No. 842,538. PATENTED JAN. 29, 1907.

J. H. ELWARD.

STOREHOUSE FOR GRAIN AND OTHER MATERIAL.

APPLICATION FILED JAN. 17, 1903.

2 SHEETS—SHEET 1.

Fig. 1.

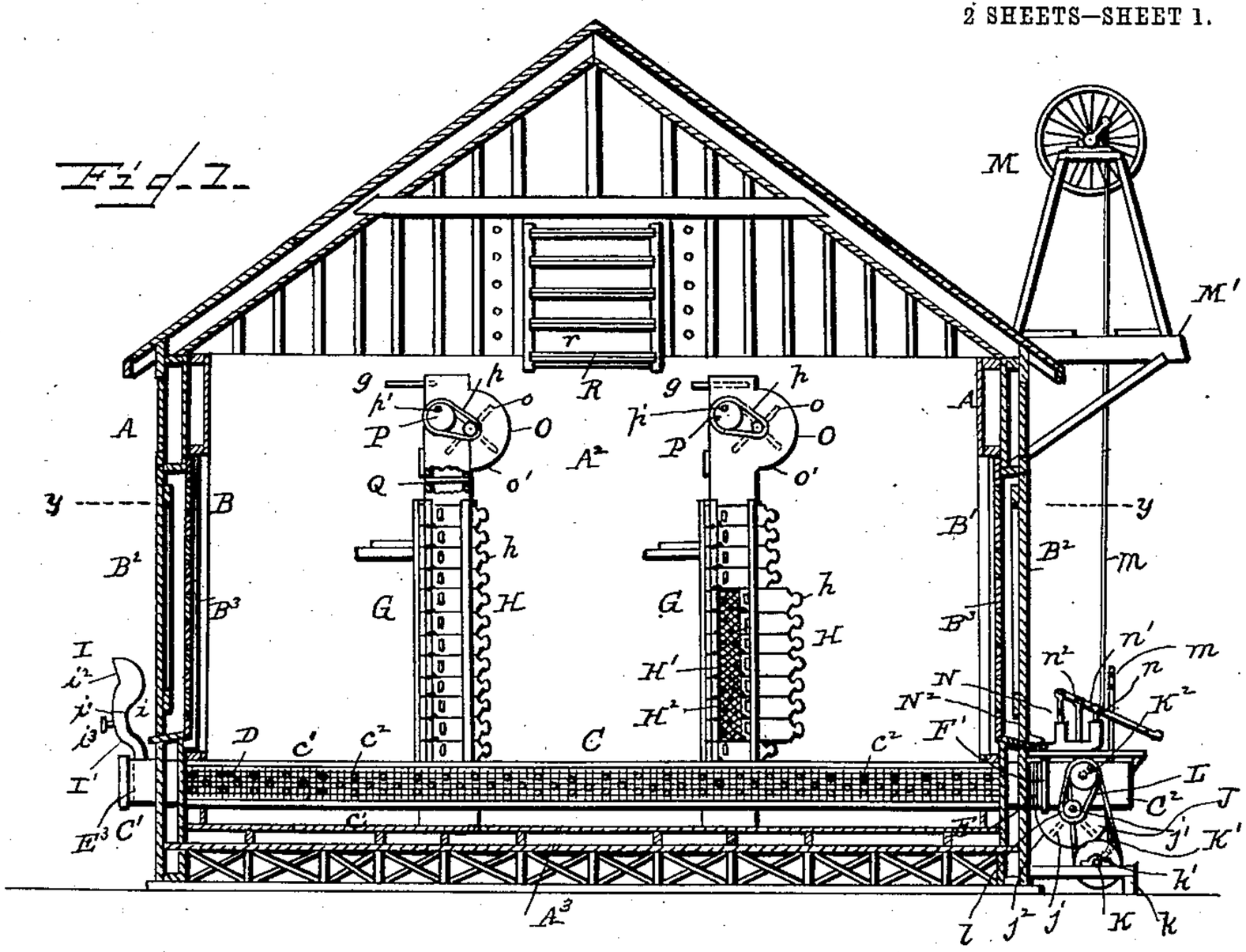
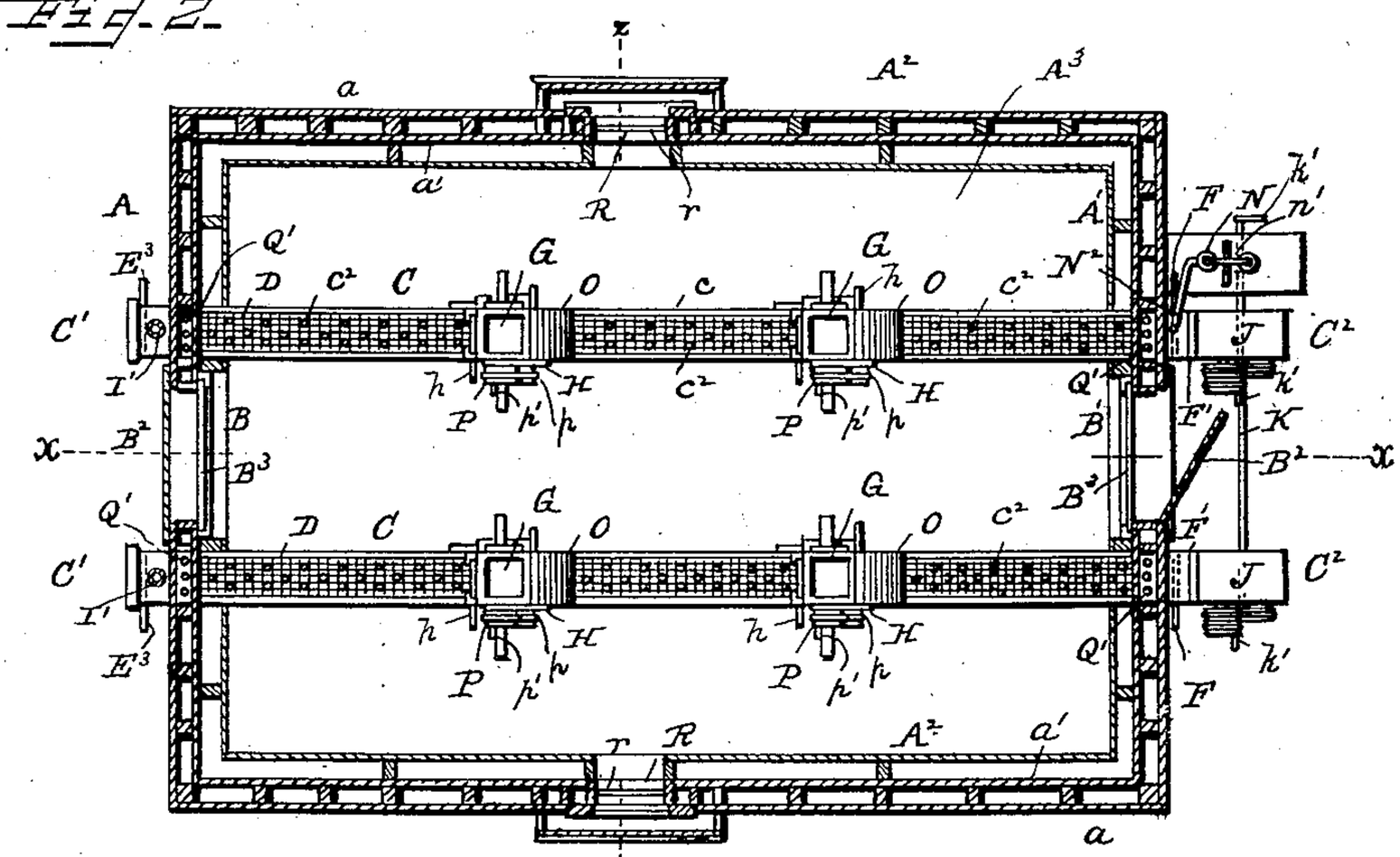


