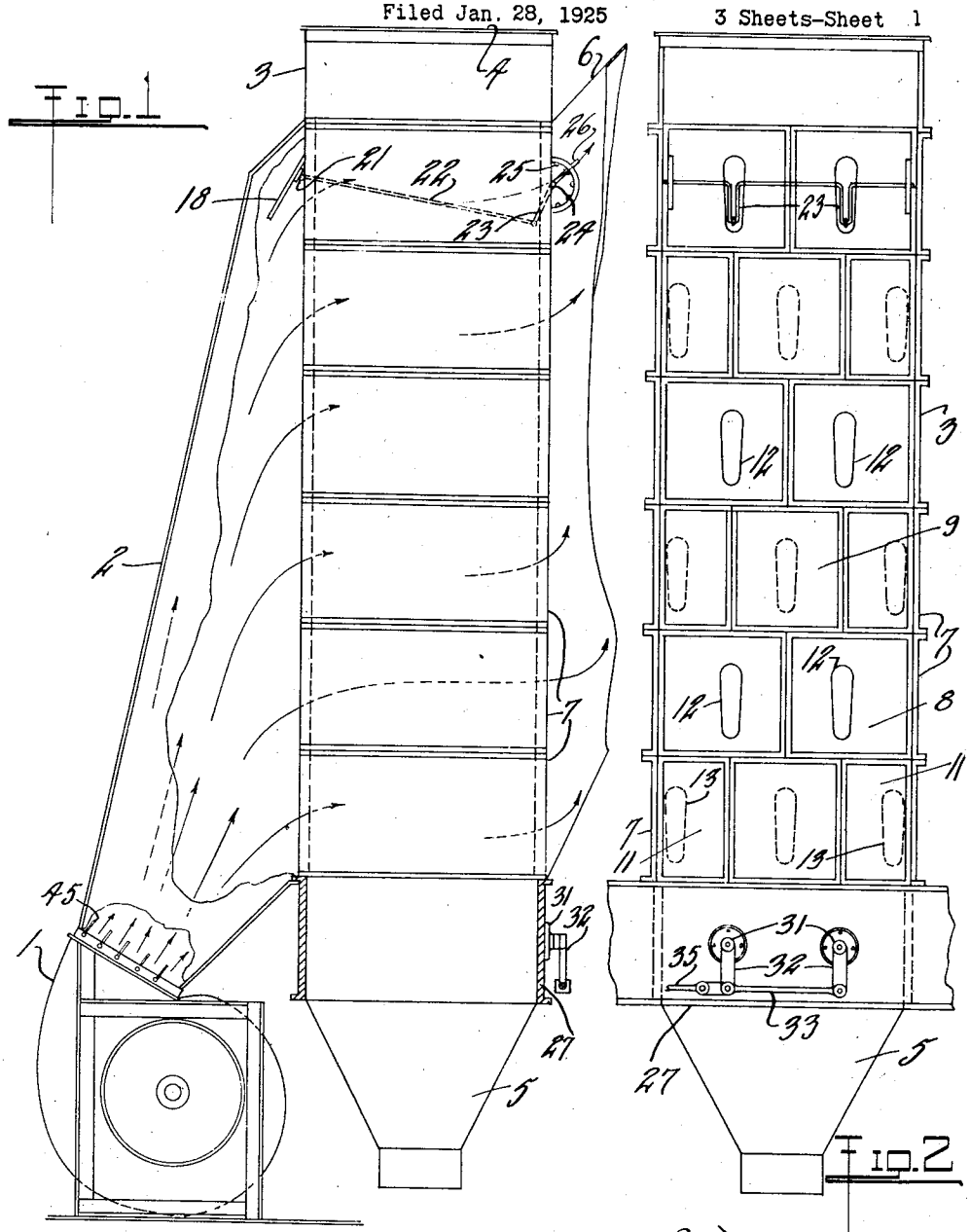

FIG. 1

FIG. 2

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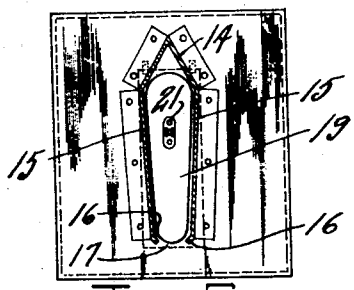

