

(No Model.)

3 Sheets—Sheet 1.

I. G. HOOPER.  
GRAIN DRIER.

No. 522,985.

Patented July 17, 1894.

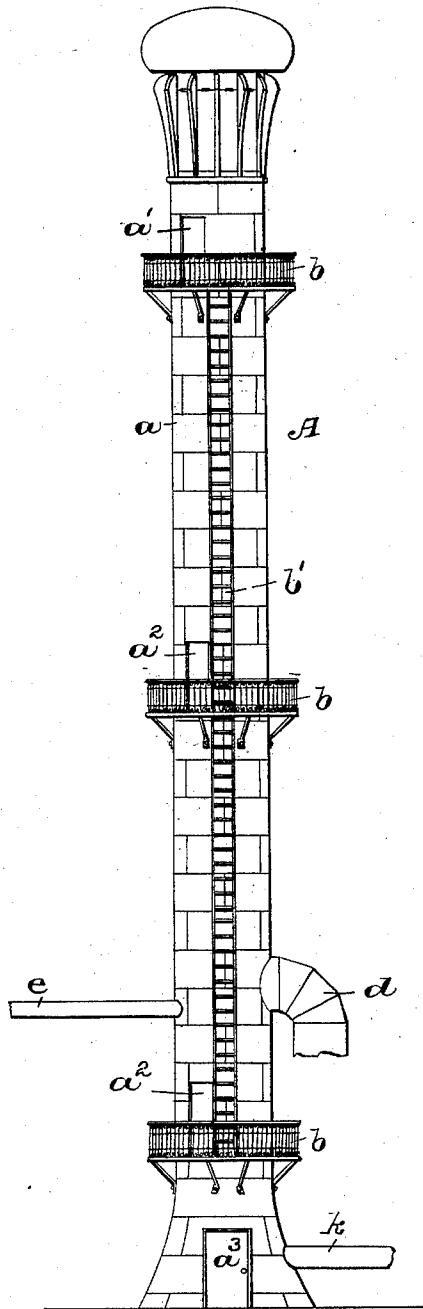


Fig. 1

WITNESSES:

*Wm. S. Camfield, Jr.*  
*H. W. Marsh.*

INVENTOR:

*Irvin G. Hooper,*

BY *Fred. Fraentzel,* ATT'Y.

