A. W. FRENCH.

GRAIN DRIER.

APPLICATION FILED AUG. 25, 1915.

1,219,816.

Patented Mar. 20, 1917.

3 SHEETS—SHEET 1.

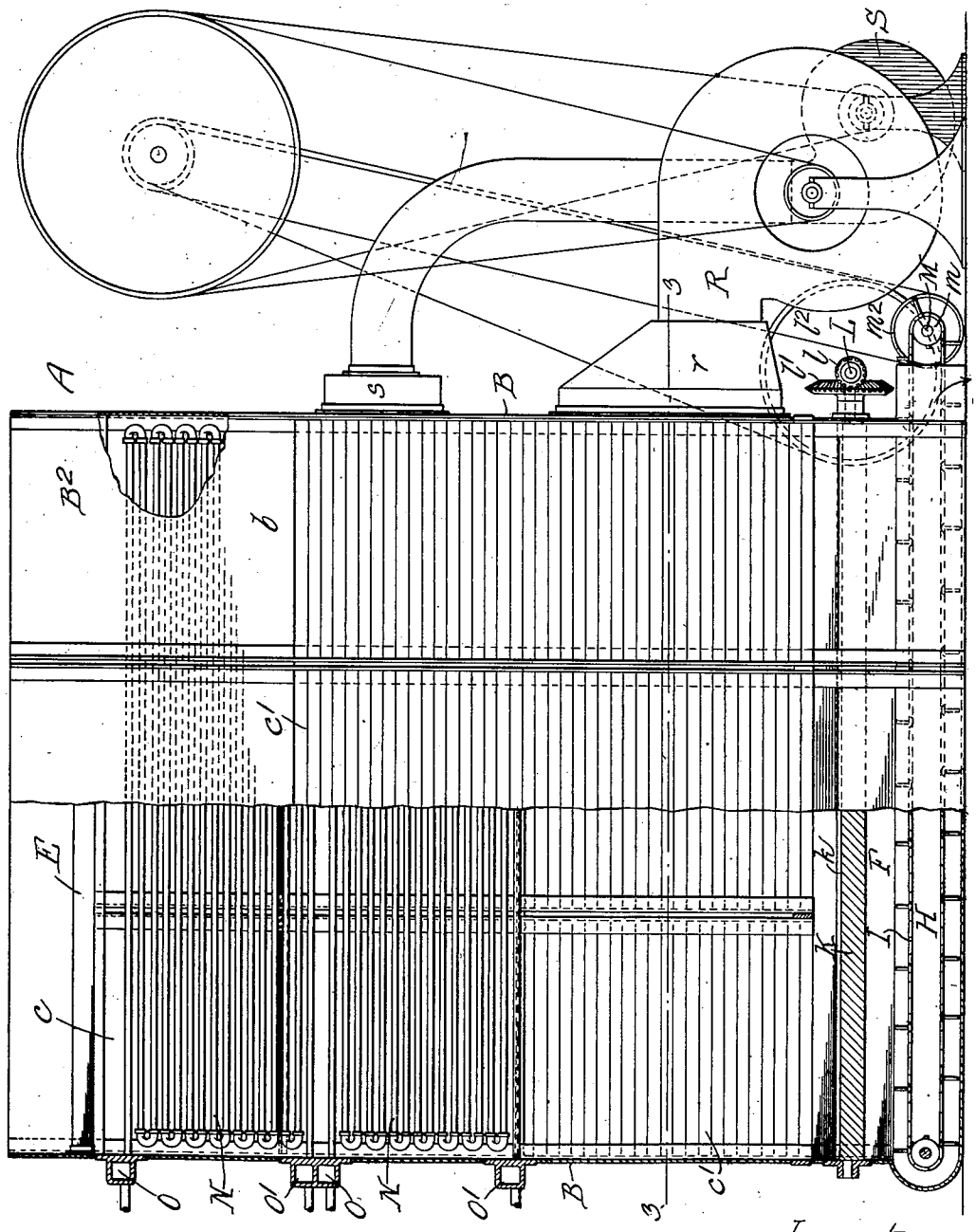


Fig. 1.