Fig. 2.



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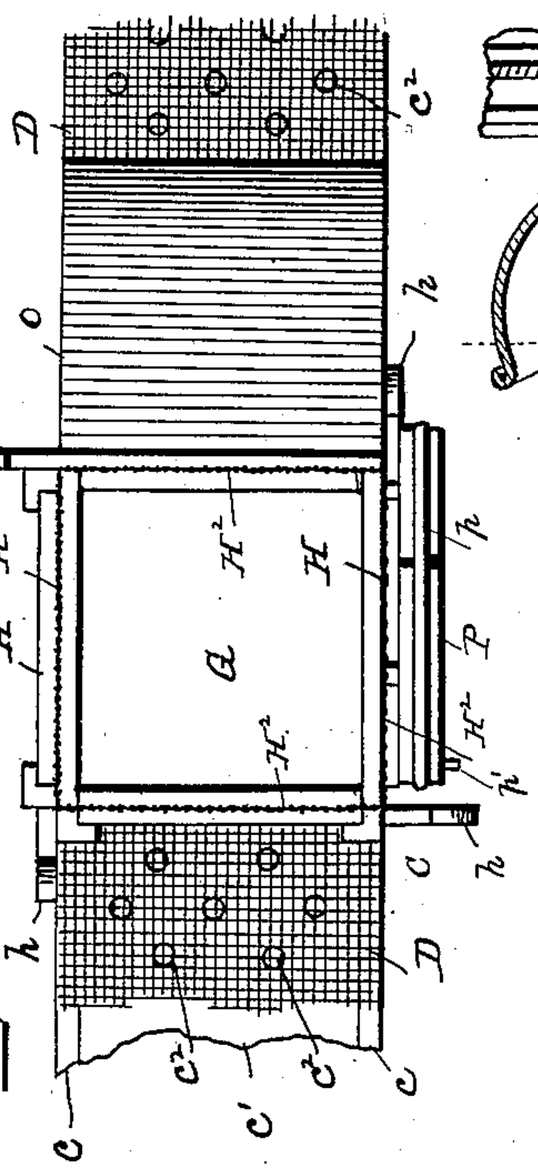

FIG. 4.

