

F. WERTENBRUCH.
 DRYING MACHINE.
 APPLICATION FILED SEPT. 21, 1910.

986,107.

Patented Mar. 7, 1911.

3 SHEETS—SHEET 1.

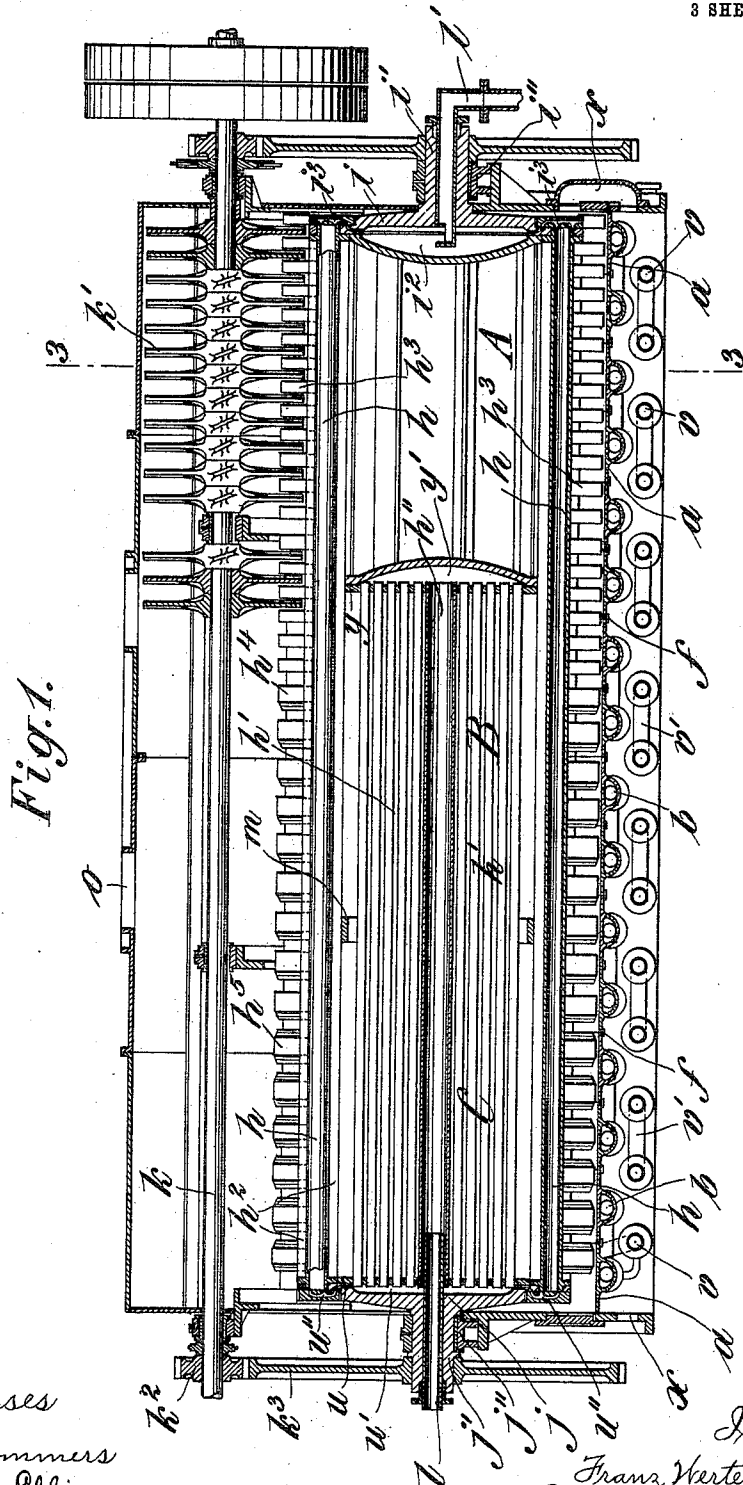


Fig. 1.

