

No. 618,508.

Patented Jan. 31, 1899.

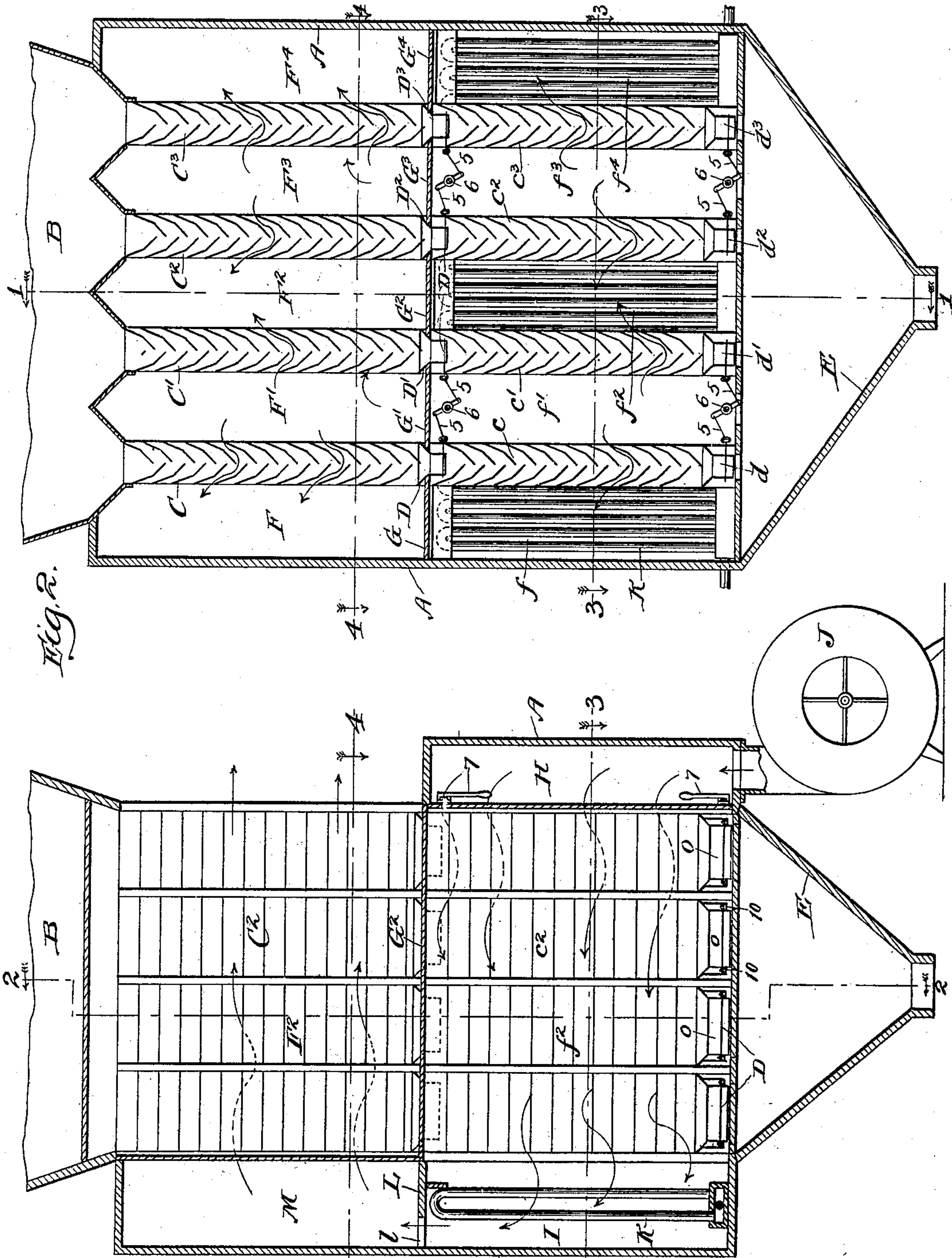
G. H. HESS, JR.

APPARATUS FOR DRYING AND COOLING GRAIN.

(Application filed Sept. 3, 1897.)

(No Model.)

3 Sheets—Sheet 1.



Witnesses
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Fig. 1.

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Fig. 4.