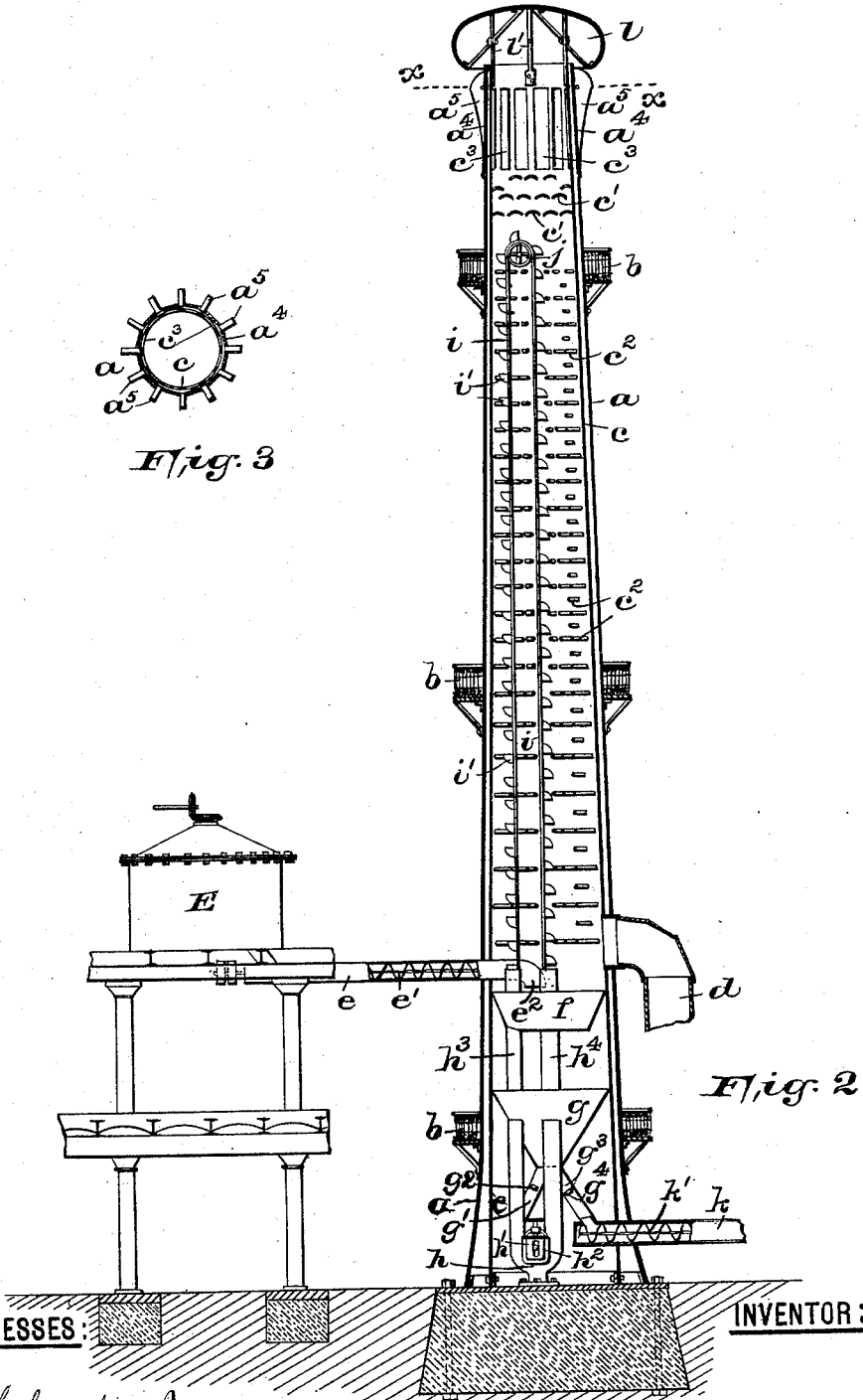
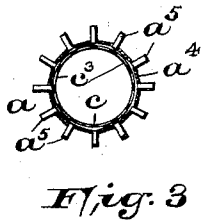
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INVENTOR:

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*H. W. Marsh.*

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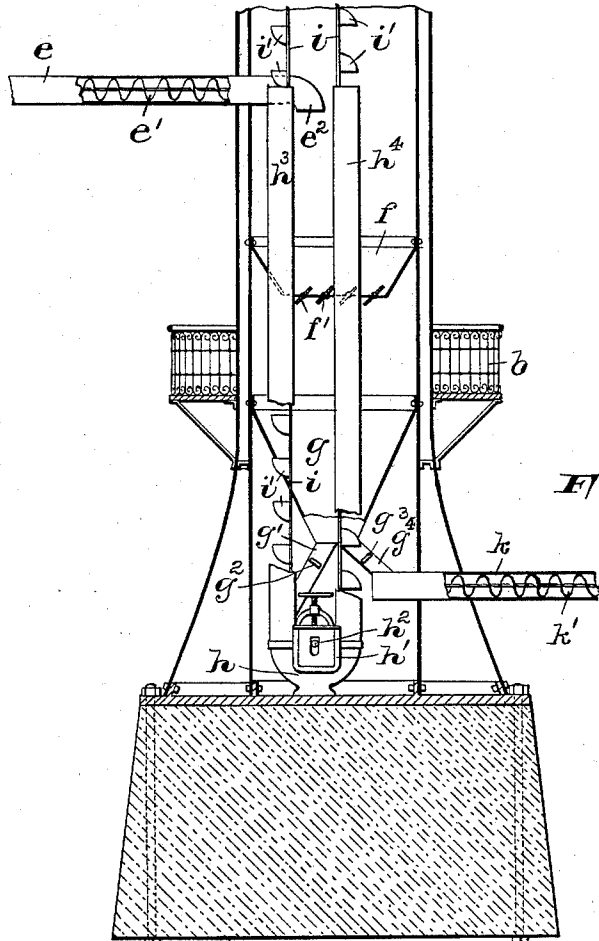