FIG. 5

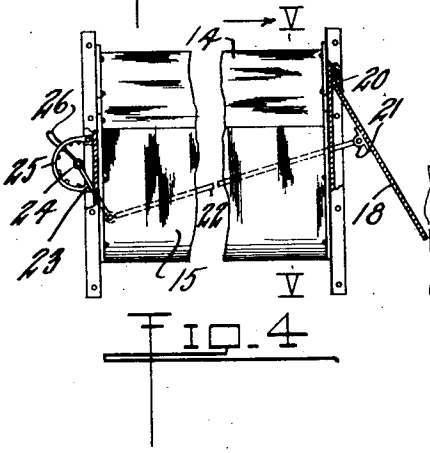

FIG. 4

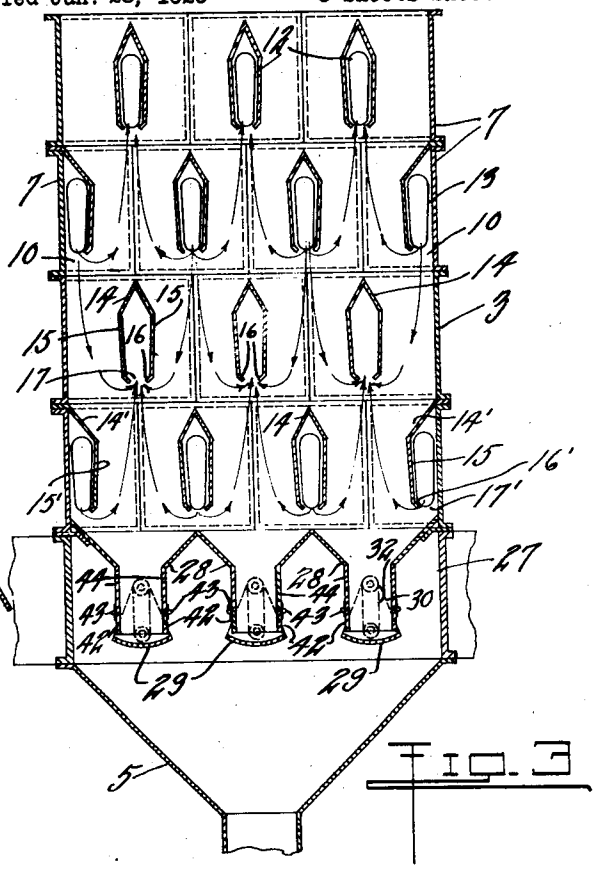

FIG. 3

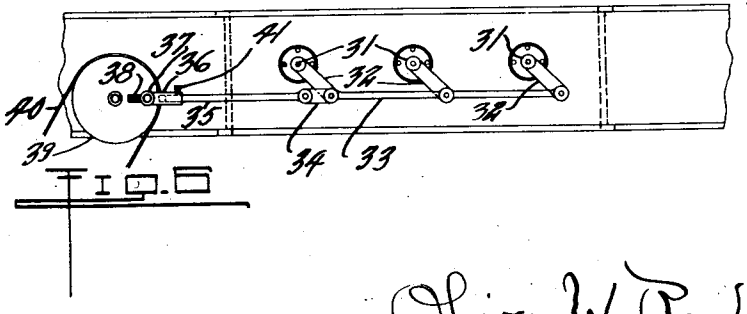

FIG. 6

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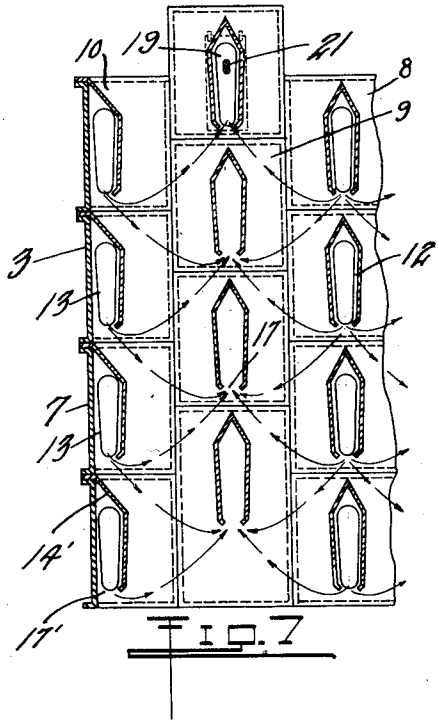

