

Nov. 12, 1935.

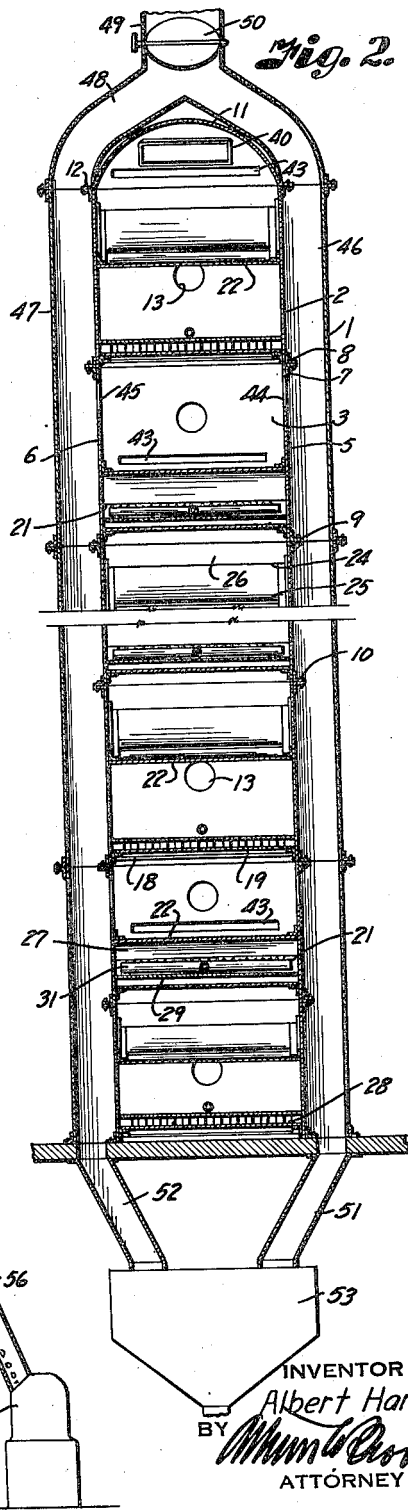
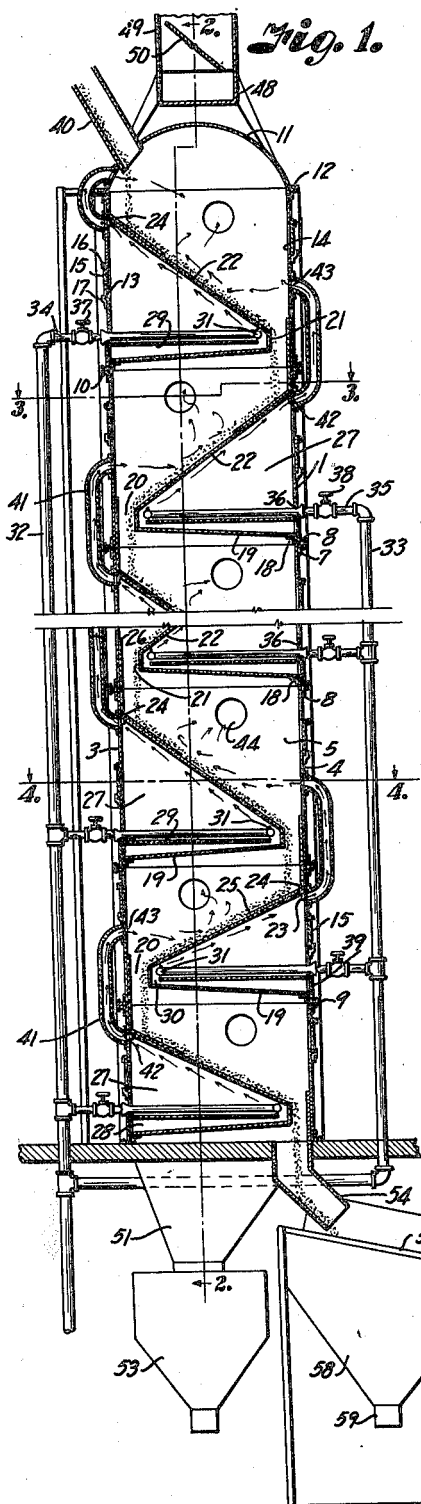
A. HANTLA

2,020,504

DRIER

Filed April 25, 1934

2 Sheets-Sheet 1



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Fig. 3.