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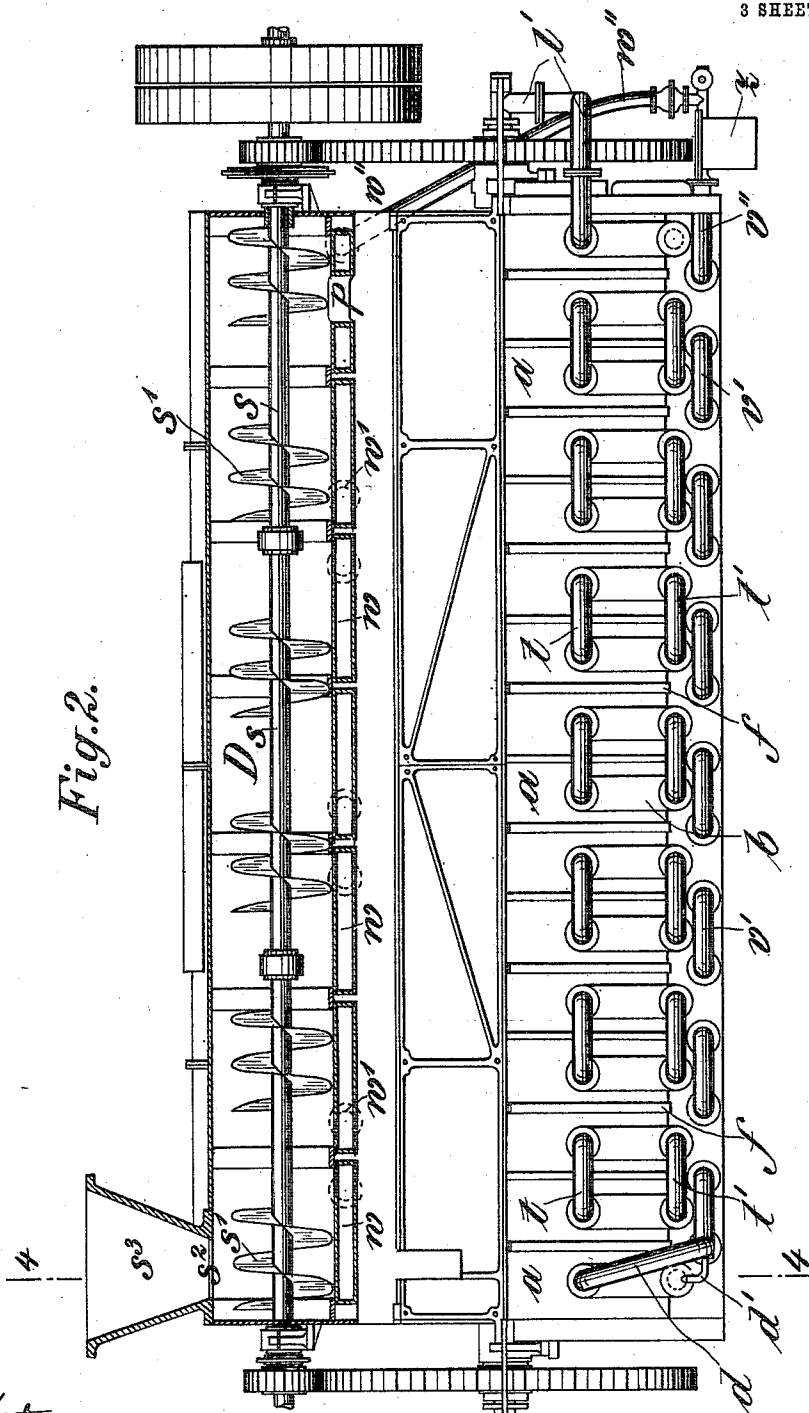


Fig. 2.

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3 SHEETS—SHEET 3.