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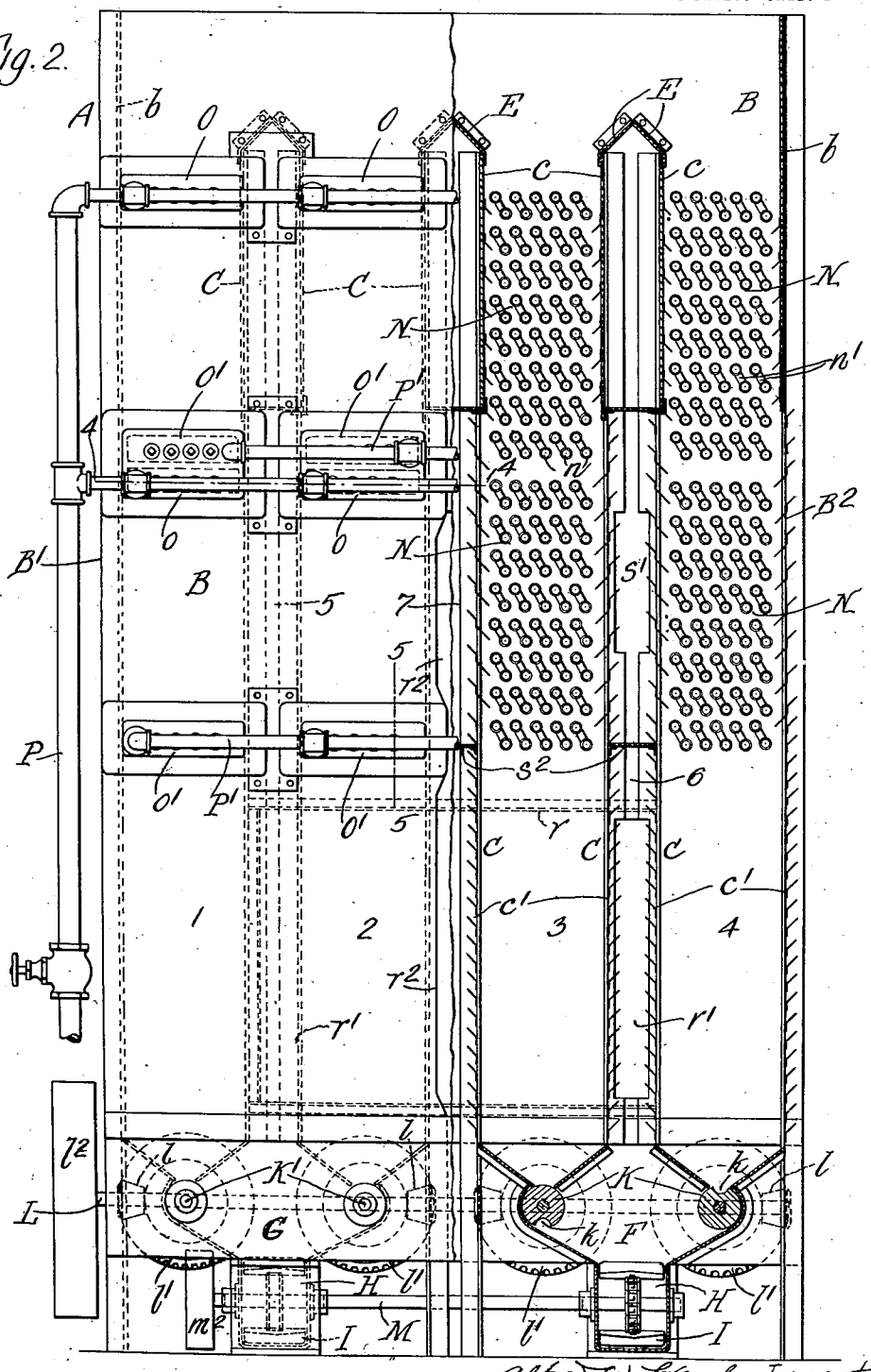
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3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 3.