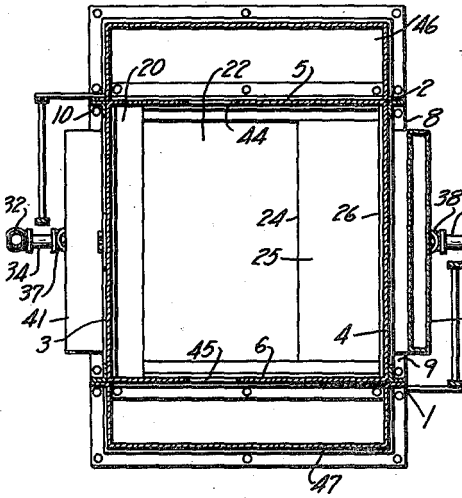


Fig. 4.

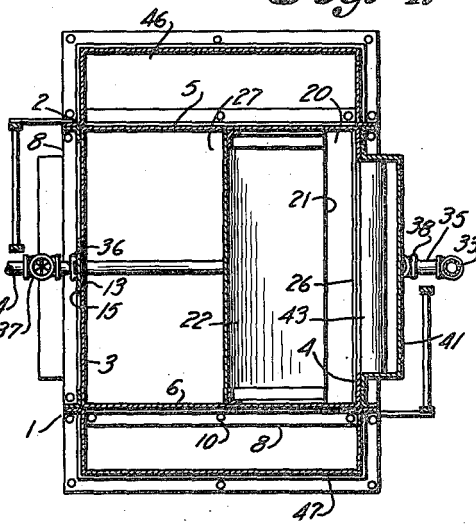
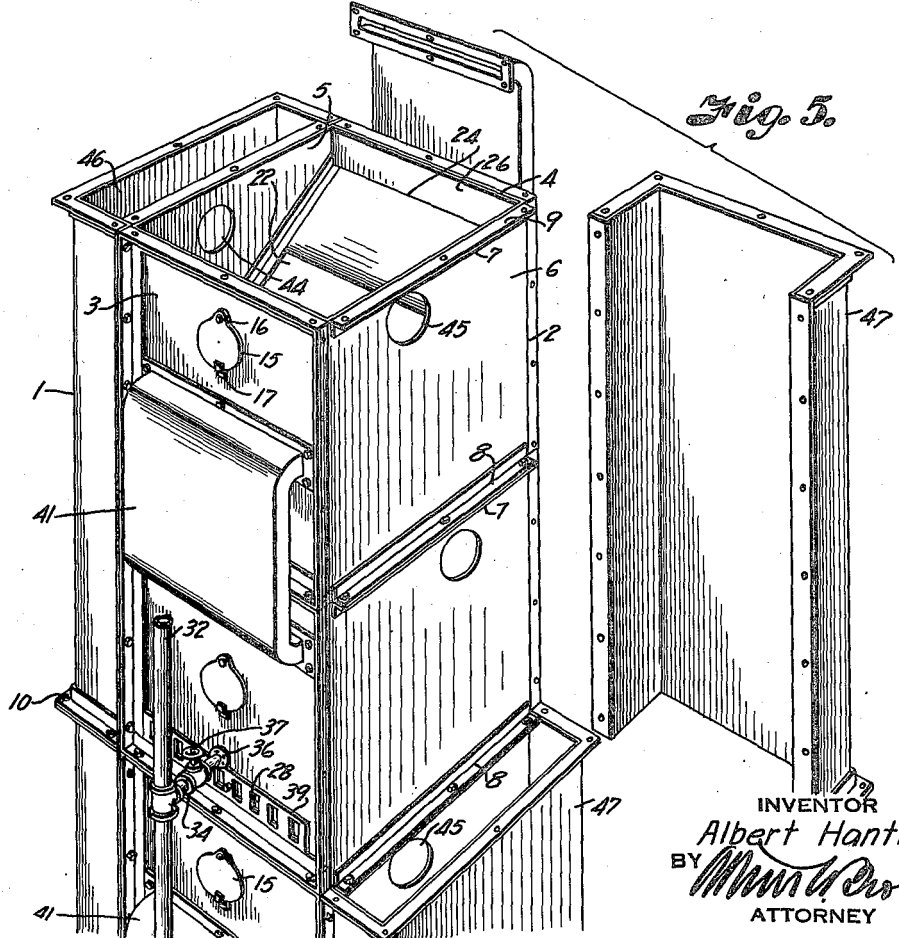


Fig. 5.