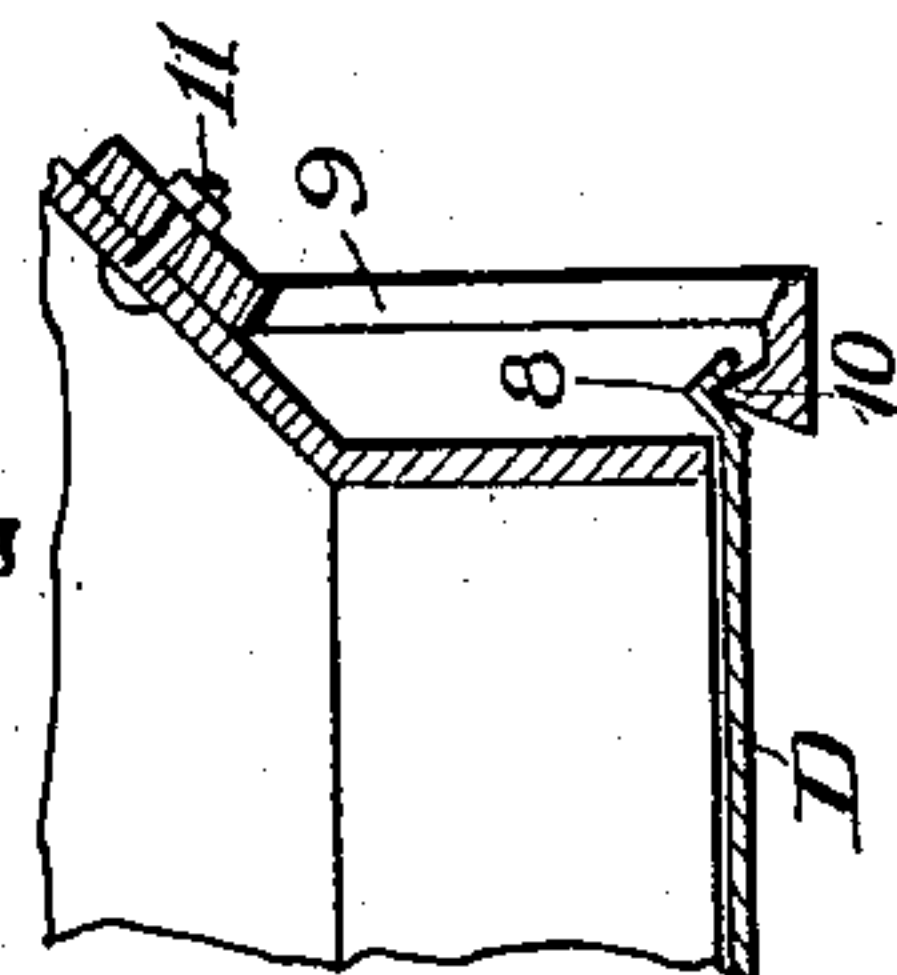
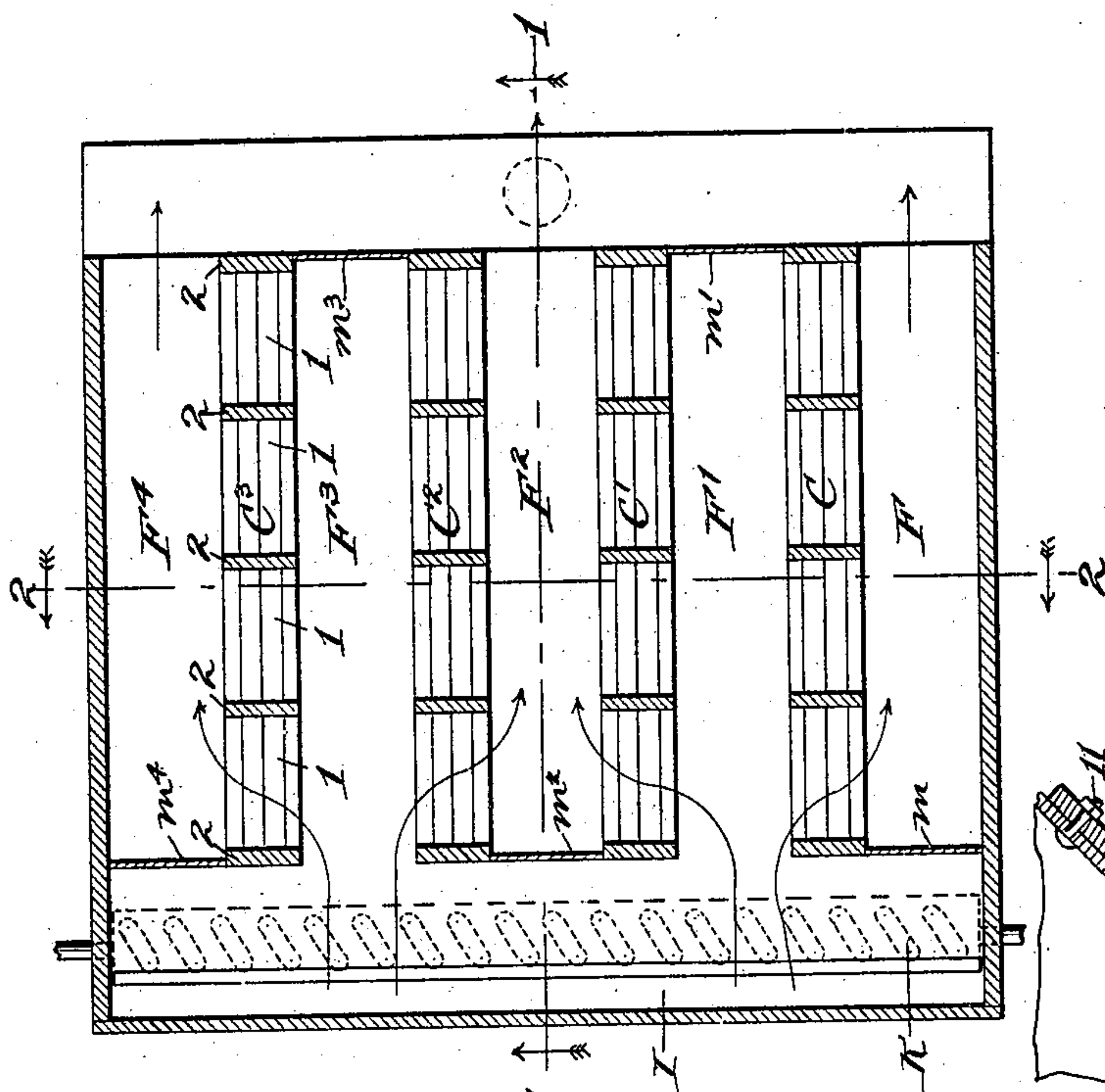
