

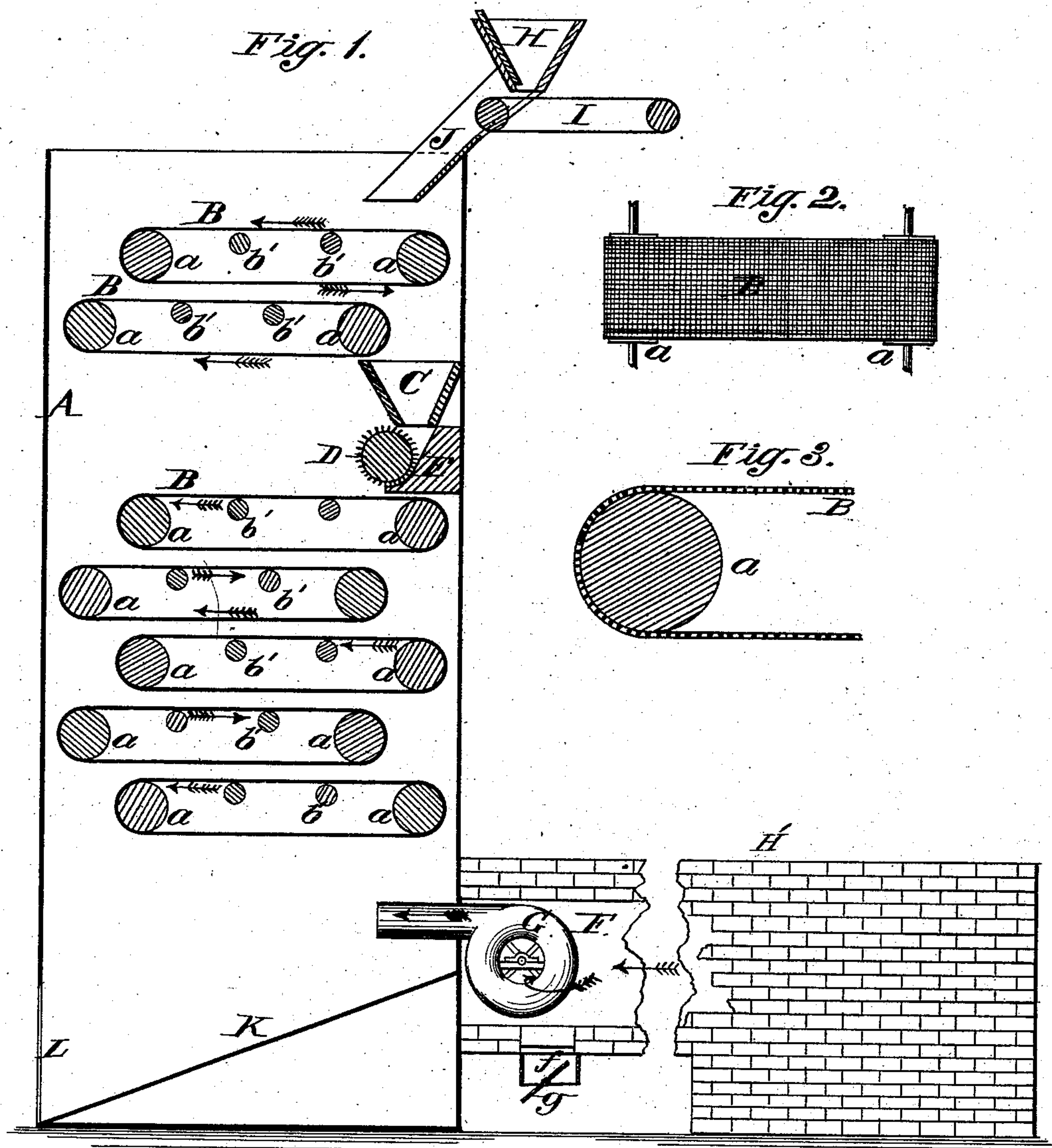
(No Model.)

M. A. SUTHERLAND.

GRAIN DRIER.

No. 294,287.

Patented Feb. 26, 1884.



Witnesses.

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UNITED STATES PATENT OFFICE.

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GRAIN-DRIER.

SPECIFICATION forming part of Letters Patent No. 294,287, dated February 26, 1884.