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# UNITED STATES PATENT OFFICE

2,020,504

DRIER

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Application April 25, 1934, Serial No. 722,322

9 Claims. (Cl. 34—37)

This invention relates to driers and more particularly to one of the character for drying comminuted material, and has for its principal objects to prevent collection of condensate upon interior walls of the drier, to provide a more efficient movement of the drying medium in contact with the material being dried, and to provide means for carrying off vapors so that they are not retained in contact with the material for any substantial length of time.

In accomplishing these and other objects of the invention, I have provided improved details of structure, the preferred form of which is illustrated in the accompanying drawings, wherein:

Fig. 1 is a vertical section through a drying apparatus embodying the features of the present invention and illustrating flow of material there-through.

Fig. 2 is a vertical section taken at right angles to the section shown in Fig. 1 on the line 2—2, Fig. 1.

Figure 3 is a horizontal section through the drier on the line 3—3, Fig. 1.

Fig. 4 is a horizontal section on the line 4—4, Fig. 1.

Fig. 5 is a detail perspective view of a portion of the drier showing one of the stack sections removed.

Referring more in detail to the drawings:

1 designates a drier including a vertically positioned housing of rectangular cross section and consisting of a plurality of superimposed tubular sections 2, each of which includes vertical side walls 3, 4, 5 and 6, having angle members 7 and 8 extending along the upper and lower ends thereof.

The angles 7 and 8 are secured to the walls of the housing so that horizontal flanges 9 thereof lie in the plane of the section ends.

The horizontal flanges at the upper ends of the sections thus form supports or seats for the horizontal flanges at the lower end of the next upper sections, as shown in Fig. 1, the sections being secured together by suitable fastening devices 10 extending through the flanges 9 of the angle members as clearly shown in Fig. 5. The upper section is closed by a substantially dome-shaped cover 11 having angle members 12 connected with the top angle members of the upper section to form a closed housing. The walls of the sections may be provided with suitable openings 13 and 14 in opposite side walls thereof for access to the burner and oven chambers later described, the openings being normally closed by doors 15 hingedly secured to the walls of the sections by fastening devices 16 and clips 17.

Extending across the wall 4 of each section at a point spaced above the bottom edge thereof is an angle member 18 forming connection supports for slightly upwardly inclined partitions 19 extending across the depth of the housing and from the angles to points spaced from the opposite side walls to provide passageways 20, as clearly shown in Fig. 1.

Connected with the spaced ends of the horizontal partitions and extending upwardly therefrom are vertical portions 21 terminating in reversely inclined partitions 22 which also connect with the side walls 4 of the sections by means of down-turned ears 23.

The last connection is reinforced by angle members 24 extending across the depth of the housing and having flange portions 25 lying flatly against the upper face of the inclined partitions 22 and flange portions 26 lying against the inner face of the adjacent walls. The flanges 26 preferably extend upwardly into the next upper section in parallel relation with the partition portions 18 to a point slightly above passageways 20 so as to prevent lodgment of comminuted material thereon.

The inclined partitions with their connecting wall portions 21 thus cooperate with the adjacent walls of the respective sections to provide substantially angular shaped burner chambers 27.

The sections thus described are arranged relatively to each other so that the partitions and passageway of one section are arranged oppositely to the corresponding parts of the next upper section, as shown in Fig. 1, whereby comminuted material delivered onto the upper inclined partition will gravitate downwardly within the housing in a zig-zag course and over each of the respective burner chambers.

Formed above each of the partitions 19 is an air inlet opening 28 for admitting secondary air to each burner chamber, and in order to deliver the secondary air for flow upwardly against the under face of the inclined partitions, each burner chamber is provided with a horizontal baffle 29 connected with the wall thereof at the upper edge of the opening 28 and having its opposite edge terminating short of the vertical partition 21 to provide an air outlet opening 30.

Supported in each burner chamber above the horizontal baffle 29 is a burner 31 having a plurality of jets arranged for directing a flame across the under face of the upper inclined partitions 22 so that the products of combustion move upwardly thereunder to heat the material gravitating down the upper face thereof.