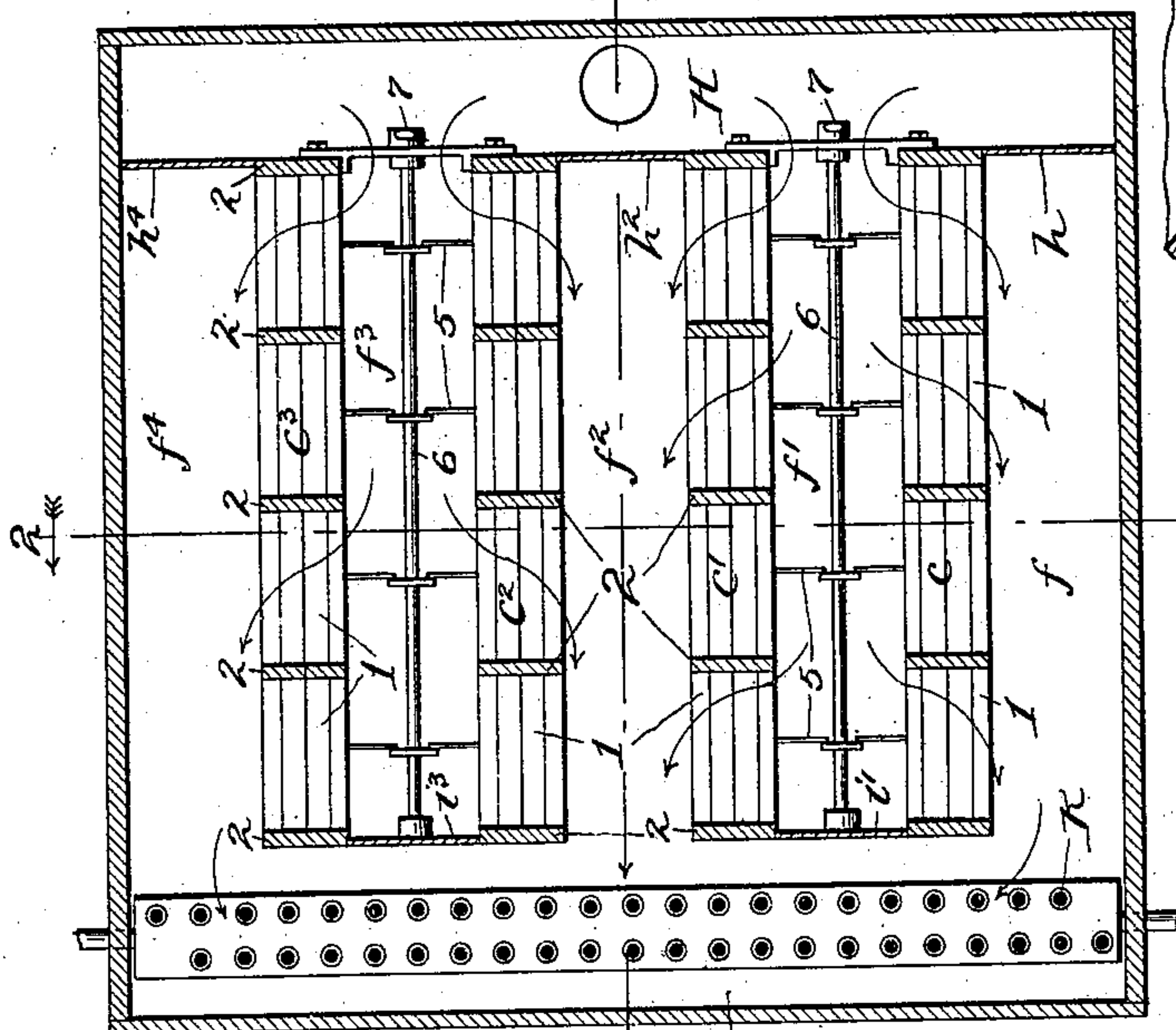