FIG. 7

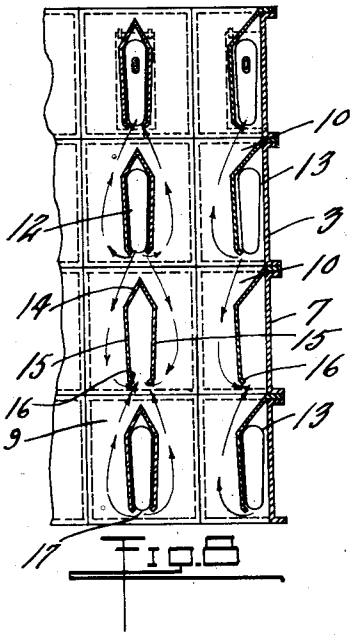

FIG. 8

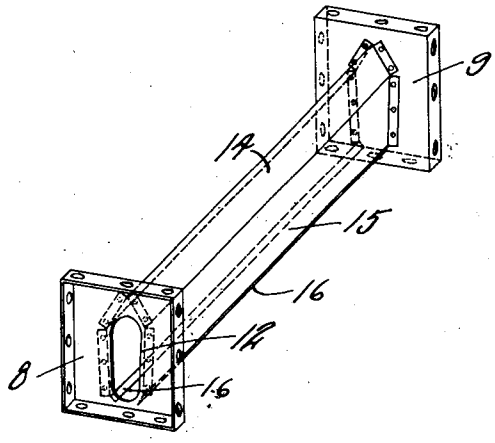

FIG. 9

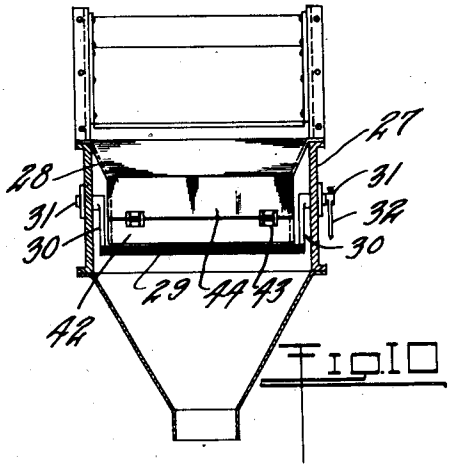

FIG. 10

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Patented Sept. 25, 1928. 1,685,338

UNITED STATES PATENT OFFICE.

OLIVER W. RANDOLPH, OF TOLEDO, OHIO.

DRYING.

Application filed January 28, 1925. Serial No. 5,235.

This invention relates to the control of air currents through material.

This invention has utility when incorporated in the handling of air or gases wherein the humidity is below the saturation point for the purpose of removal of moisture from bulk material, as coal, salvaged grain, sawdust, meals, as for feed, and seeds, as cotton seed, nuts, peanuts, and asbestos rock.

Referring to the drawings:

Fig. 1 is a side elevation, with parts broken away, of an embodiment of the invention in a drier of the column type having sections;

Fig. 2 is a view of the apparatus of Fig. 1, from the right of the showing in Fig. 1, the discharge way or stack being removed;

Fig. 3 is a section through a portion of a sectional drier, at right angles to the showing of Fig. 1, this drier being three sections wide instead of two sections wide as shown in Fig. 2;

Fig. 4 is a detail view, with parts broken away, of an upper drying air by-pass device type of duct;

Fig. 5 is a section on the line V—V, Fig. 4;

Fig. 6 is a fragmentary view of the discharge control drive for regulating the material flow made through the apparatus of this disclosure;

Fig. 7 is a view similar to Fig. 3 with the difference that this sectional type of drier has the series of duct sections in vertical rows horizontally staggered, while the showings in Figs. 2, 3, have the sections in horizontal rows vertically staggered;

Fig. 8 is a fragmentary view similar to Figs. 2, 3, 7, but the ducts herein are in rows both vertically and horizontally;

Fig. 9 is a perspective view of the duct section unit; and

Fig. 10 is a view of the discharge hopper of Fig. 3 at right angles to the showing in Fig. 3, and with parts broken away.

