(No Model.) 2 Sheets—Sheet 1.

# C. MALLINSON.

## APPARATUS FOR CONDITIONING OR DRYING GRAIN.

No. 451,306. Patented Apr. 28, 1891.

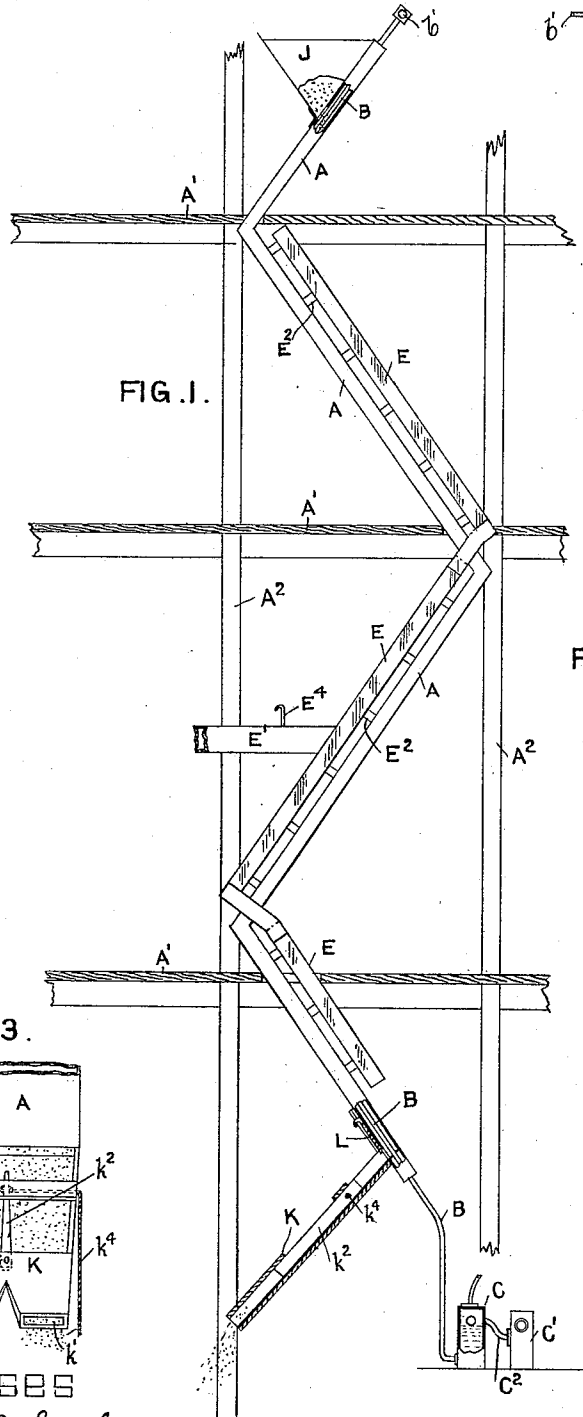



FIG. 1.

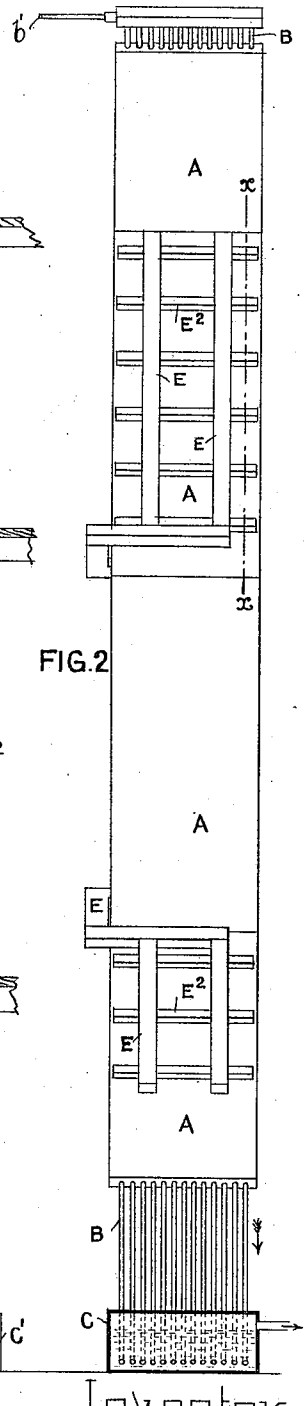



FIG. 2

FIG. 3.