Fig. 4

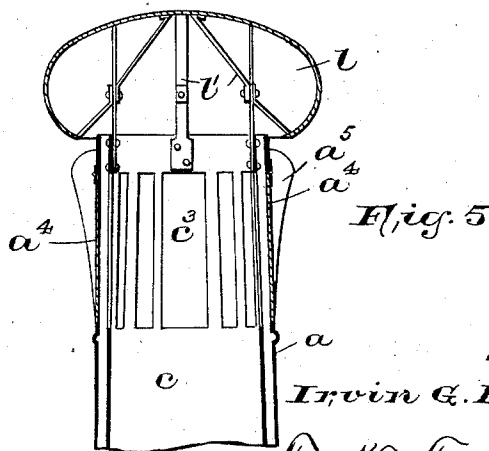


Fig. 5

WITNESSES:

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# UNITED STATES PATENT OFFICE.

IRVIN G. HOOPER, OF NEWARK, NEW JERSEY.

## GRAIN-DRIER.

SPECIFICATION forming part of Letters Patent No. 522,985, dated July 17, 1894.

Application filed May 13, 1893. Serial No. 474,058. (No model.)

*To all whom it may concern:*

Be it known that I, IRVIN G. HOOPER, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Grain-Driers; 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 of reference marked thereon, which form a part of this specification.

The primary object of this invention is to provide a drying tower, which meets all the conditions of successfully and economically drying grain, or the like, by means of heated air. These conditions, are, first, that the current of air shall be brought into intimate and uniform contact with the material to be treated, and further, that all the material to be dried shall be uniformly subjected to the treating current of air, and thereby be equally dried. The most efficient construction of a drying chamber is a vertical tower, as therein, a rising current of air will diffuse itself uniformly throughout the area and its ascent, which will be materially assisted by the difference of gravity of the heated column and the external air, will virtually hold the fine particles of material to be dried in suspension, whereby the current of hot air is brought into more intimate contact with the material to be dried.

The several ends of my invention are intended to secure the successful and economical drying of grain, or the like, and to meet these ends, I have constructed the apparatus illustrated in the accompanying drawings, in which similar letters of reference are employed to indicate like parts in each of the views, and in which views are illustrated the various mechanical devices employed to accomplish the various objects above specified.

In said drawings, Figure 1 is a front elevation of my novel form of grain drying tower. Fig. 2 is a vertical section of the same, showing its use as applied in connection with a mash tun to receive the wet or moist grain therefrom, and said view illustrating an arrangement of the various mechanical devices employed. Fig. 3 is a horizontal section,

taken on line  $x$  in said Fig. 2. Fig. 4 is a vertical section of the lower portion of the tower, on a larger scale, and Fig. 5 is a like view of the upper portion of the tower, clearly illustrating an arrangement of pivoted or hinged doors, which open automatically in the case of an explosion of the grain dust in the tower.

The mechanism shown in the various views of the drawings is adapted to perform the various functions set forth herein, and consists of a suitable tower A, preferably constructed from boiler iron, and provided at intervals with doors  $a'$ ,  $a^2$ ,  $a^3$ , &c. Said tower, as will be seen from Fig. 1, may be provided with balconies  $b$  and a connecting ladder  $b'$ .

The construction of the tower is preferably as shown in Fig. 2, consisting essentially of an outer stack or shell  $a$  and an inner stack or shell  $c$ , which stacks are suitably connected by means of stay-bolts, or in any other well-known manner, thereby providing for an air-tight space between the inner and outer stacks, for the purpose of insulation to prevent the radiation of the heat from the inner stack through the outer shell or stack. Said inner stack  $c$ , as will be seen from said Fig. 2, may be provided with any suitable form of deflectors, as  $c'$ , to prevent any undue escape of hot air from the stack, and also, to prevent the finer particles of the material to be dried, from being blown out of the top of the tower. Projecting from the inner surface of said stack  $c$ , may be arranged suitable studs or small pipes  $c^2$ . These studs or pipes are arranged to alternate in position with those next above and below them, so that the material discharged at or near the top of the stack, as it moves downward to the bottom of the stack, will be separated, and whereby the particles, are uniformly subjected to the treating current and thereby equally dried.

At or near the bottom of the drying tower and leading into and entirely through the two stacks or shells  $a$  and  $c$ , is a heat conveying pipe or flue  $d$ .