Fig. 11.

Fig. 3.



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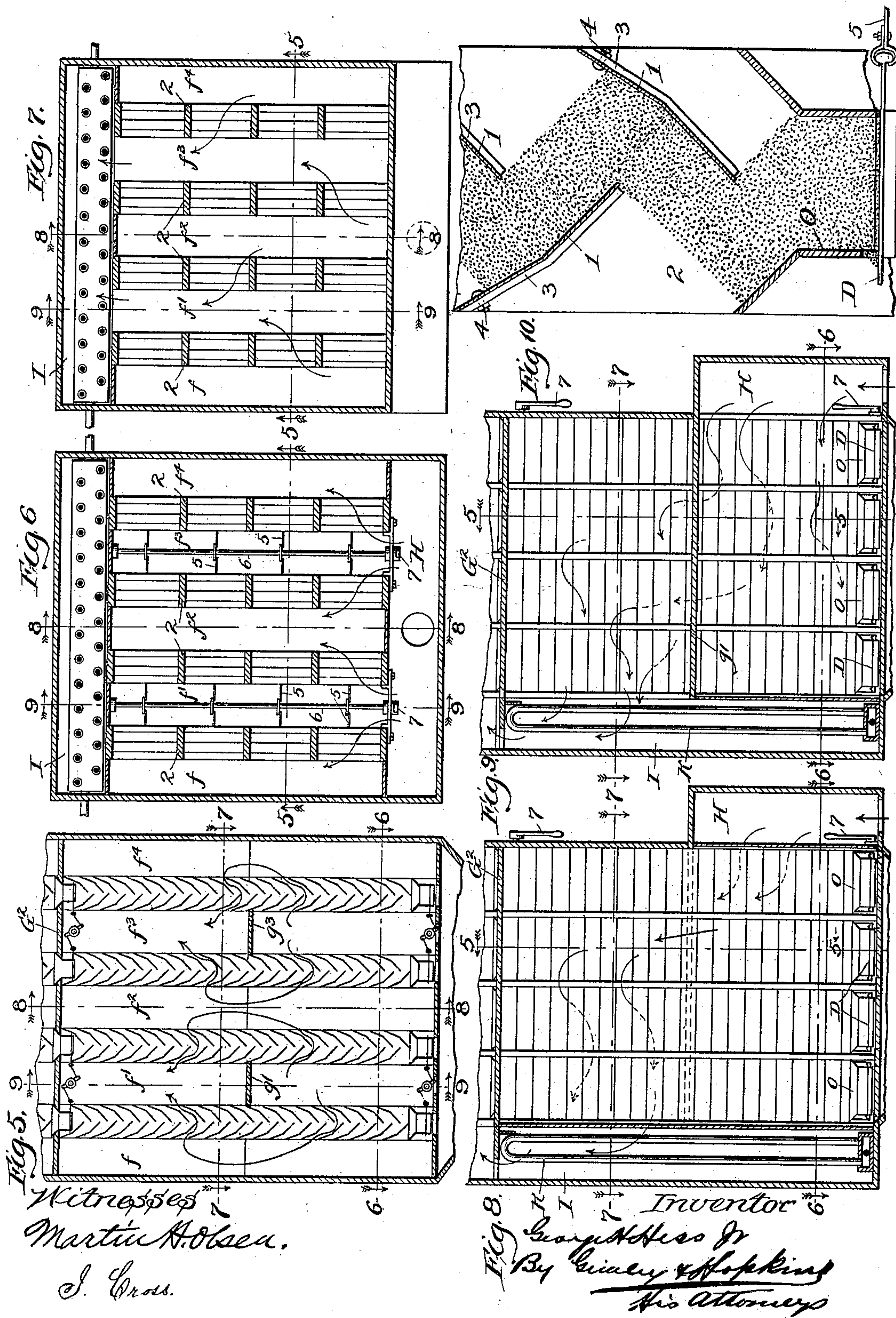
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3 Sheets—Sheet 3.