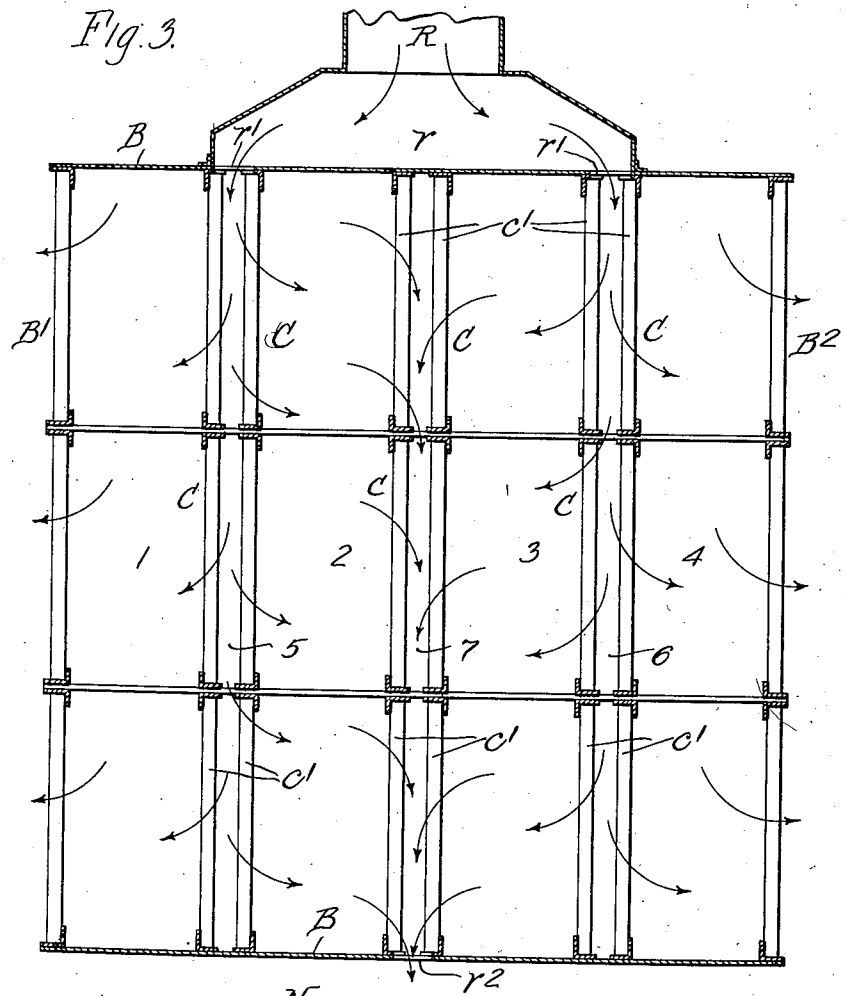


Fig. 4.

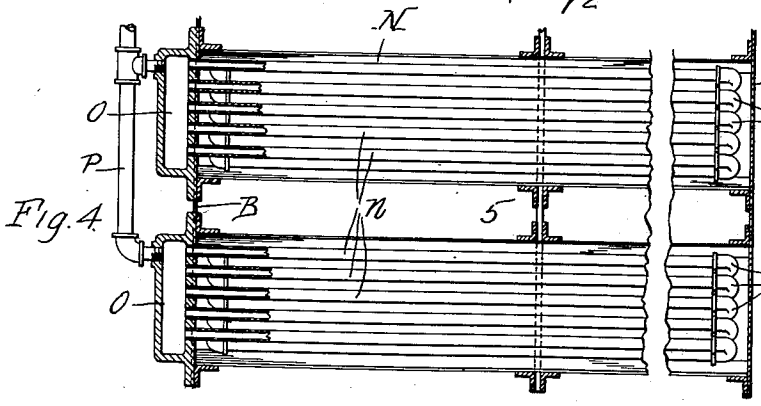
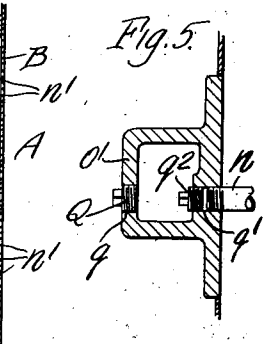


Fig. 5.



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UNITED STATES PATENT OFFICE.

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GRAIN-DRIER.

1,219,816. Specification of Letters Patent. Patented Mar. 20, 1917.

Application filed August 25, 1915. Serial No. 47,244.

To all whom it may concern:

Be it known that I, ALFRED W. FRENCH, a citizen of the United States, residing at Piqua, in the county of Miami and State of Ohio, have invented a new and useful Improvement in Grain-Driers, of which the following is a specification.

