

(No Model.)

F. E. OTTO.
DRYING APPARATUS.

No. 545,715.

Patented Sept. 3, 1895.

Fig. 1.

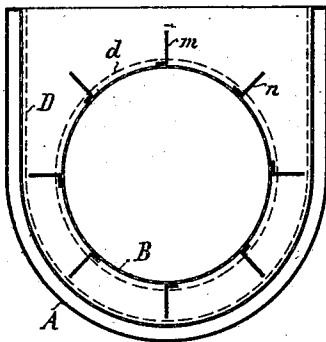


Fig. 2.

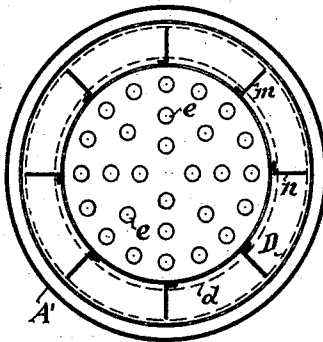


Fig. 3.

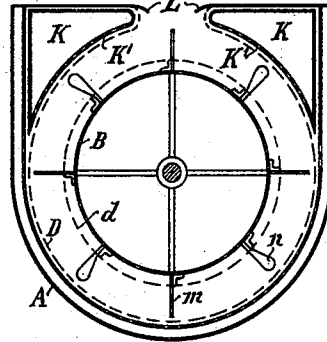


Fig. 4.

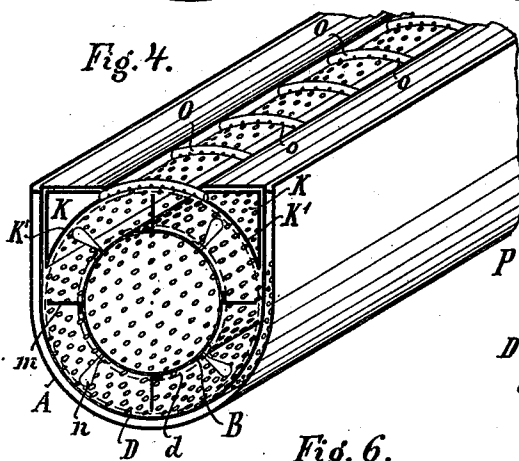


Fig. 5.

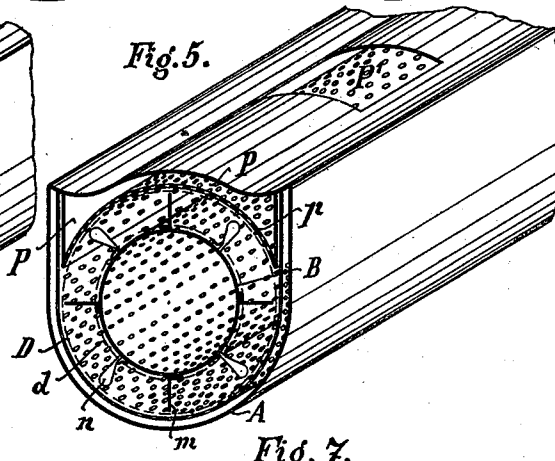


Fig. 6.

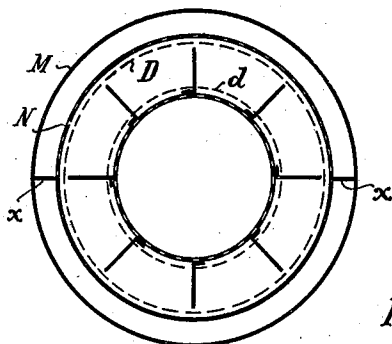


Fig. 7.

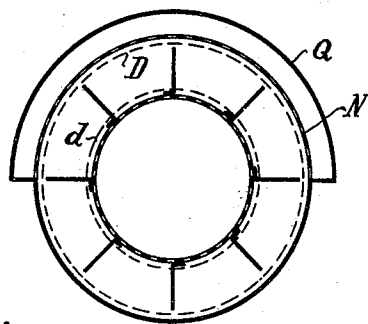
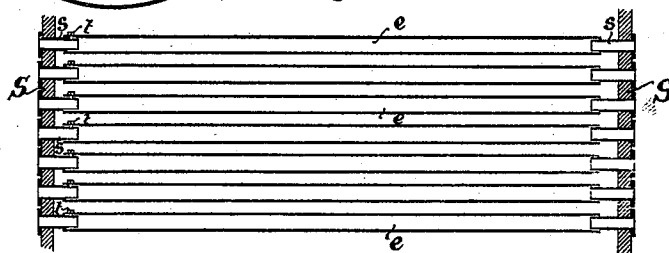


Fig. 8.