Fan 1 may deliver warmed air or exhaust gases from a heating source or furnace to pass by way 2 in serving as supply means for sub-humid gases as delivered to housing 3 shown as a column having intake 4 at the top and discharge 5 directly therebelow as to the bulk material. The gases as delivered to this housing 3 by supply way 2 pass by gas discharge 6 from this column 3.

This column 3 is shown as comprising side sections 7 assembled with full plates 8, 9, and minor plates 10, 11. The plates 8 have openings 12 therethrough, while the plates 10 have similar openings 13 therethrough, these latter openings being non-central while the openings 12 are central. The plates 8, 9, are assembled as a duct unit by a member therebetween comprising gable 14 with sides 15, 16, inwardly extending therefrom to bottom 17. This configuration of the duct is one for capacity of heating surface or direct radiation with large capacity for uniform ready flow of the bulk material through the housing 3 as a column for the treatment of said material. The gable 14 tends readily to divide the flow, but such as passing the lower corners of such gable 14 does not tend to hang for the receding walls 15 at once release such material for flow or uniform settling down through this column of the drying, warming, cooling or other treatment, apparatus.

The supply of heated air or hot gases from combustion which, as of high temperature are below the humidity saturation, flow into this duct 14, 15, in giving up heat through the walls of the gable and sides tend to contract and due to this restricted opening 17 there is maintained pressure for velocity of travel of this partially chilled gas supply into the body or stream of the bulk material. This stream from one duct as a supply source may go to one or more ducts of the exhaust or discharge series which have their openings 12, 13, in the discharge 6 instead of in the supply 2.

The plates 10, 11, carry a gable half 14′, sides 15′, 16′, toward the opening 13 for restricting outlet 17′ when operating as a supply duct. These open bottoms 17, 17′ are outlets from the supply series of ducts, while they are inlets as to the exhaust series of ducts.

In the handling of some material wherein the moisture content is high or the temperature of the supplied gases is such that as to the material as entering the housing 3 there may be quite rapid removal of water, or gas supply be of such rate that the gases as passing from a supply duct to an exhaust duct may be above the saturation point, any tendency of such gases as rising into an exhaust duct as there subjected to further chilling which may tend to precipitate and effect a re-deposit of moisture back into the bulk material, may be controllably avoided herein by swinging vane or damper 18 into supply way 2 away from opening 19.

This damper or vane 18 has pivotal mounting or hinge 20 and carries eye 21 from which

extends link 22 through this exhaust duct to crank 23 having hinge connection 24 in quadrant 25. This crank 23 has rigid extension 26 adjustable into different positions on the quadrant 25 thereby permitting manual regulation of the degree of opening of the vane 18 and thus a nicety in regulation of the warm gases as passing directly into this exhaust duct for delivery to the exhaust or discharge way 6 independently of passing through the bulk material. This by-pass as controllable, not only gives velocity of flow for discharge of the saturated gases as in such duct, but as mingling therewith tends to reduce the average humidity and to reduce the precipitation in such duct. The extent of this air by-passing or adjustment may be as desired in the handling of the particular material being treated.

This material as passing through the apparatus or moisture extracting column is so tumbled about due to the disposal of the ducts that the stock is uniformly subjected to the radiant heat action from the walls of the closed side and gable walls of the ducts as well as to the direct action of the gases in passing through the bulk material from the intake series of ducts to the outlet series of ducts.

The velocity or flow rate of this stream may be nicely controlled and maintained uniform throughout the cross-section of the housing or column 3. To this end, base section 27 is provided with minor hoppers 28 above discharge or major hopper 5. Each minor hopper 28 is normally closed as to the flow of bulk or granular material by scoop 29.