This invention relates to apparatus for drying grain and analogous material.

The objects of the invention are to produce an apparatus of a construction which makes it possible to dry large quantities of material expeditiously and economically in an apparatus which occupies comparatively small space and can be built at comparatively small expense; and also to improve grain drying apparatus in the structural respects hereinafter particularly described and set forth in the claims.

In the accompanying drawings:

Figure 1 is a side elevation, partly in section, of a drying apparatus embodying the invention.

Fig. 2 is an end elevation partly in section thereof.

Fig. 3 is a sectional plan view thereof, in line 3—3, Fig. 1.

Fig. 4 is a fragmentary sectional plan view thereof in line 4—4, Fig. 2.

Fig. 5 is a section, on an enlarged scale, through one of the steam headers in line 5—5, Fig. 2, and showing a stopper closing the end of one of the steam coils.

A represents a casing which is provided with upright drying chambers with open upper ends into which the grain is adapted to be introduced and through which it is adapted to descend in a mass by gravity at a suitably regulated rate of speed. Any number of these drying chambers may be provided, depending upon the desired capacity of the apparatus. In the apparatus shown in the drawings, four drying chambers 1, 2, 3 and 4 are provided, which are arranged parallel with each other and are separated by intervening chambers or passages 5, 6 and 7 for the supply and escape of air or other drying medium. The upright end walls B of the casing, which form the end walls of the drying chambers 1—4 may be solid. The walls B′ B^2 of the casing, which form the outer side walls of the two outer drying chambers 1 and 4 and the walls C at the opposite sides of these chambers 1 and 4, and likewise the walls C at the opposite sides of the intermediate chambers 2 and 3, preferably have solid or imperforate upper portions, indicated at *b* and *c* respectively, while the remaining portions *c′* of the walls are of slatted formation or other suitable formation providing openings for the free passage through the walls of air or other drying medium. The air chambers or spaces between the division walls C are suitably covered at their upper ends, preferably by sloping plates E, for preventing the grain from entering the air chambers and directing it into the drying chambers.

Means are provided for causing the material to discharge from the lower ends of the drying chambers at a suitably regulated speed. As shown, the lower ends of the drying chambers 3 and 4 communicate with a hopper F, and the lower ends of the other drying chambers 1 and 2 communicate with a similar hopper G. Each of these hoppers has walls which converge downwardly to a discharge trough H, in which travels a suitable conveyer I, for discharging the grain from one end of the trough. In each of the hoppers F and G is arranged discharge regulating rolls or devices K K′, one beneath each of the two drying chambers communicating with said hopper. Each of the regulating devices shown consists of a rotating roll which extends lengthwise below one of the drying chambers and is provided with a longitudinal groove *k* adapted to discharge substantially the same quantity of grain from the drying chamber to the discharge conveyer at each revolution of the roll. The regulating rolls K K′ prevent the grain from clogging or packing in the drying chambers and insure a regular and positive discharge of the grain from the chambers at a speed determined by the speed of rotation of the rolls.

The discharge conveyers and regulating rolls can be driven by any suitable mechanism, such, for example, as a shaft L, which extends horizontally at one end of the apparatus and is connected by bevel gears *l* and *l′* to each of the regulating rolls, and a shaft M, which extends horizontally at the same end of the apparatus and is geared by wheels *m* to the discharge conveyers I. The shafts L and M may be driven by belts running on pulleys l^2 and m^2 on the shafts L and M respectively, or by other suitable means.

N represents coils or pipes in the drying chambers heated by steam or other suitable

heating medium flowing through the pipes for heating the grain to drive the moisture therefrom. The pipes are preferably arranged in a plurality of banks, each comprising a series of coils n, each of which coils is arranged vertically and connects at its upper end with a steam supply header O at one end of the casing and at its lower end with an exhaust or discharge header O' which may if desired, be arranged at the same end of the casing. Each pipe coil consists of a series of lengths of pipe which extend substantially horizontally lengthwise in the drying chamber and are connected by return bends n' at their ends so as to form a continuous zig-zag coil or pipe connected at its ends respectively to the supply and discharge headers. The alternate horizontal lengths of pipe forming each coil are located in different vertical planes and the return bends connecting them are inclined as indicated in Fig. 2, so that the horizontal parts of the coils lie in staggered relation and cause the grain descending through the drying chamber to be deflected from pipe to pipe, thus causing a more thorough agitation and heating of the grain.