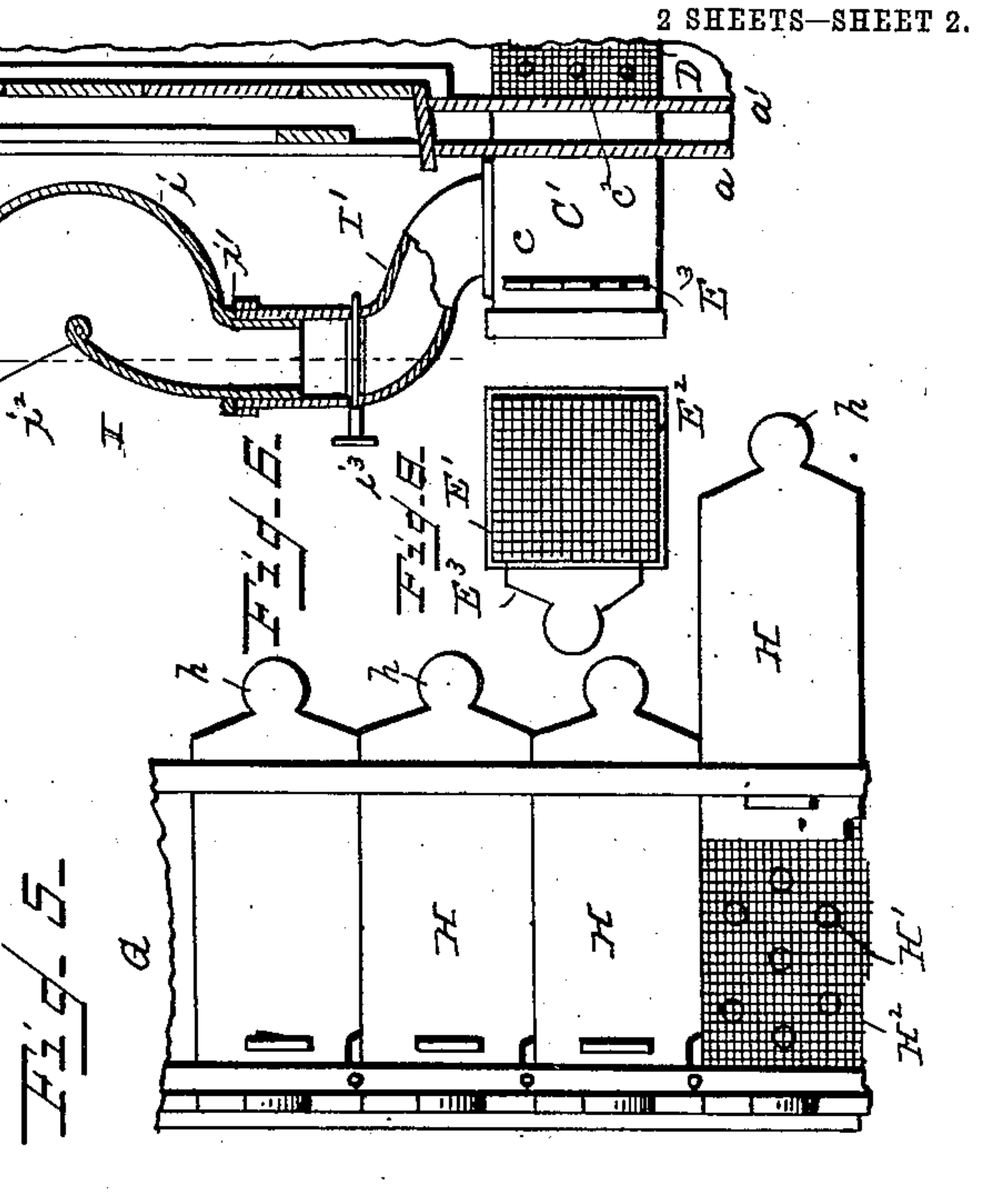

FIG. 5.

