(No Model.) 2 Sheets—Sheet 1.

E. A. ABBOTT.

GRAIN DRIER AND COOLER.

No. 265,552. Patented Oct. 10, 1882.

Fig. 1.

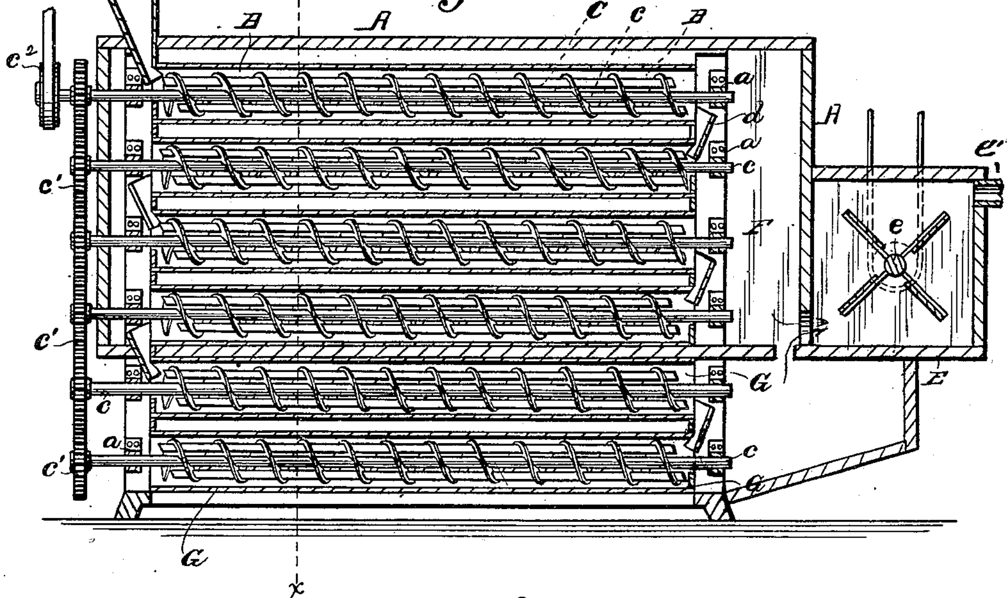


Fig. 2.

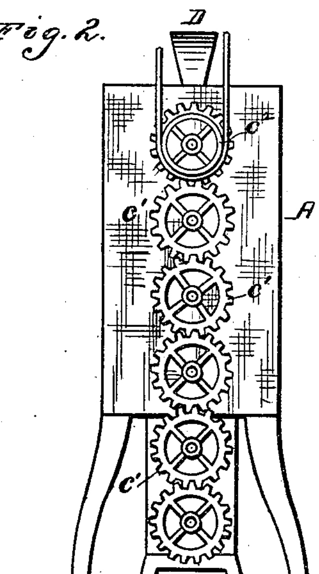


Fig. 3.

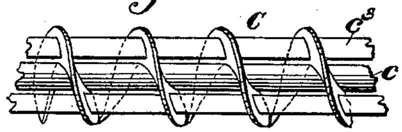


Fig. 4.

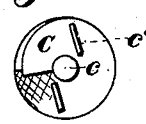
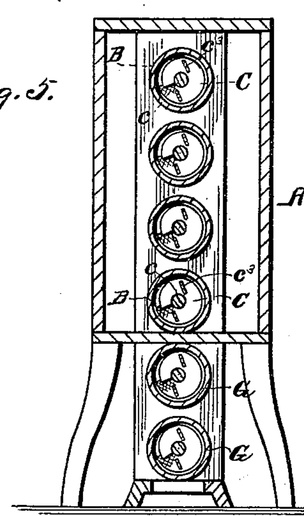


Fig. 5.