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(No Model.) 2 Sheets—Sheet 2.

# C. MALLINSON.

## APPARATUS FOR CONDITIONING OR DRYING GRAIN.

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FIG. 4.

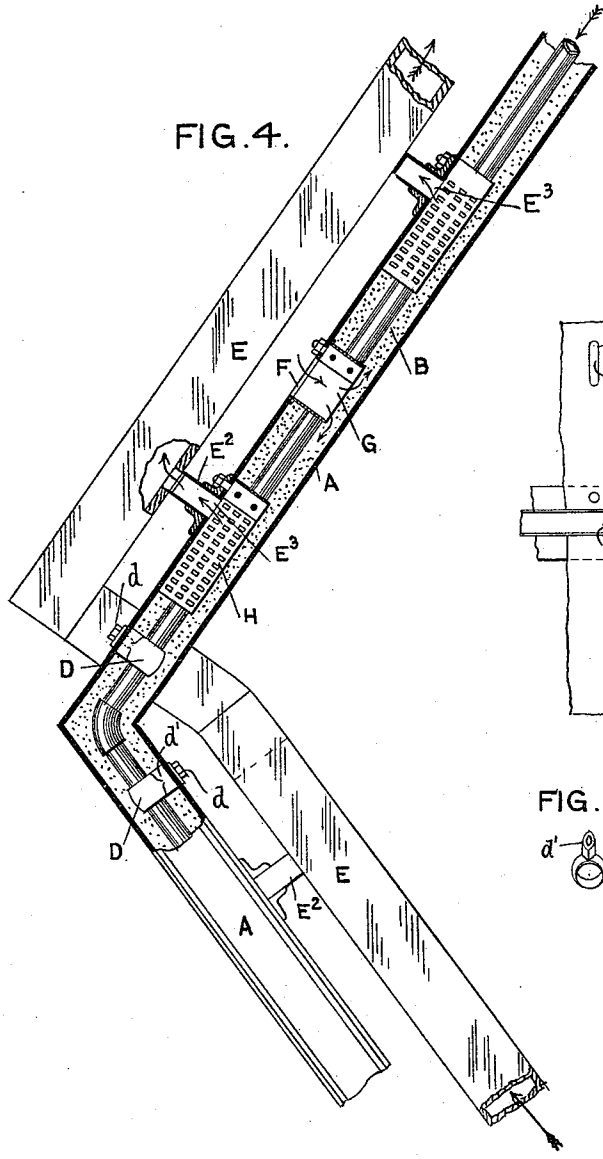



FIG. 5.

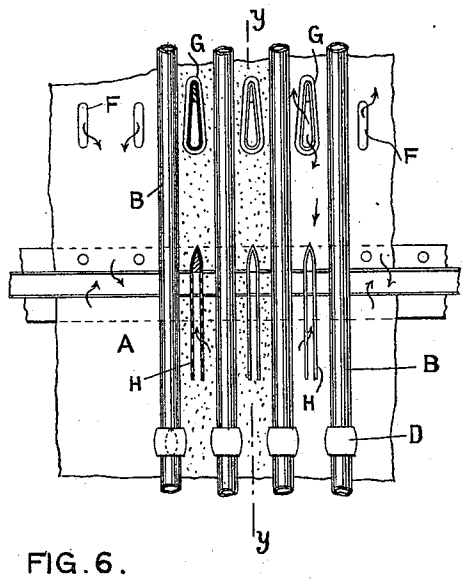



FIG. 6.



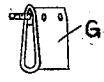




FIG. 7.

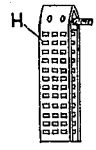



FIG. 8.

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# UNITED STATES PATENT OFFICE.

CHARLES MALLINSON, OF LIVERPOOL, ENGLAND.

## APPARATUS FOR CONDITIONING OR DRYING GRAIN.

SPECIFICATION forming part of Letters Patent No. 451,306, dated April 28, 1891.

Application filed October 24, 1890. Serial No. 369,211. (No model.) Patented in England October 2, 1888, No. 14,182, and July 11, 1890, No. 10,810; in France February 18, 1889, No. 196,140, and in Austria-Hungary September 11, 1889, No. 17,677 and No. 29,496.