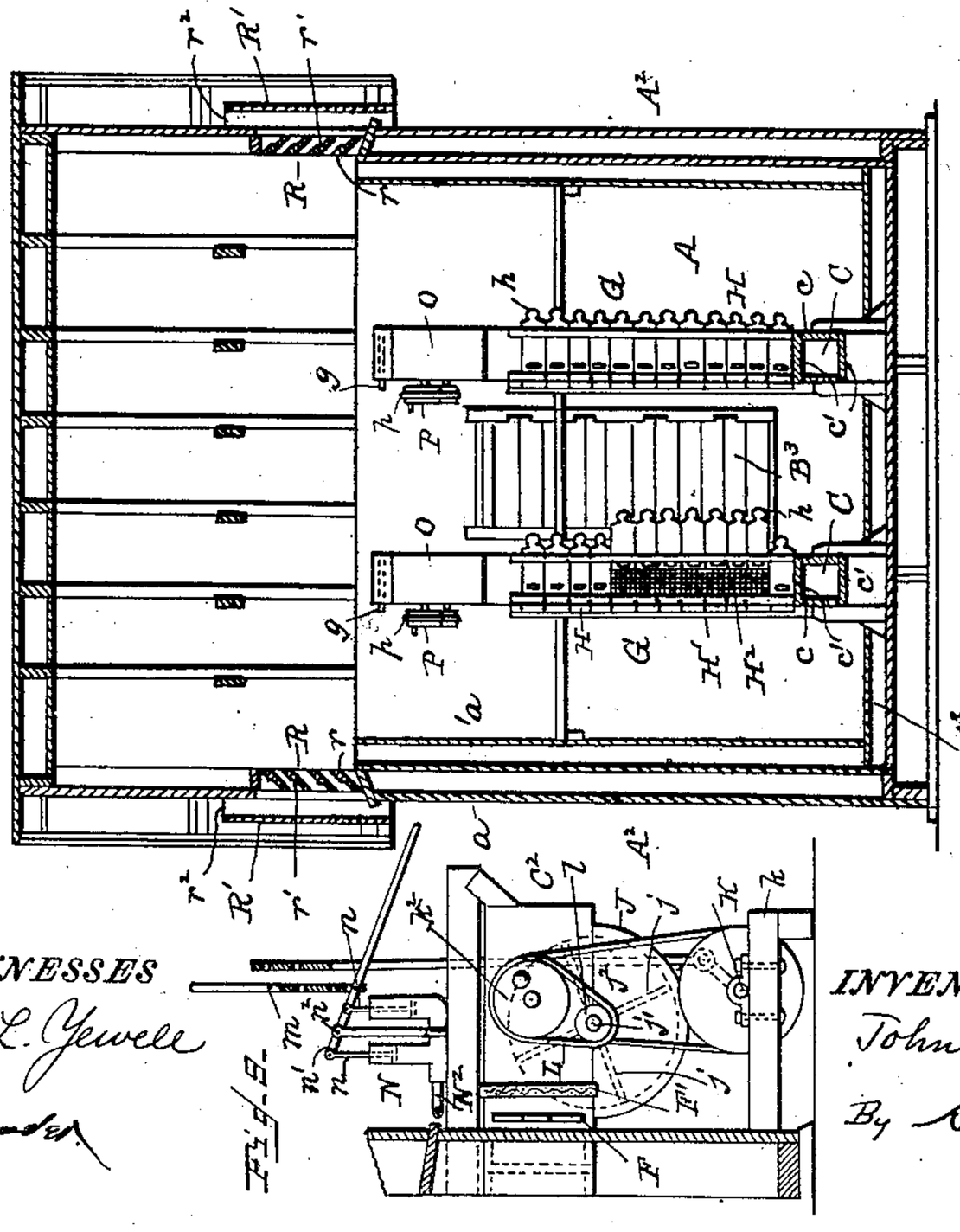

FIG. 3.

FIG. 7.

FIG. 2.

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STOREHOUSE FOR GRAIN AND OTHER MATERIAL.

No. 842,538. Specification of Letters Patent. Patented Jan. 29, 1907.

Application filed January 17, 1903. Serial No. 139,452.

To all whom it may concern:

Be it known that I, JOHN H. ELWARD, a citizen of the United States, residing at Hutchinson, in the county of Reno and State of Kansas, have invented certain new and useful Improvements in Storehouses for Grain and other Material, of which the following is a specification, reference being had therein to the accompanying drawings.

Figure 1 is a vertical section of a granary, elevator, or storehouse embodying my improvements, it being taken on the line *x x* of Fig. 2. Fig. 2 is a horizontal section taken on the line *y y* of Fig. 1. Fig. 3 is a cross-section taken on the line *z z* of Fig. 2. Figs. 4 to 9 show details.

In the drawings I have shown my improvements as applied to a structure having a closed bottom, vertical side walls, and a gable cover or roof.

A indicates one end wall as a whole, A′ the opposite end wall, A^2 A^2 the side walls, and A^3 is the bottom or floor. The sides and ends of the building are preferably constructed as shown—that is, with double walls, as at *a a′*, and suitable intermediate studs or uprights providing non-conducting spaces which may be free to the air or may contain packing material, as preferred; but with respect to this and many other details of the construction I wish it understood that I do not limit the invention thereto, as there can be modification in many respects as circumstances or preference may dictate.

In the end walls A A′ doorways are provided, as shown at B B′. These are closed by doors B^2, preferably opening outward, and on the inner sides of the door-casings there are movable and adjustable slats B^3.

One or more air-trunks are employed, (each indicated as a whole by C.) These extend from the end wall A to the end wall A′ and through each of the latter, the externally-projecting parts being indicated by C′ C^2. As shown, each trunk is rectangular in cross-section, the walls thereof being formed of vertical and horizontal boards *c c′*. In each of these wall parts of a trunk there are formed numerous relatively large air-passages c^2. Each trunk is surrounded by a sheathing of wire mesh D, the envelop or sheets thereof being placed close to the orifices c^2 and serving as guards or fenders for purposes to be described. At the end of the projecting part C′ there is a large air-passage way E′ provided, which is covered by wire mesh E^2, and at E^3 there is a cut-off or damper for closing and opening this aperture, so that the trunk can at that end be entirely shut off from the outside air. The opposite end portion C^2 of each duct extends also to points suitably beyond the outer wall of the building. It is provided with a valve or cut-off, as shown at F, for permitting or preventing the movement of air through this part of the trunk. Adjacent to the cut-off F there is a screen F′ placed across the duct.

Air-trunks of the character indicated above are employed to any suitable number corresponding to the size of the chamber in which they are placed and to the volume of the mass of grain upon the floor. Each trunk is preferably supported some distance above the floor, so that the air escaping from the trunk shall have access to it in all directions outward from the trunk.