The burners 31 are supplied with fuel from conduits 32 and 33 having branch connections 34 and 35 connected with the mixing valves 36 of the respective burners, the branches being provided with suitable shut-off valves 37 and 38. The secondary air passing through the openings 28 is controlled by sliding dampers 39, as best illustrated in Fig. 5.

The comminuted material is delivered to the upper section through a spout 40 discharging directly above the upper end of the upper partition 22 so that the material flowing from the spout gravitates down the heated partition 22 in counter-flow to the products of combustion moving in the burner chamber, through the passageways 20 and down each succeeding inclined partition 22 to effect evaporation of the moisture content of the material.

In order to assist in vaporizing the moisture content of the material I provide for directing the hot products of combustion from one burner chamber to the next higher oven chamber. This is accomplished by closed ducts 41 having L-shaped ends connected with the respective sections over slotted openings 42 and 43 located just below the upper end of one inclined partition 22 and above the lower end of the next upper inclined partition 22 respectively. The gases, upon being discharged in the oven chambers move directly against the stream of gravitating material to thoroughly dry any steam that may be rising from the material incidental to the lower heat moving under the partitions.

The dry vapors and products of combustion accumulating in the oven chambers are removed through openings 44 and 45 in the opposite side walls which connect with vertical stacks 46 and 47 extending upwardly alongside the housing walls and having a common connection 48 at their upper ends exhausting to atmosphere through a pipe 49 having a control damper 50 whereby draft through the stacks is regulated. The lower ends of the stacks connect through pipes 51 and 52 with a dust collecting hopper 53 which receives any light material that has been carried from the oven chambers and which is caused to gravitate in the stacks incidental to drop in velocity of the currents moving through the openings 44 and 45.

The dry material passes from the lower section through a spout 54 discharging onto a screen 55 from where the coarser material is delivered through a spout 56 discharging into a grinding mill 57. The fine dried material, however, which passes through the screen is delivered into a hopper 58 and discharged into sacks through a sacking spout 59.

In operating a drying apparatus constructed as described, the comminuted material is delivered through the spout 40 for discharge onto the inclined partition 22 of the upper section, after which the material will gravitate thereover and be heated by the products of combustion passing upwardly in contact with the opposite side thereof. After gravitating off the first inclined partition, the material will continue in a zigzag course across the respective burner chambers until it finally is discharged into the delivery spout 54.

During its passage down the heated partitions 22, the moisture content of the comminuted material is evaporated by the heat and reduced to dry vapors which are carried off through the stacks 46 and 47. Very light comminuted material will be drawn off with the vapors, but will

gravitate to the bottom of the stacks for flow into the dust collecting hopper 53.

The individual outlets for each section provide indirect draft for each burner chamber so that the draft does not interfere with gravitational movement of the comminuted material. In other words, there is relatively no draft through the passageways 20 in counter-flow to the material.

Another feature is that the vapors in one oven chamber will not be carried to the next upper chamber since they are directly discharged into the stacks.

Attention is directed to the fact that the fuel control valves 37 and dampers 39 and 50 may be adjusted so as to maintain a proper air and fuel mixture to produce substantially perfect combustion in the burner chambers, thereby eliminating possibility of the formation of poisonous and explosive gases in the oven chambers. With this adjustment, the damper 50 is in proper position to maintain the draft low enough to prevent loss of fine particles through the stack 49.

From the foregoing it is apparent that I have provided a drier having a more efficient movement of the drying medium to prevent condensate from collecting on the interior of the walls of the drier and to more effectively dry the comminuted material. Also due to the fact that each oven is provided with a vapor drawoff, the vapor does not remain in contact with the material for any substantial length of time but is immediately drawn off along with the products of combustion and the very fine comminuted material. The dried material, after passing through the screen, may be sacked or otherwise packaged, depending upon the kind of material and the nature of its use.

What I claim and desire to secure by Letters Patent is:

1. A drier including a housing, a plurality of superimposed burner chambers in the housing, each having an alternately arranged downwardly inclined upper wall and a bottom wall connecting the lower edge of the upper wall with side walls of the housing, means for delivering material to be dried for flow over inclined upper walls of the burner chambers, a burner in the chambers to heat the material for evaporating the moisture content thereof, means connected with the housing for delivering heating medium moving upwardly on the under side of the inclined walls for flow over the upper side of the inclined walls to prevent condensation of the vapors within the housing, and means connected with the housing for removing the vapors.