In order to illustrate one use of my drying tower, I have represented in connection with the same, as will be seen from Fig. 2, a mash tun E from which extends the grain conveying tube  $e$ , which passes through the shells or stacks  $a$  and  $c$ , and is provided with the usual form of conveyer or worm  $e'$ . Directly be-

neath the outlet  $e^2$  of the tube  $e$ , and within the stack  $c$ , I have arranged a suitable hopper  $f$ , which, as will be seen from the section in Fig. 4, is provided with an open bottom, in which are arranged the pivoted louvers or slats  $f'$ , which may be opened or closed by means of a suitable lever, to retain the grain in said hopper or to permit the same to be dropped down into a second hopper  $g$ . Passing through said hoppers  $f$  and  $g$ , is a sort of U-shaped casing  $h$ , in the bottom portion of which is an adjustable bearing  $h'$ , in which rotates a shaft  $h^2$  provided with a suitable pulley, not shown in the drawings. Passing over said pulley in said casing  $h$  and over a pulley  $j$  in the upper portion of the stack  $c$  is a conveyer belt  $i$  provided with suitable buckets  $i'$ . Said belt and its buckets pass through the legs  $h^3$  and  $h^4$  of said casing  $h$ , as will be evident from Figs. 2 and 4. A duct  $g'$  provided with a gate or valve  $g^2$  leads from the bottom of the hopper  $g$  into the side of said casing  $h$ , whereby the wet or moist grain can be passed from the hopper  $g$  into the buckets  $i'$  to be conveyed to the top of the tower and then dropped from said buckets  $i'$  to be again caught in the hopper  $f$ . A second duct  $g^3$  provided with a gate or valve  $g^4$ , leads into a pipe  $k$  provided with a conveyer or worm  $k'$  for conducting the dried grain or other material to some point outside of the tower.

As will be seen from Fig. 5, in the top of said inner stack  $c$ , I have secured suitable brackets or supports  $l'$  which carry a suitable deflecting hood  $l$  constructed to retain the hot air in the stack, but still, permitting the escape of the air therefrom, as will be evident from an inspection of said figure. The top of said stack  $c$  is provided with suitable openings  $c^3$ , while in the outer stack or shell  $a$ , are correspondingly arranged openings provided with outwardly swinging doors  $a^4$  arranged between the braces or stiffening bars  $a^5$ , as will be clearly seen from Figs. 1 and 5. Said doors are preferably hinged at the top, whereby, when an explosion of the grain dust occurs, said doors will swing outwardly and will close by their own weight, as will be clearly understood. This arrangement of the doors, which are of the proper weight to keep them closed under the normal pressure of the air in the stack, will, by their automatic opening, when an explosion of grain dust occurs, prevent the blowing-off of the hood  $l$ .

The operation of the several mechanisms herein shown for drying grain or other like material, is as follows:—The moist or wet grain is forced from the opening  $e^2$  in the pipe  $e$ , by means of the conveyer  $e'$  therein, into the hopper  $f$ , which, when sufficiently filled is emptied into the hopper  $g$  by opening the louvers  $f'$ . The gate  $g^4$  in the duct  $g^3$  being closed, and the gate  $g^2$  in the duct  $g'$  being open, the moist or wet grain passes down into the side of the casing  $h$  from which the buckets  $i'$  on the belt  $i$  convey the grain to the top of the stack, whereupon the returning buck-

ets are emptied of their contents, the grain passing down and being scattered by the arrangement of the studs  $c^2$ , and finally they are again caught in the hopper  $f$  in which they are retained until the lower hopper  $g$ , containing the moist or wet grain, has been emptied. When the lower hopper has been emptied, the louvers in the upper hopper  $f$  are opened and the grain once more passes into the hopper  $g$ , from which the material can be made to pass once more through the chute  $g'$  to be conveyed to the top of the tower, or, if the material has been sufficiently dried, said gate or valve  $g^2$  in the chute  $g'$  may be closed and the grain allowed to pass through the duct  $g^3$  and the now open gate  $g^4$  therein, into the conveyer  $k'$  to be stored away for further use.

In some instances, I may allow the grain, after it has fallen from the top of the tower, to remain in the hopper  $f$ , where it can be sufficiently baked by the heat in the stack, as will be clearly evident.