G indicates an upwardly-extending air-trunk, there being any suitable number of these for each of the horizontal trunks C. As shown, there are two so arranged as to equally subdivide the longitudinal dimensions of the storehouse. Each consists of normally tight vertical walls. At the bottom it rests upon and communicates with the interior of the horizontal trunk C. At the top it is adapted to be opened, but can be closed tightly by means of a cut-off *g*. Each of the vertical walls of the upright trunk G is provided with a series of movable dampers H, having handles or operating devices at *h*. When these dampers are all closed, the trunk G is air-tight and no air can escape laterally therefrom. Each side wall of the trunk is provided with a series of relatively large air-orifices H′, these being behind the movable wall-sections or dampers H. An envelop or sheets of wire mesh H^2 cover the side walls, lying close to the air-apertures H′ and situated between the stationary wall-pieces and the slides or dampers. By moving the dampers outward the operator can permit air to escape laterally at any horizontal plane of the storehouse structure that he may desire. For causing currents of air to pass through the ducts that have been described use may be made of any well-known power devices. Thus reliance can be placed upon the natural circulation of air caused by wind-pressure on the exterior. Thus at I is an air-funnel or cowl. It has an air-duct at I′, which communicates with the outer end part C′ of the air-trunk C. The upper part or hood

portion *i* is connected by a loose or swiveling connection at *i'* with the upper part of the duct I', and the upper or air-receiving end is so shaped that under wind-pressure it will tend to throw the mouth i^2 in the direction from which the wind is moving. At i^3 there is a damper or cut-off which controls the entrance of air from the collector I. If these parts are in operative position, it will be seen that when the wind is coming from a suitable direction there will be a forcing of air into the storehouse through the trunk C, and by the latter it will be distributed through grain that may be piled around the trunk.

J J represent a series of fans, one for each of the air-trunks C. Each fan has rotary blades *j*, mounted on a shaft at *j'* and situated in a casing j^2. The fans may be located so that their planes of rotation are in alinement with the interior of the adjacent trunk C, and the blades may force the air through the trunk inward to the interior of the building and through the vertical ducts, or the end of the trunk may be closed and air may be taken in at the eye of the fan.

The fans of the series are shown as being operated in common from a shaft K, mounted on a suitable framework at *k*. The shaft has for each mechanism a belt-wheel *k'*, which is connected by a belt K' to an intermediate or idler wheel K^2. The latter is connected by a belt L with a pulley *l* on the fan-shaft.

At M there is an illustration, more or less conventional, of a wind-wheel mounted upon the elevated support M', holding the wheel at such position as to advantageously receive power from the air moving in any direction. *m* is the connecting-rod extending downward from the wind-wheel to the shaft K and rotating the latter when power is received from the wheel. With these devices powerful currents of air can be forced through the air-trunks when the fan-blades are rotating. The air can also be forced into the interior by means of an air-pump at N, the piston-rods *n* of which are connected to a lever *n'*, pivoted at n^2, the lever being also connected to the windmill by a connecting-rod *m*. The air under pressure passes from the pump to the pipe N^2 to the air-trunk C.

At the upper end of each vertical trunk G there is a fan O, having blades *o* and the casing *o'*. The fans are capable of reversal and adapted either to draw the air into and upward through the ducts and discharge it at the upper ends or to force air downward, according as desired. The fans receive motion from pulleys or wheels P, connected by belts *p* to pulleys on the fan-shaft and each having a crank *p'*. The cranks are connected to the power mechanism in any suitable way or may be turned by hand, and the fans can be rotated in either direction, as desired.

At Q the vertical or upright air-trunks are provided with means for supporting an insecticide or germicide. They should be of such character as to allow air to pass freely in either direction, according as the power devices are operating. I have found that a series of rods adapted to be inserted into the air-trunk and made stationary there are sufficient. A vessel holding the germicide or insecticide material can be placed upon this support, or balls or equivalents of porous material, like cotton, can be saturated with it and similarly supported, the air being allowed to circulate freely through the poison-holder. Similar supporting devices for the germicide or purifying solution can be placed in the horizontal air-ducts, as shown at Q', at such position as to allow the incoming air to be charged with the insecticide, while the cotton or other holder for it is prevented from passing in.

At R there is a peculiarly-constructed ventilator at the upper part of the building. It consists of a series of slats *r*, placed in an opening in the side wall, these slats being suitably inclined and preferably shouldered, as at *r'*. R' indicates a storm-protector—that is to say, a supplemental wall in a vertical plane—outside of the ventilator R and held by offset walls r^2 at a suitable distance from the outer surface of the building, so as to leave copious air-passages at the top and the bottom and at the same time effectually prevent the entrance of rain or snow.