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his atty.

UNITED STATES PATENT OFFICE.

FRIEDRICH ERNST OTTO, OF DORTMUND, GERMANY.

DRYING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 545,715, dated September 3, 1895.

Application filed June 30, 1894. Serial No. 516,185. (No model.) Patented in Belgium April 19, 1894, No. 109,547, and in Austria March 24, 1894, No. 44/634.

To all whom it may concern:

Be it known that I, FRIEDRICH ERNST OTTO, a subject of the King of Prussia, Emperor of Germany, residing at Dortmund, in the Kingdom of Prussia, German Empire, have invented new and useful Improvements in Apparatus for Drying Beet-Root Strips, Spent Grains, and Similar Materials, (for which I have obtained patents in Belgium, No. 109,547, bearing date April 19, 1894, and in Austria, Tom. 44, page 634, bearing date March 24, 1894,) of which the following is a specification.

This invention has reference to apparatus for drying beet-root strips, spent grains, and other similar materials, which, owing to their moist condition and amylaceous nature, are very apt to adhere and bake to hot surfaces.

More especially it relates to those drying apparatus which are composed of a trough-shaped or cylindrical heating-vessel for inclosing the material and a rotating stirrer arranged within the same and so organized that the material is constantly lifted and caused to fall back, the heat being applied either in the form of radiating heat or in the form of hot-air or gas currents and emitted either from periphery to center by means of the walls of said vessel, or, vice versa, from center to periphery through the walls of an internally-arranged heating system. In case of drying by means of radiating heat the said heat-emitting walls are plain, while in the case of hot-air or gas currents they are perforated or otherwise pervious.

In apparatus of this description constructed as usual, the material to be treated is exposed to direct contact with the heat-emitting surfaces. Now, as, on the one hand, heat accumulates in the walls, and, on the other hand, the contact between them and the material continues for some time, there is a great liability of the proteine and amylaceous constituents of the material to undergo such alterations as to render the dry final product unfit for use as a feeding stuff. The aim of the present invention is to do away with this deficiency by preventing the material from any contact with the heat-emitting surfaces. To this end it consists in arranging at some distance from the heat-emitting surface a per-

forated or otherwise pervious wall. Thus the material will fall upon the latter, and therefore be protected from contact with and injury by the heat accumulating in the emitting-surfaces, being only exposed to that heat which radiates or is emitted from said surfaces and passes through the interval separating the heating and protecting surfaces. Moreover, the said protecting-wall may be utilized for separating particles which have become dried from those which are still moist and therefore coarser. For this purpose the orifices of the said wall are given a definite area, so as to act as a sieve, permitting particles of a definite body to pass into the space between the heat-emitting and protecting surfaces, where they may be received by a suitable discharging device.

In the accompanying drawings, Figure 1 is a cross-section taken at a right angle to the axis of a drier of the trough type; Fig. 2, a similar section of a drier of the cylindrical type, the heat-emitting surface consisting in a centrally-located system of heating-tubes; Fig. 3, a similar section through a drier of the trough type, the upper open part of the same being reduced by additional side pieces adapted to serve as an additional heat-emitting surface; Figs. 4 and 5, isometrical views of two modified apparatus of the same type; Figs. 6 and 7, cross-sections of two modified apparatus of the cylindrical type, the heat-emitting surface being semicylindrical; Fig. 8, a longitudinal section through the heating system shown in Fig. 2.