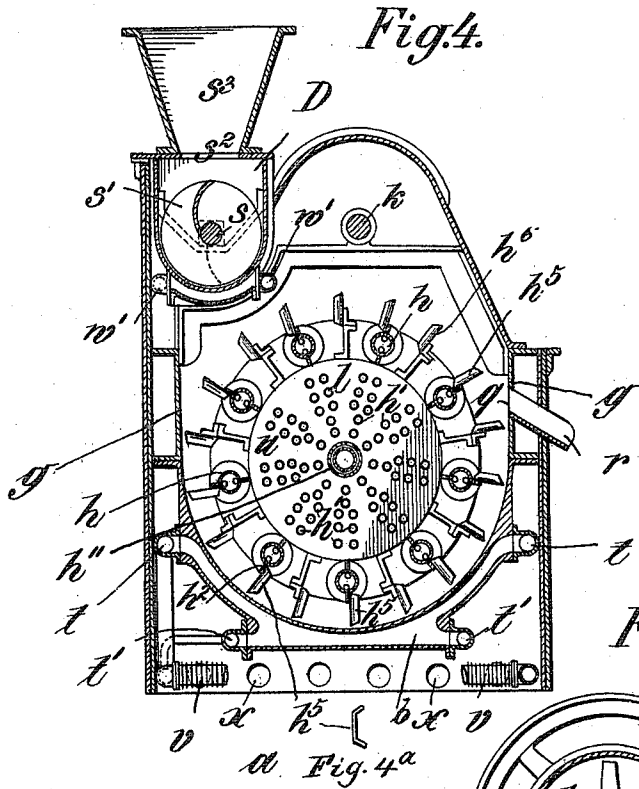


Fig. 4.

Fig. 3.

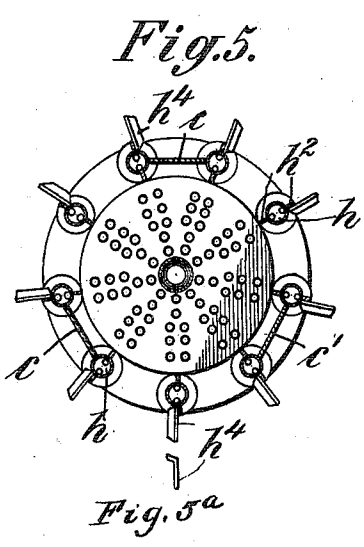


Fig. 5.

Fig. 5a

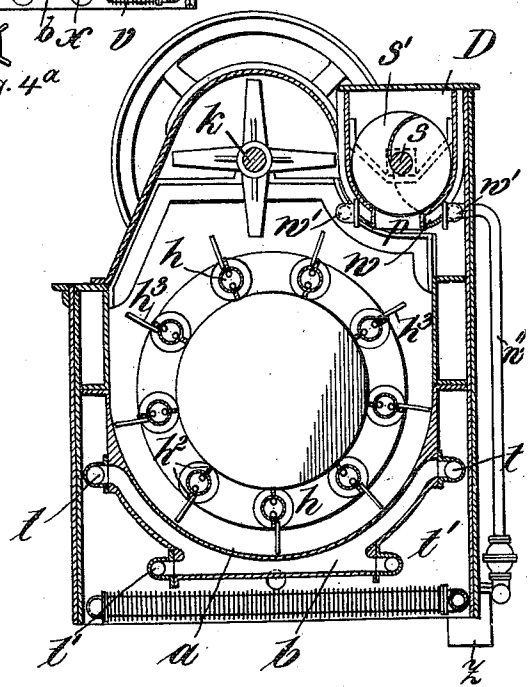


Fig. 4a

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UNITED STATES PATENT OFFICE.

FRANZ WERTENBRUCH, OF MEISSEN, GERMANY.

DRYING-MACHINE.

986,107.

Specification of Letters Patent.

Patented Mar. 7, 1911.

Application filed September 21, 1910. Serial No. 583,094.

To all whom it may concern:

Be it known that I, FRANZ WERTENBRUCH, a subject of the King of Prussia, residing at 16 Vorbrückerstrasse, Meissen, in Saxony, Germany, have invented certain new and useful Improvements in Drying-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to improvements in the construction of machines used for the drying of sticky or adhesive materials, spent grain, and other materials, the object of the present invention consisting essentially in improvements in constructing the heating systems of machines of the kind in question.