*To all whom it may concern:*

Be it known that I, CHARLES MALLINSON, mill manager, a subject of the Queen of Great Britain, residing at Liverpool, in the county of Lancaster, in the Kingdom of England, have invented certain new and useful Improvements in Apparatus for Conditioning or Drying Grain, (for which I have received Letters Patent in England, No. 14,182, dated October 2, 1888, and No. 10,810, dated July 11, 1890; in France No. 196,140, dated February 18, 1889, and in Austria-Hungary, No. 17,677 and No. 29,496, dated September 11, 1889,) of which the following is a specification.

This invention relates to apparatus for drying granular or pulverulent material.

The primary object of the invention is an apparatus which will rapidly dry grain or similar produce in quantity.

The apparatus consists, briefly, of a zigzag casing, down which the material to be desiccated falls by gravity in one or more thin streams or layers, and within which a series of steam or hot-water pipes is arranged in such manner that the descending stream of material is brought into very intimate contact with their heated surfaces. Suitable arrangements are also provided for admitting air to the casing, for drawing off the moisture therefrom, and for breaking up the stream of material as it descends therein. Suitable feed and discharge devices are also provided.

In the drawings, Figure 1 is a general side elevation of the apparatus, parts being in section. Fig. 2 is a rear elevation of the apparatus, with part in section. Fig. 3 is a front view of the discharging device shown in section in Fig. 1. Fig. 4 is a vertical section of a part of the apparatus on an enlarged scale and taken as on the line $x\,x$, Fig. 2, or $y\,y$, Fig. 5. Fig. 5 is a front view of a portion of the apparatus shown in Fig. 4, the bottom of the casing being removed and parts being in section. Figs. 6, 7, and 8 are detail views hereinafter more fully described.

A is a zigzag casing or chute of any suitable height, the various bends of which are placed at a suitable angle to secure the free descent therein by gravity of the material to be treated. I have found that in treating grain an inclination of fifty-five degrees from the horizontal gives very good results.

A′ $A^2$ is the frame-work supporting the apparatus, which latter may, as shown on the drawings, be partly supported by the various floors of the building within which it is erected.

B B are a series of heating-pipes, which are arranged parallel one to the other, as seen in Fig. 2, and follow the zigzag course of the casing A, being by preference placed about midway between its upper and lower walls, as in Fig. 4. The pipes thus offer a large amount of heating-surface to the descending material, which is presented to them in comparatively thin streams or layers. The pipes are supplied with either steam or hot water, which (when steam is employed) enters, by preference, at their upper ends, as at *b*, Figs. 1 and 2, their lower ends being connected with a tank C, partly filled with water. The steam is discharged into the water near the bottom of the tank, and that part which remains uncondensed rises to the top of the tank and is thence conducted to a steam-trap C′ by the pipe $C^2$, or it may be discharged direct into the atmosphere from the tank. I find that by permitting the steam to discharge into the tank C instead of directly into the steam-trap I am enabled to obtain a more uniform distribution of the steam in the several pipes. Pressure-gages may be provided at suitable points on the pipes B and tank C, and valves may also be provided for regulating the flow of the steam or hot water in the pipes and to some extent the temperature in the casing. The pipes B are retained in position by sockets D, Figs. 4, 5, and 6, secured to the upper walls of the casing, as by set-screws *d*, so that the material has a perfectly free passage along the lower walls of the casing. The necks *d*′ of the sockets and also the sides of the sockets themselves are beveled or rounded off to a thin edge, as shown, in order to offer as little resistance as possible to the descending material. This method of mounting the pipes also enables the latter to expand or contract freely in a longitudinal direction.

E E are ventilating-trunks, which are con-

nected by a main trunk E′ with an exhausting device, such as a fan. The trunks E follow approximately the zigzag course of the casing and are connected therewith by a series of cross-pipes $E^2$, which are each open to the casing throughout their entire length, as seen in Figs. 4 and 5. It will be observed that the cross-pipes $E^2$ communicate by openings $E^3$ with the upper sides of the various bends of the casing. This arrangement has a double advantage—first, there is no liability of the material entering the cross-pipes $E^2$, so that the openings $E^3$ of said pipes may be unobstructed, perforated shields being quite unnecessary; secondly, the descending stream of material as it passes along the various bends has both sides exposed alternately to the ventilating-openings, and this greatly facilitates the drawing off of the vapor.

A suitable valve or valves, as $E^4$, is or are provided at a convenient point or points for the purpose of controlling and distributing the flow of the mixed air and vapor in the various trunks.