UNITED STATES PATENT OFFICE.

GEORGE H. HESS, JR., OF LA GRANGE, ILLINOIS.

APPARATUS FOR DRYING AND COOLING GRAIN.

SPECIFICATION forming part of Letters Patent No. 618,508, dated January 31, 1899.

Application filed September 3, 1897. Serial No. 650,426. (No model.)

To all whom it may concern:

Be it known that I, GEORGE H. HESS, Jr., a citizen of the United States, residing at La Grange Park, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Apparatus for Drying, Cooling, and otherwise Treating Grain and other Substances, of which the following is a specification.

10 The present invention relates more particularly to that class of apparatus in which grain is first dried and then cooled by subjecting it to the action of a current of air which, being taken from the atmosphere, is first passed
15 through the dried grain, whereby the grain is cooled and the air is initially heated, then passed through a suitable heating apparatus, whereby it is heated to the temperature necessary for drying purposes, and then passed
20 through the body of grain which is to be dried. I am aware that, broadly stated, it is not new to dry and cool grain in this manner; and I would therefore have it understood that my present invention resides in the construction
25 of the apparatus by which this work is done.

The objects of the invention are to provide an apparatus which shall effect to the greatest possible extent a conservation of the energy expended in the drying and cooling process, to the end that the apparatus shall be of
30 maximum efficiency, to provide an apparatus which may be made of sufficient capacity to satisfactorily handle on a commercially successful basis large quantities of grain, while
35 at the same time requiring but comparatively little floor-space, the latter being a matter of great importance, especially where ground-rents are high, and to provide an apparatus of such construction that when it is found
40 desirable to do so the same body of air may be passed successively back and forth in opposite directions through different portions of a body of grain.

To these ends the invention consists in the
45 features of novelty that are hereinafter fully described with reference to the accompanying drawings, which are made a part of this specification, and in which—

50 Figure 1 is a vertical section of an apparatus for drying, cooling, and otherwise treating grain or other substances constructed in accordance with the invention, the plane of

the section being indicated by the line 1 1, Figs. 2, 3, and 4. Fig. 2 is a vertical section thereof on the line 2 2, Figs. 1, 3, and 4. Figs. 55 3 and 4 are horizontal sections thereof on the lines 3 3 and 4 4, respectively, Figs. 1 and 2. Fig. 5 is a vertical section of a portion of an apparatus embodying one feature of the invention in its preferred form, the plane of the
60 section being indicated by the line 5 5, Figs. 6, 7, 8, and 9. Figs. 6 and 7 are horizontal sections thereof on the lines 6 6 and 7 7, respectively, Figs. 5, 8, and 9. Figs. 8 and 9
65 are vertical sections thereof on the lines 8 8 and 9 9, respectively, Figs. 5, 6, and 7. Fig. 10 is a vertical section of a portion of one of the grain-racks on a larger scale. Fig. 11 is a vertical section of one of the valves and the
70 hopper it controls.

A represents the side walls of the apparatus. They may be of any desired material or construction, and their dimensions will be determined by the capacity of the apparatus. As before suggested, it is important to minimize the floor-space occupied by the apparatus, and for this reason it is desirable that
75 an apparatus of large capacity shall differ from one of small capacity in its vertical rather than in its horizontal dimensions. 80

At the top of the shell or casing A is a garner B, into which the grain to be treated is delivered and by which the grain is in turn delivered to grain-racks C C', &c., any desired
85 number of which may be used. These racks are disposed in upright position. Preferably they are vertical; but it is not necessary that they be absolutely so, and any arrangement of them which will permit the grain or
90 other substance being treated to pass freely through them from top to bottom by gravity will answer the requirements of the invention. They may be of any desired construction, so long as they have in their sides openings which will permit the passage of air.
95 Preferably each of them is constructed of a number of slats or shelves 1 and uprights 2, to which the ends of the slats are secured. The slats of each rack are disposed in two
100 vertical rows or tiers, the slats of each tier being sloped downward toward the slats of the other tier and arranged to alternate therewith, so that the grain will pass successively from a slat of one tier to the next slat of the