Application filed March 4, 1882. (No model.)

To all whom it may concern:

Be it known that I, MOSHER A. SUTHERLAND, of the city, county, and State of New York, have invented certain Improvements in
5 Apparatus for Drying Grain, Malt, Brewers' Grains, &c., of which the following is a specification.

This invention comprises a novel combination of parts, whereby is produced an efficient
10 and easily-operated apparatus for drying grain, malt, brewers' grains, and other substances for the preservation of which the removal of large percentages of water is required.

Figure 1 is a vertical sectional view of an
15 apparatus constructed according to my said invention. Fig. 2 is a top view of one of the endless belts included in said apparatus, and Fig. 3 is a vertical sectional view, on a larger scale, of a portion of one of said belts.

20 A is a vertical trunk, of any desired horizontal area, and of a height sufficient to accommodate the operative parts hereinafter described, and situated therein. B are horizontal belts, each of which runs over two
25 drums, *a*, and each of which is provided with any suitable number of supporting-rolls, *b'*, arranged to sustain the upper portions of the belts against the weight of the material placed thereon. These belts have severally the re-
30 volving motion indicated by the several arrows in the drawings—that is to say, each belt runs in a direction opposite to that of the others immediately adjacent thereto—and the belts are staggered—that is to say, that (with
35 the exception hereinafter noted) one end of each belt is placed over the end portion of the belt next below the same, so that the material passed off from the belt above will fall upon the belt below, in order that the material
40 may pass from one to the other of the said belts throughout the series thereof. Interposed between two of the belts is a hopper, C, below which is a crushing or disintegrating cylinder, D, and concave E, it being preferred that the
45 cylinder and concave be provided with intermeshing teeth, and that the hopper C be arranged to receive the material from the belt above, while the cylinder and concave are so placed as to deliver the material to the belt
50 below.

Placed in suitable relation with the trunk A, is the outlet-flue F of a furnace, H', of any suitable construction, which said flue communicates with the inlet of a fan-blower, G, through the center side openings, *c*, the out-
55 let of the said fan-blower communicating with the lower end of the trunk A. The flue F may be provided with an opening, *f*, through which the outer atmosphere may pass. The operation of the fan-blower G throws the hot
60 gaseous products of combustion from the flue E into the lower part of the trunk A, from which the said hot gaseous products of combustion rise by their own buoyancy and draft through the said trunk A to dry the material
65 as the same passes upon the belts B and from one to another of the said belts. The object of admitting atmospheric air through the opening *f* into the flue F, and thence directly into the trunk A, is to reduce the temperature of
70 the hot gaseous products of combustion when the same is found to be higher than is desirable or necessary for the drying of the material. The belts B are made of wire-cloth or of perforated sheet metal. The sheet metal or wire-
75 cloth, as the case may be, becomes heated to the same temperature as that of the hot products of combustion aforesaid, and, being in immediate contact with the material to be dried, raises the temperature thereof simul-
80 taneously with the action thereon of the hot gaseous products of combustion passing up through the perforations or interstices of the perforated sheet metal or wire-cloth, as the case may be, and thereby insures a much more
85 rapid and effective drying action than would be possible with endless belts of non-metallic material, and void of perforations or openings through which the hot products of combustion can pass into intimate contact with the
90 material to be dried.

The grain, malt, brewers' grains, or other material or substance to be dried, is poured into a hopper, H, above the trunk A, and by an endless apron, I, is carried to and
95 deposited in a chute, J, coming from which it flows or passes to the uppermost of the belts B. The rotation of this belt deposits the said substance or material upon the belt below, which latter deposits the material in the hop-
100

per C, from which it passes between the cylinder D and concave E, which disintegrates and powders any lumps which may have formed in the material during or before the previous stages of the operation. This is effected by providing the cylinder with teeth or beaters to receive the material from the hopper C, and break up any lumps and perfectly loosen it, carrying it against the concave E and delivering it upon the endless belt. For this purpose the hopper is arranged to receive the material from the end of the belt above moving toward the hopper, which is placed against the inner wall of the trunk, while the concave delivers the material upon a belt below moving from the concave.