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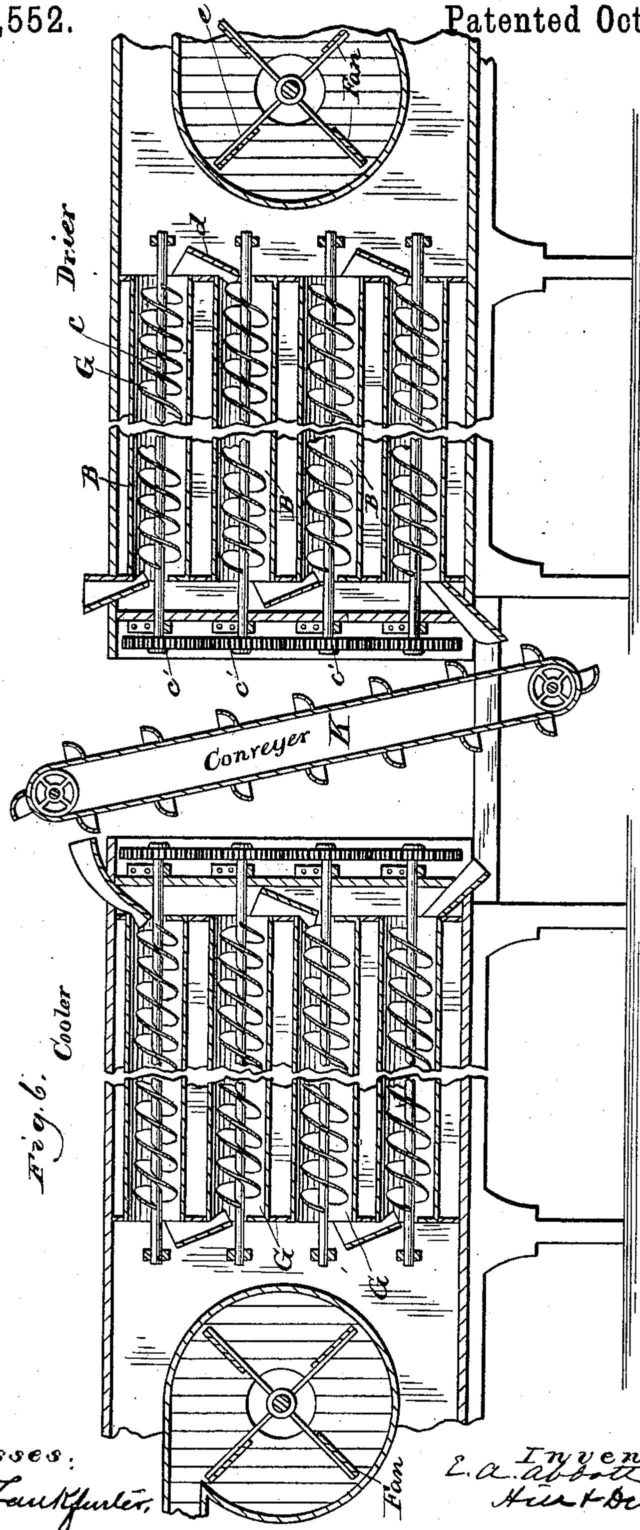
(No Model.) 2 Sheets—Sheet 2.

E. A. ABBOTT.

GRAIN DRIER AND COOLER.

No. 265,552. Patented Oct. 10, 1882.



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UNITED STATES PATENT OFFICE.

EDSON A. ABBOTT, OF MARSHALLTOWN, IOWA.

GRAIN DRIER AND COOLER.

SPECIFICATION forming part of Letters Patent No. 265,552, dated October 10, 1882.

Application filed July 29, 1881. (No model.)

To all whom it may concern:

Be it known that I, EDSON A. ABBOTT, of the city of Marshalltown, county of Marshall, and State of Iowa, have invented a new and useful Improvement in Grain Driers and Coolers, of which the following is a description, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal vertical section of the apparatus. Fig. 2 is an end view of the same. Fig. 3 represents a portion of one of the spirals for conveying the grain through the tubes, and Fig. 4 an end view of the same. Fig. 5 represents a cross-section of the apparatus, taken on the line *x x* of Fig. 1. Fig. 6 represents two series of tubes, conveyers, and suction-fans, one series being adapted to the drying of the grain and the other series to the cooling of the same.

Like letters represent like parts in the several figures.

The object of my invention is to provide an improved mode of treating damp or unsound grain, consisting in subjecting it first to the combined and simultaneous action of heat derived from steam surrounding the inclosing pipes and of currents of air passing through said pipes, and then subjecting it to the action of other currents of cold air passing through other tubes exposed to the atmosphere; also, in an improved form and construction of the spiral conveyers employed in moving the grain through the tubes, all of which will be hereinafter more fully explained, and pointed out definitely in the claims.

In the drawings, A represents the steam-chest, formed by suitable frame-work and inclosed so as to retain the steam within it, and provided with suitable inlet and outlet pipes for the steam.

Arranged longitudinally within the steam-chest A is the series of metallic tubes B B, preferably arranged in a vertical plane, one above another. These tubes are attached at their ends to the casings at the ends of the steam-chests in steam-tight joints, so that the steam within the chest cannot penetrate within the tubes.

Within the tubes are inserted the spiral conveyers C C, each provided with a central shaft, *c*, which is prolonged at the ends and inserted in suitable bearings, *a a*, placed at the ends of the steam-chest A.

At one end of the steam-chest the shafts *c* are further prolonged, and gear-wheels *c'* are attached thereto, meshing into each other, as shown clearly in the drawings, so that when one spiral is set in motion all will be actuated. For the purpose of communicating power to the spirals another gear-wheel may be suitably attached, meshing into one of the gear-wheels *c'*; or the pulley and belt c^2 may be placed upon the end of one of the spiral shafts for that purpose.

The peculiarity in the construction of the spiral conveyers consists in the insertion within the spirals of the longitudinal bars or slats c^3, the location of which in the body of the spiral is shown clearly in Figs. 3 and 4. These bars are inserted within slits cut in the spirals, and are of such narrow width that their outer edges leave a space between them and the circumference of the spiral, while a space is also left between their inner edges and the central shafts, *c*. They are also preferably inserted at a slant, approaching to a tangent to the interior shaft, rather than radially to the center of the spiral. In the preferable construction their width bears about the proportion to the diameter of the spiral shown in Fig. 4.