Fresh air is admitted into the casing by means of the openings F on the upper walls thereof, the said openings being provided with coamings G, Figs. 4, 5, and 7, which project a considerable way into the casing, so as to lead the air into the body of the material. The coamings G are tapered more or less toward their upper ends, as shown, so that they offer little resistance to the descent of the material. They serve further to subdivide or break up the stream of material, so that the air-currents may act upon it with greater effect, and so that it may be brought into more intimate contact with the heating-tubes. For a similar purpose I also provide other tapered coamings or double diaphragms H, Figs. 4, 5, and 8, placed intermediate to the coamings G. The coamings H are by preference placed directly below the cross-pipes $E^2$, so that the vapor is drawn from the stream of material while in its broken or subdivided state. To still further assist the drawing off of the vapor, the coamings H are perforated, as shown, and thus form a series of perforated ventilating-tubes projecting into the casing. The size and arrangement of the perforations in the coamings are preferably such that the material cannot readily enter the coamings and choke them.

It will be obvious that the angles formed at the various bends of the casing need not necessarily be acute, as shown in the drawing. They may be rounded to a greater or less extent, so that the contour of the casing approaches more or less to that of a sinuous line.

The material to be treated is placed in or supplied to a hopper J, provided with any suitable adjustable feed device. Thence it descends by gravity in thin streams or layers through the zigzag-casing A to the discharge-chute K, being thoroughly dried in its descent by the joint action of the heating-pipes and the currents of air drawn into the casing through the openings F and out through the openings $E^3$. The chute K may be of any ordinary description. When filling into bags, however, I prefer to provide it with two discharge-nozzles $k\,k'$, each adapted to discharge into one bag. A shutter $k^2$, pivoted at $k^3$, midway between the nozzles, is adapted to be drawn over to either side of the chute by means of a cord $k^4$, for the purpose of closing either of the nozzles while a full bag is being removed and an empty one put in its place. An adjustable slide L is also provided for regulating the discharge of the material from the casing. I am aware that a series of inclined plates or boards has been mounted within a casing or housing and the material dried in passing over these plates or boards, and to such constructions I make no claim.

I declare that what I claim is—

1. The combination, with an inclined chute down which the material may descend by gravity, said chute having air-admission orifices in its upper walls and heating-surfaces in contact with the descending material, of vapor-pipes communicating on the one hand with an exhaust device and on the other hand with the upper sides of said chute at points intermediate to the aforesaid orifices, substantially as described.

2. The combination, with the zigzag chute A, having air-admission orifices F in its upper walls and vapor-exits $E^3$ intermediate thereto, and the heating-pipes B, of the tapered coamings G, surrounding said admission-orifices and projecting inward between the heating-pipes, substantially as and for the purposes described.

3. In a desiccating-machine, the combination, with an inclined chute having inlet-openings and outlet-openings arranged alternately in its upper walls and having internal heating-surfaces, with which the material descending the chute is brought into contact, of wedge-shaped coamings located below said inlet and outlet openings and projecting for a considerable distance into the chute with their narrow ends facing the descending stream of material, substantially as described.

4. The combination, with the zigzag chute A, having inlet-openings F and outlet-openings $E^3$, arranged alternately, as described, and the heating-tubes B, of the tapered coamings G H, projecting between the pipes and located below the openings F $E^3$, respectively, and having their narrow ends facing the descending stream of material, substantially as and for the purposes described.

5. In combination with the zigzag chute A and the heating-pipes B, passing down the center thereof, the pipe-sockets D and the tapered coamings G H, the said coamings and sockets being all attached to the upper walls of the various bends of the chute, whereby each side of the stream of material is alternately broken up and permitted to descend

without impediment, substantially as described.

6. The combination, with an inclined chute having internal heating-surfaces, as described, and a series of eduction-pipes opening into its upper walls, of a series of narrow perforated ventilating-coamings projecting into said chute and communicating with said eduction-pipes, substantially as and for the purposes described.

7. In combination with the zigzag chute A, the heating-pipes B, and the eduction-pipes $E^2$, a series of perforated ventilating-coamings H, communicating with said eduction-pipes and projecting into the chute between the heating-pipes, the said coamings being formed narrow with tapering upper ends, whereby they serve to break up the descending stream of material while offering a minimum amount of resistance thereto, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES MALLINSON.

Witnesses:

GEO. C. DYMOND,

H. P. SHOOBRIDGE.