In the drawings which accompany this specification and are referred to in the following description, Figure 1 is a vertical lengthwise section of the machine. Fig. 2 is a side elevation partly in section, the side wall being removed. Fig. 3 is a transverse section on the line 3—3 of Fig. 1. Fig. 4 is a transverse section on the line 4—4 of Fig. 2. Fig. 4^a is a detail end view of one form of shovel. Fig. 5 is a vertical transverse section through the central rotary heating tube system as constructed in the middle part of the machine. Fig. 5^a is a detail end view of another form of shovel.

The machine herein referred to comprises a trough the lower part of which is heated by steam; within the trough a system of steam heated tubes is fitted to rotate. The trough comprises three portions A, B, C, which are different from one another in the construction of the heating tubes, the chambers B and C having a greater number of tubes than chamber A, within which the material to be dried first enters; and in the latter chamber, there is an arrangement of beaters for breaking up the lumps of the material. In the chamber B there are provided means for securing air spaces between the moist material passing through this chamber. Above the trough A B C there is arranged a trough D of smaller width, extending laterally from one end of the machine to the other; through this trough D the bottom of which is heated by hot water from

the tubes beneath the trough A, B, C the material to be dried is conveyed by means of some screw windings *s'*, before it enters the chamber A. The outside of the lower part of the trough, in conjunction with the sides of the machine, forms an air-heating chamber, and the air from such chamber is drawn or forced into the trough at the front end thereof.

In the machine shown in the drawings the drying-trough is composed of a number of semi-circular sections *a*, each of which has a transverse steam-passage *b* on the under side. At the front end of the machine the steam-passage under the first section of the trough is connected to a steam-supply pipe *v'*, and the steam circulates under all the trough-sections in succession and in alternate directions the steam flowing from the steam-passage in one section to the next steam-passage by the upper coupling-pipes *t*, while by the lower coupling-pipes *t'* the condensed steam passes from one of the passages *b* to the other. The joints between the sections *a* are covered by strips *f*, and all the sections are attached to girders *g*.

From the last steam-passage *b*, at the rear end of the machine the condensed steam passes by a pipe *d* (and the steam flows by a pipe *d'*) to ribbed or radiator tubes *v* arranged transversely in the space beneath the trough; these tubes are connected to one another by coupling pipes *v'* arranged alternately at the one and the other side of the machine. By these tubes an air current is heated, which enters the space beneath the trough through openings *x* provided underneath in the rear end wall of the machine and is introduced into the trough by means of a coupling pipe *x'*; the air current traverses the moist material in the trough, and gets out of it, together with the vapors from the material to be dried, through openings *o* at the top of chamber B.

From the last radiator tube *v* the steam and water passes through a pipe *v''* into a steam separator *z* and hence the hot water flows through pipe *w''* into the hollow mantle *w* forming the under wall of the small trough D. This mantle or double wall is composed of single sections, the flat steam chambers of the single sections being connected to one another by coupling-pipes *w'* arranged alternately at the one and the other

side of the small trough. The rotary heating tube system within the trough A, B, C comprises a group of tubes h disposed in a circle and extending from the front end of the machine to the rear end. These tubes h are carried by end plates i, j , provided with hollow journals i', j' , which journals are fitted to rotate in bearings i'', j'' secured to the end walls of the trough. As far as chamber A extends, the space within the circle of tubes h is empty, and throughout the length of chambers B and C, within this space there are disposed tubes h' of a smaller diameter in a star like arrangement and a central tube h'' of larger diameter, the ends of which tubes h' and h'' are beaded into holes of plates u, y , plate u being secured to plate j and plate y to the tubes h . The whole nest of tubes is rotated by gear wheels k^2, k^3 from the driving shaft k , on which the beaters k' are keyed, and which has bearings in the end walls of the trough and two intermediate bearings.

Fresh steam is supplied to the central tube h'' through the hollow journal j' by means of a pipe l . The steam passes through tube h'' into the flat steam chamber y' provided at the outside of plate y and hence enters tubes h' and flows into the flat steam chamber u' provided between plate j and u , from which chamber the steam flows through radial passages u'' into the outer tubes h . From these tubes the steam flows through the radial passages i^3 into the flat chamber i^2 , arranged at the inside of plate i , from which chamber it is conducted by pipe l' through journal i' to the first of passages b at the under side of the trough, as above stated.