It will also be understood that, in lieu of the hopper C, the back of the concave may be elongated, to form, in conjunction with the opposite surface of the disintegrating-cylinder D, a suitable directing device to guide the grains or material between the said cylinder and concave. From the cylinder D and concave E the pulverulent material passes from one to another of the belts B until it reaches the bottom of the trunk A, where, falling upon the inclined floor K, it descends to the outlet-opening L.

It is of course to be understood that rotary motion is to be given to the belts B, and also to the fan-blower G, by suitable belts and pulleys, or other appropriate means. Where the trunk A is of sufficient height and appropriate proportions, the natural ascensive force or draft of the hot gaseous products of combustion will be sufficient to carry the same upward in requisite volume and degree through the said trunk A; but under other conditions, when this ascensive force is found to be insufficient, the use of the fan-blower G is requisite, or, at least, desirable, in order to give sufficient rapidity of movement to the ascending hot gaseous products of combustion.

It is to be understood that the fan or blower is so arranged as to draw the hot gaseous products of combustion from the rear portion of the furnace.

It is important in my process of treating grain, malt, or brewers' grains to dry and preserve it, that the heat be derived direct from the furnace in the dry gaseous products of combustion to obtain the necessary economy in the fuel.

It is also important that in using the dry products of combustion the top of the drying-trunk should be open, to give a free outlet to the products of combustion and a good draft, it being unnecessary in my process to retard the heat, but, on the contrary, to give a continuous and direct ascent to the products of combustion and cause them to pass directly through the substance, moving in thin layers across the ascending current of hot gases.

The important advantage of this process is that I am enabled to use the waste products of combustion direct from any furnace, and

to send such products of combustion in a column through the substance without diverting its direct ascent, as contradistinguished from a process in which the substance is moved in layers in one direction, and air heated by pipes or other artificial means, is moved over it in a circuitous course. In my process of utilizing the waste products of combustion I effect at least seventy-five per cent. in saving in the cost of fuel, which is a matter of the last importance in the treatment of brewers' grains, which are, to a great extent, a waste product of the brewery, and which is made a valuable feed by my cheap process. By the means described the superfluous moisture may be rapidly, cheaply, and conveniently eliminated from damp grain, from malt, brewers' grains, and from other like substances.

It is obvious that when the blower is not used there will be an inlet-passage in the wall of the trunk, through which hot products of combustion pass from the furnace into said trunk.

I claim—

1. The combination, in apparatus for drying malt and brewers' grains, of a substantially-closed vertical flue or trunk open at the top for a direct draft, and having a bottom opening, L, and a series of perforated endless aprons, with a furnace and a blower arranged to inject the hot gaseous products of combustion into the bottom of said trunk, substantially as described, for the purpose specified.

2. An organized apparatus for drying grain, malt, brewers' grains, &c., composed of the following elements, viz: a flue or vertical chamber open at the top; connected with a suitable furnace, to receive the hot gaseous products of combustion therefrom, a series of perforated endless aprons arranged within said flue or chamber to transmit the material to be dried from one to the other of said aprons successively from above downward, and subjected to the action of the gaseous products of combustion, a blower arranged to inject the hot gaseous products of combustion into said flue or chamber, and devices, substantially as described, for separating or disintegrating the material while subjected to the action of said products of combustion, all substantially as and for the purpose herein set forth.

3. An organized apparatus for drying grain, malt, brewers' grains, &c., composed of the following elements, viz: a flue or vertical chamber open at the top, connected with a suitable furnace to receive the hot gaseous products of combustion therefrom, a series of perforated endless aprons arranged within said flue or chamber to transmit the material to be dried from one to the other of said aprons successively from above downward, and subjected to the action of the gaseous products of combustion, and a blower arranged to inject hot gaseous products of combustion into said

flue or chamber, a valve and inlet-passage, so placed as to control the admission of air to the flue, and devices, substantially as described, for separating or disintegrating the material while subjected to the action of said products of combustion, all substantially as and for the purpose herein set forth.

4. The combination, in apparatus for drying grain, of a flue or vertical trunk open at the top, a furnace connected with it at the bottom to deliver the gaseous products of combustion into said flue or trunk, a series of end-

less perforated aprons arranged within and across said flue to transmit the material to be dried and to allow the hot products of combustion to pass directly through the moving substance, with means, substantially such as described, for separating and disintegrating the material while subjected to the action of said products of combustion.

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