Reference being had to Fig. 1, A is the trough-shaped vessel, constructed with two parallel walls, the inner one of which is perforated, the heating agent (hot air or combustion-gases) being admitted into the space comprised between said walls. B is a perforated drum rotatably arranged in the long axis of the trough and carrying on its circumference knives *m* for reducing the material and vanes *n* for stirring and lifting the same, the said knives and blades alternating with each other. At some distance from the inner perforated wall of the trough is arranged the protecting-wall D, constructed with wire-gauze or perforated sheet metal. *d* is a similar protecting-wall surrounding the drum B. This wall

d may be stationary or it may rotate together with the drum. In the first case it must be provided with slits for the passage of the knives and blades. The material to be dried is charged into the space confined between the two protecting-walls $D d$, while the heating agent (hot air, combustion-gases, or the like) is admitted into the space between the walls of the vessel A , and therefrom passes toward and into the drum B , traversing the material to be dried and carrying with it the vapors. If it is desired to carry out the drying operation by means of the radiating heat of a furnace, the trough is constructed with a single plain wall.

In Fig. 2 the apparatus consists of a closed cylindrical drum A' , and the heat is emitted by a system of heating-tubes e , arranged around the axis of the cylinder. The latter is constructed with two concentric walls separated by an interval, and of which the inner one is perforated, so that there is formed an annular passage for the discharge of the vapors evolved from the material. The knives m and vanes n are mounted on an open rotatable frame surrounding the system of heating-tubes e . $D d$ are the two protecting-walls hindering the material from falling on the heating-tubes and the perforated inner wall of the cylinder. With this construction the tubes e may also be perforated for passing hot air or combustion-gases through the material from center to periphery. Moreover, the cylinder may also be caused to rotate and this rotation performed in direction opposite to that of the knives and blades.

In Fig. 3 the apparatus is of the trough type, but the heat-emitting surface is increased by hollow auxiliary pieces $K K$, secured to the upper upright portions of the trough. The inner side K' of these pieces is made concave in accordance with the diameter of the cylindrical part of the trough and is perforated. These hollow pieces are also fed with hot air or combustion-gases to deliver the same into the trough through the perforated side K' . The protecting-wall D is prolonged parallel to the sides K' . L denotes two plates projecting above the pieces K for preventing the material from being thrown on the upper surface of said pieces. The open interval between the auxiliary heating-pieces K forms the discharge-opening for the vapors.

It is evident that the auxiliary heating-pieces K may communicate with each other. Figs. 4 and 5 represent two such modifications. In Fig. 4 communication between the hollows of the pieces $K K$ is established by means of tubes or channels O , so curved each as to form an arc of a circle having the same

diameter as the curvature of the pieces $K K$. These tubes, channels, or passages may also be provided with perforations, as indicated by the letter z , in their under side, so that part of the heating agent may be caused to act at the top of the apparatus. In the other modification, or that represented in Fig. 5, the auxiliary pieces $K K$ of the apparatus shown in Fig. 4 are united so as to form a hollow cover P , provided with perforations in its curved under side p and a central aperture P' for the discharge of the vapors.

Fig. 6 represents a drying apparatus of the cylindrical type, in which the heating agent is caused to pass from periphery to center; but in this modification only the top part of the inner wall N is perforated, and the space between this wall and the plain outer one M is shut off at points, as x , where the material moving round ceases to touch the protecting-walls $D d$. The heating agent is charged into the space above the points x . By this construction the material is very efficiently prevented from continued contact with hot parts, as the space below the points x receives no heat.

The distinctive feature of the modified construction Fig. 7 is that the circular wall M of the apparatus represented in Fig. 6 is replaced by the semicircular wall Q , surrounding the perforated portion of wall N .

When a system of heating-tubes e , Fig. 2, is used, the ashes and the like may be conveniently removed from the several tubes by the arrangement represented in Fig. 8. The plates S , holding the ends of the tubes e , are provided with inner tubular pieces s , upon which these tubes are first slid at one front plate and after moving the tubes backward they can be slid upon the tubular pieces at the other front plate. By suitable fastening devices—for instance, by means of pins or screws t , passed through openings in the tubes and tubular pieces—the tubes are kept in their proper position.

I claim as my invention—

In apparatus for drying beet root strips, spent grains or similar material, the combination of the heat emitting surface, with sieve-like protecting walls arranged as described and having openings of such width as to allow the dried particles to pass into the space between said heat emitting and protecting walls, for the purpose stated.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

FRIEDRICH ERNST OTTO.

Witnesses:

FRANZ WEINDORF,
ALBERT KLINGHAMMER.