other tier, and so on, zigzagging back and forth as it passes downward through the rack. Each of these slats is of angular cross-section, as shown, and they are so disposed that the portion of the slat which is above the angle occupies a position more nearly vertical than the portion which is below the angle. The advantage of this is that with material of a given thickness—sheet-iron, for example—the slat is very much more rigid than it would be were it formed in a single plane, as is customary in racks of this same general character, and, furthermore, the steep upper half of the slat facilitates the downward movement of the grain when the rack is being emptied. In order to attach the slats to the uprights, the latter, which are preferably of cast-iron, are provided with flanges 3, which conform to the cross-section of the slats, as shown more clearly in Fig. 10, each slat being secured at each end to one of the flanges by a single bolt or rivet 4.

At the bottoms of the racks are gates or valves $D D'$, &c., by which the exits from the racks may be closed and the grain held therein, as shown more clearly in Fig. 10.

Arranged immediately below the racks $C C'$, &c., are similar racks $c c'$, &c., whose exits are provided with valves $d d'$, &c., whereby the grain may be held up in them in the manner described, and below these latter racks is a hopper E , into which the grain is delivered when the valves $d d'$, &c., are open. It is in the racks $C C'$, &c., (hereinafter called the "drying-racks,") that the grain is dried, and it is in the racks $c c'$, &c., (hereinafter called the "cooling-racks,") that the grain is cooled.

As shown in the drawings, each of the cooling-racks forms a continuation of one of the drying-racks; but by reason of the valves placed at the bottoms of the drying-racks the drying and cooling racks are to all intents and purposes separate structures, and they will be so considered in this specification.

The racks $C c$, $C' c'$, &c., divide the interior of the shell or casing into a number of upright chambers or trunks $F f$, $F' f'$, &c., and these trunks are divided by horizontal bulkheads $G G'$, &c., into separate compartments, the upper compartments being lettered $F F'$, &c., and the lower compartments $f f'$, &c.

H is a chamber disposed at the front ends of the cooling-racks and communicating directly with the alternate chambers $f' f^3$, hereinafter called "supply-chambers," at the front ends thereof, and I is a chamber at the rear ends of the racks $c c'$, &c., communicating directly with the rear ends of the alternate chambers f , f^2 , and f^4 , hereinafter called "exhaust-chambers," the rear ends of the chambers f' and f^3 being closed by vertical walls i' and i^3 and the front ends of the chambers f , f^2 , and f^4 being closed by vertical walls h , h^2 , and h^4 .

J is a device by which a current of air is caused to pass through the apparatus in the

manner hereinafter described. So far as the broad idea of the invention is concerned it is not material what the construction of this device is, nor is it material where it is located, so long as its construction and location are such that the air will be caused to circulate in the manner described. Preferably, however, it has a blast-fan, which takes its air from the atmosphere and blows it into the chamber H , from which it enters the chambers f' and f^3 . These chambers being closed at top by the bulkheads G' and G^3 , respectively, the air entering them is compelled to pass through the racks c and c' into the chambers f and f^2 and through the racks c^2 and c^3 into the chambers f^2 and f^4 . From the chambers f , f^2 , and f^4 , the tops of which are closed by the bulkheads G , G^2 , and G^4 , the air passes into the chamber I , in which it is heated by some suitable means.

The invention is not limited to the means for heating the air; but preferably I use a heating-coil K , which is supplied with steam from any suitable source. The part of the chamber I immediately above and in front of the heating-coil K is closed by a bulkhead L , in rear of which is an opening l , through which the air after being heated may pass into a chamber M , disposed at the rear ends of the racks $C C'$, &c. From this chamber the air passes directly into the rear ends of the alternate chambers F' and F^3 , hereinafter called "supply-chambers," the front ends of which are closed by vertical walls m' and m^3 . From the chamber F' the air passes through the rack C into the exhaust-chamber F and through the rack C' into the exhaust-chamber F^2 , and from the chamber F^3 it passes through the rack C^2 into the exhaust-chamber F^2 and through the rack C^3 into the exhaust-chamber F^4 . Communication between the rear ends of the chambers F , F^2 , and F^4 and the chamber M is cut off by vertical walls m , m^2 , and m^4 , respectively, and the front ends of these chambers are in direct communication with the atmosphere.