The heating coils N are sufficient in number and extent to supply all the heat necessary to cause the grain to sweat or to drive the moisture out of the grain, and they preferably occupy the upper portions of the drying chambers from points near the tops of the chambers to points a considerable distance below the lower ends of the imperforate upper portions of the walls of the drying chambers. The slatted portions of the walls of the drying chambers thus extend some distance above the lower ends of the heating coils and are adapted to admit the air or drying medium to the chambers in the vicinity of at least a part of the coils.

P represents a steam supply pipe connecting with the supply headers O, and P' is a discharge pipe connecting with the discharge headers.

In order to permit any one of the heating coils to be cut out in case the coil should burst or leak, and thus enable the apparatus to be operated without the defective coil or coils, each of the steam supply and discharge headers is preferably provided in its outer wall opposite the end of the pipe coil with a screwthreaded opening q closed by a removable cap or plug Q, see Fig. 5, and the inner wall of the header is provided with a screwthreaded opening q' into the inner end of which the pipe coil is secured and into the outer end of which a cap or plug q^2 is adapted to be screwed for closing said coil. The opening in the outer wall of the header is large enough to permit the passage therethrough of the inner plug q^2 so that when the outer cap or plug Q is removed, the inner plug q^2 can be passed through the hole q and screwed into place to close the end of the steam coil. The ends of any one of the steam coils can thus be closed, and the holes q in the outer walls of the headers closed by replacing the caps or plugs Q, and in this way any one or more of the coils which may be defective can be cut out without interfering with the use of the remaining coils, thus enabling the operation of the apparatus even though one or more of the steam coils may be broken or defective.

R represents a fan or blower for supplying unheated air or other cooling medium for the material to the lower portions of the drying chambers 1, 2, 3 and 4, and S represents a fan or blower for supplying heated air or other drying medium for the material to the intermediate portions of the drying chambers or portions thereof next above the portions to which the cool air is admitted. The discharge pipe of the cool air blower R connects with a trunk r which extends crosswise at one end of the casing and connects with the lower portions of the air chambers 5 and 6, through openings r' in the end walls thereof. The air thus admitted to the air chamber 5, passes through the openings in the lower portions of the opposite walls C of this chamber and through the material in the drying chambers 1 and 2 on opposite sides of this air chamber 5. The air escapes from the outer drying chamber 1 through the openings in the outer wall B' of this chamber and the air escapes from the drying chamber 2 through the openings in the division wall C into the air chamber 7 from which it passes to the atmosphere through openings r^2 at the end or other suitable portion of this chamber. In a similar manner, the air admitted to the air chamber 6 between the other two drying chambers 3 and 4 passes through the material in the lower portions of these chambers and escapes to the atmosphere through the openings in the outer wall of the chamber 4 and through the openings in the division wall C of the chamber 3 and the air chamber 7.

The discharge pipe of the hot air fan or blower S connects in a similar manner by means of a trunk s with the intermediate portions of the air chambers 5 and 6 through openings s' in the end walls thereof. The air chambers 5, 6 and 7 are provided with horizontal partitions s^2 which divide these chambers into separate passages for the cool and hot air. The hot air passes from the air chambers 5 and 6 through the drying chambers on opposite sides thereof and through the material in these chambers in the same manner as explained in connection with the cool air.

In the operation of the apparatus the grain is fed into the upper ends of the drying chambers in any suitable way and de-

scends in mass through the drying chambers under the control of the discharging means. The grain is heated in the upper portions of the drying chambers by the heating pipes and the moisture from the grain is carried off and the grain dried by the air or drying medium passing through the drying chambers and the grain therein. The air or drying medium supplied to the portions of the drying chambers in the vicinity of the heating pipes is heated sufficiently to dry the heated grain and prevent chilling the same so as to cause the condensing of the moisture on the grain and the heating pipes, but this air is not relied upon to heat the grain, this function being performed by the heating pipes. When the grain reaches the lower portions of the drying chambers it is cooled by the air supplied thereto. By heating the grain to the required temperature by means of the steam pipes and utilizing the air for drying the grain thus heated in the manner explained, large quantities of grain can be quickly and economically dried in a comparatively small apparatus.