The manner of using a granary, elevator, or storehouse constructed with the improvements which I have shown and described will be readily understood. Assuming that a mass of grain has been placed in the building of such volume as to extend from the floor A^3 to points above the horizontal air-trunks C—say for a couple of feet—and that it is desired to dry the grain and to ventilate it, if the wind or natural movements of the air are sufficiently powerful at the time and it is desired not to use the power mechanism the funnel or cowl at I is brought into action, the damper at i^3 being opened, and such dampers or cut-offs as those at E^3 and F being closed, and with the grain in a mass, such as has been assumed, the wall sections or dampers H should also be closed and the top cut-offs at *g*. Under such conditions the air will be driven by natural pressure in at the funnels or cowls I, the ducts I', and the horizontal trunks C, the grain being assumed as piled or stored around the latter. The air will escape through the apertures or orifices c^2 in the horizontal trunks and circulate through the mass of grain and will carry off moisture and escape through the ventilators at R at the top. Now assuming that a larger volume of grain has been stored in the building and that the mass rises well up around the vertical air-trunks, those of the dampers or wall-sections at H which are well below the top of the grain mass should be

opened, and thereupon the air which is being pressed inward through the trunks will not only pass upward laterally and downward from the horizontal trunks C, but will also escape laterally from all sides of the upright trunks, and thus be evenly distributed throughout the entire mass. In case it is necessary to force the air through the trunks with a pressure greater than that attainable through the funnels or cowls I the dampers or cut-offs at E^3 can be closed and the windmill or other motor can be put into operation to actuate the fans at J or the air-pump at N. The air forced by these mechanisms is caused to circulate through the grain mass in the manner above described, according as it reaches to a lower or a higher plane in the building.

It is frequently desirable to treat masses of grain that are stored in elevators or houses of this character with materials capable of destroying germs, insects, &c. I have designed the present mechanism in such way that this end can be readily attained. Some of these germicide materials give off fumes or vapors which are considerably heavier than the normal air, and they can be carried to the grain much more efficiently by being caused to travel downward. Under such circumstances and with such materials use is made of supporting devices at Q. Balls of cotton or equivalent absorbent material are placed thereon below the fans O. Then the cut-offs or valves at E^3 and F are closed at the ends of the horizontal trunks and those at *g* at the upper ends of the vertical trunks are opened and the fans O O set in operation. The downwardly-driven air-currents carry the fumes or vapors from the germicide materials downward through the trunks G and horizontally through the trunks C, and from these they escape outward and permeate the mass of grain. After the grain has been subjected to such treatment a sufficiently long period of time the air-currents are reversed—that is to say, they are forced inward through the trunks C and upward through the trunks G and outward among the grain and the air with the fumes or vapors caused to escape at the ventilators R.

A ventilating system comprising my invention may be readily installed in barns, granaries, elevators, and the like which are already constructed. The arrangement of the ventilating-trunks is such that this installation may be accomplished without penetrating the roofs of the structures, which is a matter of considerable importance. Again, the system is one which accommodates itself to the means of farmers in all sections of the country, because all that is necessary in its construction in any granary or barn is the lumber and wire-netting of which the trunks are made. The arrangement of the fans within the building is such as to permit the air to be forced in either direction through the vertical air-trunks, which enables the operator to regulate the ventilating system according to the weather conditions, so that the air in the interior of the compartment can be forced through the grain instead of taking the air in the first instance directly from the exterior of the compartment. Thus it will be seen that I provide a storing mechanism capable of meeting the several ends which are well recognized to be desirable.

As hereinbefore stated, I do not limit myself to all the details here presented for illustration, and I wish it to be further understood that I do not limit the invention to any particular material, for although I have above referred mainly to grain as the substance to be stored, yet it will be seen that other masses of material, such as fruits and the like, can be similarly treated.

What I claim is—

1. The combination with an inclosed compartment, of a horizontally-disposed box-like duct arranged within said compartment and having one end communicating with the outside air, means at said end of the duct for controlling the passage of air to or from said duct, vertical ducts arranged entirely within the said compartment, communicating at their lower ends with said horizontal duct and arranged to distribute air in all horizontal directions to the mass of grain within the compartment, and air-forcing means arranged within said compartment and connected with the tops of said vertical ducts for causing the air from within the compartment to be forced downward through said vertical ducts and then through said horizontal duct.