It will be seen that by my arrangement of parts and the general construction of the drying tower, the material is brought to the top of the tower and then the material moves by gravity slowly down the vertical chamber, striking the studs, which separate the grain, whereby all the material is uniformly subjected to the heated air and equally dried. Furthermore, owing to the upward flow of the hot air in the tower, the downward progress of the grain or other material to be dried is impeded, the particles being virtually held in suspension, whereby the current of air is brought into intimate and uniform contact with the material to be treated, and none of the material can escape without being thoroughly dried.

The drying tower herein set forth is especially adapted for the drying of grain, for the feeding of cattle, but may be used for the drying of bark, leaves, malt, or any other material.

Having thus described my invention, what I claim is—

1. In a drying tower, the combination, with the tower proper, of a pair of hoppers at or near the bottom of the tower, a conveyer chute at one side for conveying the material into the upper hopper, a heat duct leading into said tower, a bucket conveyer for conducting the material to be dried to the top of said tower, and a conveyer tube at the bottom of said tower connected and communicating with the lower of said hoppers, all arranged substantially as and for the purposes set forth.

2. In a drying tower, the combination, with the tower proper, of a pair of hoppers at or near the bottom of the tower, a conveyer chute at one side for conveying the material into the upper hopper, a heat duct leading into said tower, a bucket conveyer for conducting the material to be dried to the top of said tower, a conveyer tube at the bottom of said tower, and deflectors  $c'$  in the top of the tower,

and studs  $c^2$  arranged to separate the falling material, substantially as and for the purposes set forth.

3. In a drying tower, the combination, with the tower proper, of a pair of hoppers at or near the bottom of the tower, a casing  $h$ , a belt or bucket conveyer, a duct  $g'$ , having a gate  $g^2$  therein, connecting the lower hopper with said casing  $h$ , a duct  $g^3$ , having a gate  $g^4$ , a conveyer chute  $k$  connected with said duct  $g^3$ , and a conveyer tube  $e$ , all arranged, substantially as and for the purposes set forth.

4. In a drying tower, the combination, with the tower proper, of a pair of hoppers at or near the bottom of the tower, a casing  $h$ , a belt or bucket conveyer, a duct  $g'$ , having a gate  $g^2$  therein, connecting the lower hopper with said casing  $h$ , a duct  $g^3$ , having a gate  $g^4$ , a conveyer chute  $k$  connected with said duct  $g^3$ , and a conveyer tube  $e$ , substantially as and for the purposes set forth.

5. The drying tower herein set forth, consisting essentially of an outer shell  $a$  and an inner shell  $c$ , said shells having correspondingly arranged openings near the top of the tower, and swinging doors arranged in the openings in said outer shell  $a$ , substantially as and for the purposes set forth.

6. In a drying tower, of the class herein set forth, hot air deflectors  $c'$  in the top of the tower, and studs  $c^2$  extending inwardly from the sides of the tower for separating the descending particles of the material to be dried,

and means for discharging the material to be dried at or near the top of the tower, substantially as and for the purposes set forth.

7. The herein described drying tower, consisting essentially of an outer shell or stack  $a$  and an inner shell or stack  $c$ , means for conveying the material to be dried through said stacks into or near the bottom of said inner stack  $c$ , a conveyer within said stack  $c$  for discharging the material to be dried at or near the top of said stack, and a conveyer chute at or near the bottom of said stack  $c$  for conducting the dried material from the stack, substantially as and for the purposes set forth.

8. In a drying tower, of the class herein set forth, the combination with the tower proper, a hopper  $f$  provided with slats or louvers  $f'$  in its bottom, a conveyer-chute at one side for conveying the material into the said hopper, a second hopper  $g$  directly below said first hopper, a bucket conveyer for conducting the material to be dried to the top of said tower, a duct for conveying the material from said hopper  $g$  into said bucket conveyer, and a conveyer tube  $k$  at the bottom of said tower, substantially as and for the purposes set forth.

In testimony that I claim the invention set forth above I have hereunto set my hand this 10th day of May, 1893.

IRVIN G. HOOPER.

Witnesses:

FREDK. C. FRAENTZEL,  
WM. H. CAMFIELD, Jr.