The tubes h are each provided with an outwardly and with a centrally directed rib h^2 . To the outer ribs are secured shovels or scrapers h^3 . The shovels h^3 in chamber A are flat, the shovels h^4 in chamber B are made with oblique flanges at the one side, the shovels h^5 and h^6 in the chamber C have oblique flanges at both sides; the oblique flanges are provided for the purpose of lifting the almost dried material which is not sufficiently moist to adhere to the shovels, after the manner of the buckets of an elevator. For the purpose of scraping off the moist material adhering to the shovels, ribs and tubes in chamber A, above the tube system in this chamber, beaters k' are fitted to rotate, which beaters are keyed on the driving shaft k . The radially directed arms of the beaters passing through the spaces between the shovels stand a little oblique so that their sides form parts of a helicoidal face, for readily shoving forward the material. The beaters rotate quicker than the tube system as will be understood from the drawings (see gearing k, k^3).

In order to avoid sticking fast of the yet

moist material in chamber B in the spaces between tubes h' , and to enable the air and vapors to pass through said spaces and material, in this chamber two or three of the spaces between two adjacent tubes h are covered by plates c , so that the material lifted up at the left side (Fig. 5) by the shovel behind plate c cannot fall down upon the tubes h' , but is carried around and, to the right, thrown down to the bottom of the trough.

In order to maintain the tubes h' , during the rotation, covered by the almost dried material in chamber C (the material in this chamber drizzling readily down from the tubes), a double number of bucket like shovels h^5, h^6 is provided in chamber C, the shovels h^6 being secured by means of angles to Z-bars; a Z-bar is located in each space between two adjacent tubes h , the one end of each Z-bar being attached to plate u , the other end to the ring m , which is secured to the inner ribs h^2 of the tubes h .

The material to be dried is poured into the hopper s^3 arranged at the rear end of the machine above the small water-heated trough D, falls into this latter through an openings s^2 and is conveyed through the trough by some sections of a screw s^1 , keyed at intervals on a shaft s , which is driven by means of a chain gear from the main shaft. In operating between two adjacent screw sections there is formed a heap of material, the one section shoving the material forward to the heap and the other taking off the material sliding down from the heap at its forward side. In this way the material on its passage through the trough is mingled together. After having passed the small trough the material falls through opening p at the front end of the machine into the portion A of the trough A B C and is there, when carried around by the shovels, at the same time slowly shoved forward by the beater arms k' acting somewhat like a screw. When thus having passed through the machine the dried material is discharged through an opening q and gutter r provided at the ascending side of shovels h^5, h^6 into a receiver or conveying apparatus.

I claim—

1. In an apparatus of the kind described a heating tube system a trough in which said system is fitted to rotate comprising three portions, the first of which has heating tubes arranged in a circle and carrying ribs and outwardly extending shovels, and beaters passing through the spaces between said shovels, the second and third portion having also a circle of tubes and a nest of tubes arranged within said circle, the second portion having a part of the spaces between two adjacent circle tubes covered by plates, while in the third portion in the spaces between two adjacent circle tubes and rows of shov-

els connected to the tubes, additional shovels and means for securing same are arranged for lifting the partially dried material.

2. In an apparatus of the kind set forth
5 in the description a drying trough a smaller trough for the preliminary drying of the material, arranged lengthwise above the drying trough, a conveying screw within the small trough, the bottom of the latter
10 being formed by double walled sections, and the cavities in the sections being connected together and to a condensed steam receiver by pipes.

3. In apparatus of the kind described, the

combination with a heated trough, and
15 heater tubes revolving in the trough, of an air heating chamber, radiators in the chamber, means to supply steam to the revolving tubes and connections whereby the revolving
20 tubes discharge into the radiator tubes.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

FRANZ WERTENBRUCH.

Witnesses:

PAUL ARRAS,
CLARE SIMON.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