In the operation of this device the drying-chambers are first filled with grain, the valves at their exits being closed. The blower being set in operation, the air will be caused to circulate through the apparatus in the manner described and indicated by the arrows. Being heated in the chamber I and passed through the grain in the drying-racks, said grain will be dried. The valves at the exits of the drying-racks are opened, and all of the grain is allowed to fall from them into the cooling-racks, the valves at the exits of said cooling-racks being closed. The valves at the exits of the drying-racks are then again closed and the drying-racks again filled with grain to be dried. Thereafter the cold air which is blown into the apparatus by the fan will cool the grain in the cooling-racks, absorbing and retaining its heat, after which it will be heated in the chamber I to the temperature necessary for drying and will pass on through

the apparatus in the manner described. When the grain in the cooling-racks is sufficiently cool, the valves at their exits are opened, and the grain is delivered into the hopper E.

Each of the racks is divided longitudinally by the uprights 2 into a number of separate sections, and at the bottom of each of these sections is placed a hopper O, each of which
hoppers is under the control of one of the valves already referred to. As shown more clearly in Fig. 10, each of these valves consists of a sliding cut-off disposed in horizontal position opposite the bottom of the hopper, and one side of the hopper is shorter than the other in order to avoid the possibility of the valve's being obstructed by the accumulation of grain in front of it as it is being closed. As shown more clearly in Fig. 2, the valves of adjacent racks are connected by links 5 with arms projecting from a rock-shaft 6, which is journaled in suitable bearings between the racks and is provided at its end within the chamber H with a lever 7, by which the shaft may be partially rotated. When the shaft is rotated in one direction, all of the valves connected with it are withdrawn from their positions opposite the exits of the hoppers O, and when partially rotated in the opposite direction they are all advanced to closed position, as shown in Fig. 10. In order to avoid the necessity for close fitting and at the same time prevent the grain from escaping between the sides of the delivery-spout of the hopper and the valve, the latter is provided, as shown in Fig. 11, with marginal flanges 8, which project upward a short distance past the bottom of the hopper-spout. The valve is supported by brackets 9, having parallel ways 10, which occupy grooves formed in the under side of the valve, the brackets being secured to the hopper by bolts 11. In order to avoid a possible accumulation of grain between the outside of the hopper and the brackets, the latter are provided with openings 12, as shown more clearly at the right-hand side of Fig. 11, where the bracket is shown in section.

In Figs. 1 to 4, inclusive, I have shown an apparatus in which the air for cooling the grain passes only once through the rack; but preferably the cooling part of the apparatus is so constructed that the air will pass at least twice through the grain in the cooling-rack before it reaches the heater. In order to accomplish this, the alternate chambers f' and f^3 are divided into separate compartments by horizontal bulkheads g' and g^3 , and up to the height of these bulkheads all the chambers are closed at back, so as to prevent air from passing from them into the heating-chamber I. In addition to this the chamber H terminates at the level of the bulkheads, and above the level of these bulkheads the forward ends of all of the chambers $f f'$, &c., are closed. With this arrangement the air will take the course indicated by the arrows, passing twice

through one or another of the racks before reaching the heating-chamber.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. In an apparatus for treating grain, the combination with a suitable shell or housing, of a plurality of upright grain-racks disposed therein and dividing its interior into a plurality of supply and exhaust chambers or passages disposed upon opposite sides of said racks, respectively, bulkheads dividing said chambers or passages horizontally into separate compartments, means for causing a current of cool air to enter the supply-chambers below the bulkheads and pass thence through the racks and into the exhaust-chambers upon the opposite sides thereof, means for causing the same current of air to enter the supply-chambers above the bulkheads and pass thence through the racks and into the exhaust-chambers at the opposite sides thereof, and means for heating the air after leaving the exhaust-chambers below the bulkheads and before entering the supply-chambers above the bulkheads, substantially as set forth.

2. In an apparatus for treating grain, the combination with a suitable shell or housing, of a plurality of upright grain-racks disposed therein and dividing its interior into a plurality of supply and exhaust chambers or passages disposed upon opposite sides of the racks, respectively, bulkheads dividing said chambers or passages horizontally into separate compartments, valves disposed in the racks at about the level of the bulkheads and dividing each rack into a drying-rack and a cooling-rack, disposed the one above the other, valves at the bottoms of the cooling-racks, means for causing a current of cool air to enter the supply-chamber at the side of each cooling-rack, and pass thence through the cooling-racks and into the exhaust-chambers at the opposite sides thereof, and means for causing heated air to enter the supply-chamber at one side of each of the drying-racks, and pass thence through the drying-racks and into the exhaust-chambers at the opposite sides thereof, substantially as set forth.