The scoop 29 has terminal upwardly extending arms 30 to pivot bearings 31. Fixed with the pivot bearing 31 is depending arm 32 connected as to a number of these minor hoppers 28 by links 33, 34, and sectional link 35, 36, to wrist pin 37 adjustable in slot 38 in crank disk 39. Belt 40 serves to rotate this crank disk 39 continuously during the operation of the drier at a desired rate of speed, which is preferably less than that which might cause the scoops 29 to throw the material. The amplitude of the arc of oscillation of the scoops 29 may be adjusted. The centering of this arc or oscillation of the respective scoops 29 as to the respective hoppers 28 is adjusted by varying the length of the link 35, 36, telescopically and holding it as so adjusted by set screw 41.

As the bulk material may have its elements more or less hard and the clearance between the scoop 29 and the side walls of the hoppers 28 is not great, there may be tendency in this positive drive to swing the scoop 29 against the side of the hopper 28 with a particle of the material between the hopper and such scoop. Relief from disaster under such a condition is provided herein by hopper side wall sections 42 mounted by spring hinges 43 to be normally held in alignment with side walls 44 of the minor hopper 28. Accordingly, as the scoop 29 may jam a small lump of coal against a side wall section 42, such wall 42 acts as a gate and opens on its hinges 43 to permit the scoop 29 to have its full swing at the adjusted set thereof.

Under the device of this disclosure it is possible to have great flexibility in installation not only as to vertical and horizontal capacity but as to gas flow due to the by-pass, and there is further flexibility in the flow rate of material so that all may be adjusted for efficient operation to the desired drying extent uniformly with a capacity for output permitted by the installation under exigencies of the drying action.

The delivery by the fan 1 to the way 2 is automatically opened only during the operation of the fan. To this end, louvres 45 are opened against gravity by the fan draft and at once the fan stops, such louvres close. This precludes any back-draft upon the fan, and when the operation is one of heating, there is no leakage of the heating or drying gas or fumes into the apparatus. This is a safety against fire hazard.

What is claimed and it is desired to secure by United States Letters Patent is:—

1. Apparatus for the reduction of the moisture content of bulk material comprising a vertical housing for a column of said material, a first series of ducts extending transversely into said housing, sub-humid gas supply means to said first series of ducts, and a second series of ducts extending from said housing to be supplied by gas as passing through the material from said first series of ducts, said ducts having closed gable type tops and narrowing sides downward to open bottoms.

2. A duct unit comprising a pair of end plates, one having an opening therethrough, and a gable top member having sides narrowing toward an open bottom and assembled with said plates to have said open bottom between said plates.

3. Apparatus for the handling of flowing bulk material including a main discharge, a hopper thereto, a scoop normally closing said hopper, a mounting for the scoop centrally of the hopper, and continuous driving means for rocking the scoop, including means for adjusting the extent of the rocking of the scoop whereby the rate of flow of the bulk material from the main discharge may be varied.

4. Apparatus for the handling of flowing bulk material including a main discharge, a hopper provided with an outlet therefrom, a scoop normally closing said hopper outlet, a mounting for the scoop centrally of the hopper, a drive for oscillating said scoop across the hopper outlet, and means between the drive and the scoop for varying the throw of

the scoop while maintaining its operation symmetrical as to the hopper.

5. Apparatus for the handling of flowing bulk material including a main discharge, a hopper thereto having a lower edge, a scoop normally closing said hopper by movement to position as to said edge, a mounting for the scoop centrally of the hopper, means for rocking the scoop, and jam precluding means mounting said lower edge of the hopper for movement with the scoop as to the hopper.

6. Apparatus for the handling of flowing bulk material including a main discharge, a hopper thereto having depending side extensions, a scoop normally closing said hopper, a mounting for the scoop centrally of the hopper, means for rocking the scoop, and jam precluding means hinge-mounting side extensions for mounting with the scoop as to the hopper.

In witness whereof I affix my signature.

OLIVER W. RANDOLPH.