2. A drier including a housing, a plurality of burner chambers in the housing, means for delivering material to be dried for successive flow over the burner chambers, burners in the chambers for heating the material for evaporating the moisture content thereof, means connected with the housing and with the burner chambers for delivering heating medium into the housing from the burner chambers to prevent condensation of the vapors within the housing, means connected with the housing for removing the vapors, and means for controlling draft through the housing.

3. A drier including a housing, a plurality of angular shaped burner chambers in the housing, means for delivering material to be dried over an inclined side of said burner chambers, burners in the chambers to heat the material for evaporating its moisture content, conduits connected with the burner chambers to convey the

products of combustion over said inclined sides in counter-flow to the material to prevent condensation of the vapor in the housing, and means for removing the vapor including means for removing the products of combustion.

4. A drier including a rectangular housing, a series of inclined partitions extending alternately from opposite side walls of the housing and spaced from the opposite walls to provide passageways for material to be dried, oppositely inclined partition walls fixed to said side walls at points spaced above said first named partitions and connected with the spaced ends thereof to provide inclined heating surfaces and to form angular shaped burner chambers therebetween, means for delivering the material for gravitational flow down the second named inclined partition walls, burners in the burner chambers for heating the gravitating material by the products of combustion moving upwardly against the opposite face of said second named inclined partition walls, and means for delivering the products of combustion over the gravitating material for preventing condensation of moisture within the housing.

5. A drier including a rectangular housing, a series of partitions extending alternately from opposite side walls of the housing and spaced from the opposite walls to provide passageways for material to be dried, inclined partition walls fixed to said side walls at points spaced above the first named partitions and connected with the spaced ends of said first named partitions to provide inclined heating surfaces and to form angular shaped burner chambers therebetween, means for delivering the material for gravitational flow down the inclined partition walls, burners in the burner chambers for heating the gravitating material by the products of combustion moving upwardly against the opposite face of the inclined partitions, and means for delivering the products of combustion over the inclined partitions to prevent condensation of moisture in the housing, and means for removing vapor from the housing including means for removing the products of combustion.

6. A drier including a rectangular housing, a series of partitions extending alternately from opposite side walls of the housing and spaced from the opposite walls to provide passageways for material to be dried, inclined partition walls fixed to said side walls at points spaced above the first named partitions and connected with the spaced ends of said first named partitions to provide inclined heating surfaces and to form triangular shaped burner chambers therebetween, means for delivering the material for gravitational flow down the inclined partition walls, burners in the burner chambers for heating the gravitating material by the products of

combustion moving upwardly against the opposite face of the inclined partitions, conduits connected with the burner chambers adjacent the upper portions of the inclined partitions for delivering the products of combustion over the corresponding upper inclined partitions to prevent condensation of moisture within the housing, and means for removing the vapor from the housing including means for removing the products of combustion.

7. A drier including a housing, a plurality of alternately inclined baffles forming superimposed drying chambers in the housing, means for delivering material to be dried for successive flow through said drying chambers and over the baffles, a plurality of means for indirectly heating the material when moving over said baffles for evaporating the moisture content thereof, means connected with the housing for delivering heating medium from each of said indirect heating means directly into the heating chambers above said indirect heating means to prevent condensation of the vapors within the housing, and means connected with the housing for removing the vapors.

8. A drier including a housing, a plurality of alternately inclined baffles in the housing, means for delivering material to be dried for successive flow over the baffles, burners below said inclined baffles for heating the material for evaporating the moisture content thereof, means connected with the housing for delivering products of combustion from the burners across portions of the housing above said baffles to prevent condensation of the vapors within the housing, and means connected with the housing for removing the vapors including means for removing the products of combustion.

9. A drier including a rectangular housing, a series of partitions extending alternately from opposite side walls of the housing and spaced from the opposite walls to provide passageways for material to be dried, inclined partition walls fixed to said side walls at points spaced above said first named partitions and connected with the spaced ends thereof to provide inclined heating surfaces and to form angular shaped burner chambers therebetween, means for delivering the material for gravitational flow down the inclined partition walls, burners in the burner chambers for heating the gravitating material by the products of combustion moving upwardly against the opposite face of said inclined partition walls, means for delivering the products of combustion over the gravitating material for preventing condensation of moisture within the housing, and means in the housing for controlling velocity of the products of combustion moving through said passageways.

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