3. In an apparatus for treating grain, the combination with a suitable shell or housing, of a plurality of upright grain-racks disposed therein and dividing its interior into a plurality of supply and exhaust chambers or passages, bulkheads dividing said chambers or passages horizontally into separate compartments, valves disposed in the grain-racks at about the level of the bulkheads and dividing each rack into a drying-rack and a cooling-rack, disposed the one above the other, valves at the bottoms of the cooling-racks, means for causing a current of cool air to enter the supply-chamber at the side of each cooling-rack and pass thence through the cooling-racks and into the exhaust-chambers at the opposite sides thereof, means for causing the same

current of air to pass into the supply-chamber at one side of each of the drying-racks and thence through the drying-racks and into the exhaust-chambers at the opposite sides thereof, and means for heating the air after it leaves the exhaust-chambers of the cooling-racks and before it enters the supply-chambers of the drying-racks, substantially as set forth.

4. In an apparatus for treating grain, the combination of a plurality of upright cooling-racks having in their sides openings for the passage of air, a supply-chamber disposed upon one side and an exhaust-chamber disposed upon the opposite side of said racks, a chamber disposed at the ends of the racks and communicating with the supply-chamber, means for discharging a current of cool air into the chamber last aforesaid, a chamber disposed at the opposite ends of the racks and communicating with the exhaust-chamber, means for heating the air in the chamber last aforesaid, a drying-rack, and means for causing the air to pass through the grain in the drying-rack after it is heated as aforesaid, substantially as set forth.

5. In an apparatus for treating grain, the combination with a suitable shell or housing, of a plurality of upright grain-racks disposed therein and dividing its interior into a plurality of supply and exhaust chambers or passages, bulkheads dividing said chambers or passages horizontally into separate compartments, and means for causing a current of air to pass alternately through one of said compartments and then through the grain-racks, whereby it is compelled to pass repeatedly through said racks, substantially as set forth.

6. An apparatus for treating grain having, in combination, a plurality of upright cooling-racks disposed side by side, supply and exhaust chambers disposed upon opposite sides, respectively, of the cooling-racks, a chamber disposed at the ends of the cooling-racks and communicating with the exhaust-chambers aforesaid, means for heating the air in the chamber last aforesaid, a plurality of upright drying-racks disposed side by side, supply and exhaust chambers or passages disposed upon opposite sides, respectively, of the drying-racks, and an air-chamber disposed at the ends of the drying-racks and communicating with the supply-chambers last aforesaid and with the air-heating chamber, substantially as set forth.

7. In an apparatus for treating grain, the combination with a suitable shell or housing, of a plurality of drying and cooling racks having in their sides openings for the passage of air, the drying-racks being disposed above the cooling-racks, said racks being so disposed within the shell or housing as to divide it into a plurality of vertical passages, horizontal bulkheads dividing said passages into a plurality of chambers F , F' , &c., disposed

at the sides of the drying-racks, and a plurality of chambers f , f' , &c., disposed at the sides of the cooling-racks, valves for controlling the exits of the drying-racks, valves for controlling the exits of the cooling-racks, a chamber H communicating with the alternate chambers of the group f , f' , &c., a chamber I communicating with the other alternate chambers of the group f , f' , &c., and a chamber M communicating with the chamber I and with the alternate chambers of the group F , F' , &c., substantially as set forth.

8. In an apparatus for treating grain, the combination of an upright rack having in its sides openings for the passage of air, and means for causing a current of air to repeatedly pass through the rack from side to side thereof first through one portion of the rack in one direction and then through another portion thereof in the opposite direction, said means including a chamber disposed at the side of the rack and spanning the aforesaid portions thereof, substantially as set forth.

9. In an apparatus for treating grain, the combination of an upright rack having in its sides openings for the passage of air, and means for causing a current of air to repeatedly pass through the rack from side to side thereof first through one portion of the rack in one direction and then through another portion thereof in the opposite direction, said means including a chamber disposed at one side of the rack and spanning both of the aforesaid portions thereof, and two chambers disposed at the other side of the rack and each spanning one of the aforesaid portions thereof, substantially as set forth.

10. In an apparatus for treating grain, the combination of an upright rack having in its sides openings for the passage of air, and means for causing a current of air to repeatedly pass back and forth through the rack, from side to side thereof in opposite directions, said means including chambers disposed upon opposite sides of the rack, and bulkheads arranged in the chambers alternately so as to divide them up into separate overlapping compartments, substantially as set forth.

11. The combination of a hopper, a valve for controlling its exit and means for supporting said valve so that it may slide back and forth across the exit of the hopper, the wall of the hopper at one side thereof being terminated a short distance above the valve, substantially as set forth.

12. The combination with a hopper, of a slide-valve having grooves in its under side and brackets 9 secured to the hopper and having ways 10 occupying the grooves of the valve, substantially as set forth.

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