A hopper, D, is placed at the end of the upper tube, B, opening into the interior thereof. At the opposite end a spout, *d*, is placed, affording a passage for the grain from the upper tube into the end of the tube next below, and corresponding spouts are placed at the ends of the tubes throughout the series, so that when the conveyers are set in motion the grain entering the hopper D is conveyed through the system of pipes, and thence through a suitable trough into the receptacle provided. If preferred, the spouts *d* may be made interchangeable with larger spouts, which shall carry the grain by one or more of the tubes B into a lower tube, giving it a shorter passage through the steam-chest, or, if so desired, to deliver the grain into the receptacle provided at the end of any one of the tubes B. The ends of the tubes B are open, so that a current of air can pass through the tubes longitudinally. As a means of creating this current of air a fan-box,

E, is placed at one end of the tubes B, and a fan, *e*, is suitably inclosed therein and connected with the motive power. The fan is constructed in any of the well-known forms, and is so adjusted as to create a current of air in the tubes B, which is drawn into their ends opposite to the fan by suction and expelled through the aperture *e'* in the fan-box E. A strong current of air is thus caused to pass through the entire length of each of the tubes B, entering at one end and passing out at the other.

In my first construction of this apparatus I placed the fan in the rear of the series of tubes B, at or near the middle thereof, and made an opening at the middle of each tube communicating with the fan-box, so that, owing to the suction of the fan, the air would enter at both ends of each tube and pass out of the middle thereof into the fan-box. While this arrangement did good work, there was a marked tendency to clog up the passages from the middle of the tubes to the fan-box, and two currents of air from the ends of each tube meeting deposited at their outlet from the tube an accumulation of dirt, chaff, and other impurities. This incidental objection I have wholly overcome by placing the fan-box at the end of the tubes B and creating an unbroken current of air through the entire length of the tubes, as herein described, by which any accumulation of dirt or impurities will fall to the bottom of the air-receptacle F, between the ends of the tubes B and the fan *e*, and be readily removed.

In passing the grain through the series of tubes B, where, owing to the great dampness of the grain, it is desirable to employ a considerable degree of heat in the steam-chest, the grain is sometimes warm when it emerges from the last of the tubes. When it is desired to cool this or other heated grain I make use of a second series of tubes, G G, similarly constructed to the tubes B, and provided also with interior spiral conveyers and a similar system of spouts connecting the tubes. An important modification of the frame-work is, however, made, in that while the tubes B are inclosed within a steam-chest, so as to subject them to the heat of the steam, the tubes G are so arranged that their exterior surface is freely exposed to the atmosphere, which circulates around them, keeping them cool, so as to reduce the temperature of the grain passing through them. Currents of cool air are also forced through the tubes G in like manner to the tubes B, either by connecting their ends to the fan-box E or by providing in similar manner a separate fan-box and fan, creating directly a suction within the tubes G.

In the construction illustrated in the drawings, Fig. 1, the series of tubes G is placed in a vertical plane directly beneath the tubes B; but it is obvious that this cooling apparatus may, if preferred, be wholly detached, and the grain be conveyed to it by means of a conveyer, K, such as shown in Fig. 6; or it can be used separately when for any reason it is not desirable to first pass the grain through the tubes B.

The operation of the above-described apparatus is very simple. Power being communicated to the spiral conveyers and to the fan, and grain being poured into the hopper D, it is forced along by the revolutions of the spirals through the series of tubes B. These tubes, being heated by the action of the steam upon their exterior surfaces, expel the moisture from the inclosed grain, which moisture is immediately carried off by the currents of air created by the fan and passing longitudinally through the tubes. The rapidity of the movement and the degree of heat applied are regulated to suit the condition of the grain. The function of the longitudinal bars or slats c^3 is to agitate the grain which is conveyed through the tubes by the revolution of the spirals and to shake up the mass of grain between the adjacent flanges of the spirals as they revolve, the grain being forced against the interior circumference of the tubes. After the grain has passed through a sufficient number of the tubes B it is passed or conveyed into the series of tubes G, where it is subjected to a double application of cooling agents—namely, the passage of currents of cold air longitudinally through the tubes G and the action of the cold air upon the exterior surface of those tubes—tending constantly to lower the temperature of the grain passing through them.

It is obvious that the currents of air in the tubes G may be created by suction or by forcing the air through with a blower, and these currents may enter at one end of the tube and pass out at the other, as above described.

The result of the practical operation of the above-described apparatus is that the most damp and the most heated grain is at a very small expense thoroughly cured by this treatment, and is delivered at the end in a dry and a cool condition, fit for market and for use.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The herein-described mode of treating damp or unsound grain, consisting in subjecting it first to the combined and simultaneous action of heat derived from steam surrounding the inclosing pipes and of currents of air passing through said pipes, and then subjecting it to the action of other currents of cold air passing through other tubes exposed to the atmosphere, substantially as described.

2. In a grain drier or cooler, an inclosed spiral conveyer consisting of a shaft, spiral flanges, and longitudinal bars connected to said flanges so as to leave a space between the inner edges of said bars and the shaft, and also between the outer edges of said bars and the periphery of the spiral, substantially as described.

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