I claim as my invention:

1. The combination of an upright drying chamber through which the material is adapted to descend, means for controlling the descent of the material through the chamber, heating pipes occupying the upper portion of said chamber for heating the material, the portion of said chamber below said heating pipes being substantially unobstructed, means for passing a heated drying medium through a portion of said chamber occupied by said heating pipes for drying the material heated by said pipes, and means for passing a cooling medium through the portion of the chamber below said heating pipes for cooling the material.

2. The combination of an upright drying chamber through which the material is adapted to descend, means for controlling the descent of the material through the chamber, heating pipes occupying the upper portion of said chamber for about one-half the length of said chamber, means for passing a heated drying medium through the lower part of the portion of the chamber occupied by said heating pipes for drying the material heated by said pipes, and means for passing a cooling medium through the portion of the chamber below said heating pipes for cooling the material.

3. The combination of an upright drying chamber through which the material is adapted to descend, means for controlling the descent of the material through the chamber, said chamber having side walls provided below the upper portions thereof with openings for the passage of drying and cooling mediums, heating pipes occupying the upper portion of said chamber for heating the material, means for passing a heated drying medium through the walls of the portion of the chamber occupied by said pipes, and means for passing a cooling medium through the walls of said chamber below said heating pipes.

4. The combination of an upright drying chamber the walls of which have imperforate upper portions and are provided below said imperforate portions with openings for the passage of drying and cooling mediums, heating pipes occupying the upper imperforate portions of the chamber and extending below the same in the chamber, means for passing a heated drying medium through the walls of the portion of said chamber adjacent to said heating pipes, and means for passing a cooling medium through the walls of the portion of the chamber below said heating pipes.

5. The combination of an upright drying chamber through which the material is adapted to descend, means for controlling the descent of the material through the chamber, heating pipes occupying the upper portion of said chamber for a relatively large part of the height of the chamber, means for passing a heated drying medium through the material occupying a relatively large part of the portion of the chamber occupied by said heating pipes, and means for passing a cooling medium through the material occupying the portion of the chamber below that occupied by said pipes.

6. The combination of an upright drying chamber through which the material is adapted to descend, means for controlling the descent of the material through the chamber, heating pipes occupying the upper portion of said chamber for heating the material, there being sufficient of said pipes to supply the heat necessary to drive the moisture out of the material, means for passing through the material in the upper portion of the chamber a drying medium having a temperature sufficient to prevent condensing the moisture on the material, and means for passing a cooling medium through the material in the chamber below said heating pipes.

7. The combination of an upright drying chamber through which the material is adapted to descend, means for controlling the descent of the material through the chamber, heating pipes in the chamber for heating the material, an air chamber at one side of said drying chamber, the wall between said chambers having openings through which said chambers communicate, said air chamber being divided into separate passages for a heated drying medium and a cooling medium, and means for supplying the drying and cooling mediums to said passages.

8. The combination of two upright drying chambers through which the material is

adapted to descend, means for controlling the descent of the material through said chambers, said drying chambers being separated by an air chamber, the walls between said drying and air chambers having openings through which the air chamber communicates with said drying chambers, and said air chamber being divided into a lower passage for cool air communicating with the lower portion of said drying chambers and a passage for heated air communicating with the drying chambers above said cool air passage, and means for supplying cool air to said lower passage and heated air to said other passage.

9. The combination of a drying chamber through which the material passes, steam supply and exhaust headers, a plurality of heating coils in said chamber over which the material passes for heating the material, each of said coils connecting at its ends with said steam supply and exhaust headers, means at the ends of said coils for the retention of stoppers for closing the ends of said coils, said headers being provided in the outer walls thereof with openings through which said stoppers can be inserted for closing the ends of said coils, and closures for said openings in the outer walls of said headers.

10. The combination of a drying chamber through which the material passes, a plurality of heating coils in said chamber over which the material passes for heating the material, each of said coils comprising substantially horizontal lengths of pipe arranged alternately in different vertical planes and inclined end connections, a steam supply header to which the upper ends of said coils are connected, and an exhaust header to which the lower ends of said coils are connected.

Witness my hand, this 19 day of August, 1915.

ALFRED W. FRENCH.

Witnesses:
WALTER I. FULLER,
WALTER R. AUMSBURG.