2. The combination with an inclosed compartment, of a horizontally-disposed box-like duct arranged within said compartment and having one end communicating with the outside air, means at said end of the duct for controlling the passage of air to or from said duct, vertical ducts arranged entirely within the said compartment, communicating at their lower ends with said horizontal duct and arranged to distribute air in all horizontal directions to the mass of grain within the compartment, air-forcing means arranged within said compartment and connected with the tops of said vertical ducts for causing the air from within the compartment to be forced downward through said vertical ducts and then through said horizontal duct, and means for forcing air inward along said horizontal duct and upward through said vertical ducts.

3. In a storing and ventilating house, the combination with an inclosed compartment, of a horizontally-arranged perforated air-trunk extending through said compartment and communicating at its opposite ends with the external air, vertical perforated air-ducts

arranged within said compartment, communicating with said horizontal duct and adapted to have air escape laterally therefrom in all horizontal directions and from any desired portion or portions thereof, valves at either end of said horizontal duct for controlling the flow of air to or from said duct, means for forcing external air into said horizontal duct and up through said vertical duct, and means connected to the tops of said vertical ducts and arranged to force air from the interior of said compartment above material stored therein down through said vertical ducts and then through said horizontal ducts.

4. In a storing and ventilating house, the combination with the inclosed compartment, of the horizontally-arranged air-trunks provided with air-escapes, the vertically-arranged air-trunks communicating with the horizontal air-trunks, closed, at their upper ends and provided with air-escapes, and the series of dampers inclosing said vertical trunks when shut and adapted to vary the escape area for air therefrom, substantially as set forth.

5. In a storing and ventilating house, the combination with the inclosed compartment, of the horizontally-arranged air-trunks provided with air-escapes, the vertically-arranged trunks communicating with the horizontal trunks and provided with air-escapes, and a series of dampers arranged to surround said vertical trunks to prevent the escape of air therefrom, substantially as set forth.

6. In a storing and ventilating house, the combination with the inclosed compartment, of the horizontally-arranged air-trunks provided with air-escapes, the vertically-arranged trunks communicating with the horizontal trunks and provided with air-escapes, and a series of dampers arranged to prevent the escape of air from those sections of the vertical ducts inclosed by the dampers and to permit its escape from those sections in which the dampers are not shut, substantially as set forth.

7. In an air-duct for a ventilating system, the combination of the perforated walls forming the duct and the series of dampers arranged edge to edge on all sides of said wall and adapted to vary the escape area for the air from the duct, substantially as set forth.

8. A ventilator-duct comprising a perforated wall surrounded by a series of adjustable sections, whereby the escape area for the air from the duct may be varied at will, substantially as set forth.

9. A ventilator-duct comprising a mesh-covered, perforated tube surrounded by a series of adjustable sections, whereby the escape area for air from the duct may be varied at will, substantially as set forth.

10. A ventilator-duct comprising a perforated tube rectangular in cross-section, and a series of adjustable sections arranged edge to edge on each side of said duct and adapted to vary the escape area for the air therefrom, substantially as set forth.

11. In a storing and ventilating house, the combination with the inclosed compartment, of the vertically-arranged air-trunks adapted to be surrounded by a mass of grain or equivalent material and having two or more of its sides open for air-escape, and a vertical series of adjustable dampers or cut-offs arranged edge to edge on said open sides, and means for delivering air under pressure to the said vertically-arranged air-trunks, substantially as set forth.

12. In a storing and ventilating house, the combination with an inclosed compartment, of a horizontally-arranged perforated air-trunk adapted to be covered over by a mass of grain and to deliver air in all directions thereto and having one end communicating with the external air, a valve at the said end for controlling the passage of air to and from said horizontal duct, a plurality of vertically-arranged trunks, each communicating with said horizontally-arranged trunk, arranged entirely within said compartment and adapted to deliver air in all horizontal directions throughout its length, means for varying the area over which air is delivered from said vertical trunks, means arranged at the upper ends of said vertical trunks for forcing air from within said compartment through both said vertical and horizontal trunks, and means connected with the valved end of said horizontal trunk for forcing air into said trunk and into the said vertical trunks.

13. In a storing and ventilating house, the combination with an inclosed compartment, of a plurality of vertically-arranged air-trunks perforated on all sides throughout their length and provided with a series of adjustable sections adapted to be adjusted to regulate the area over which air may escape horizontally in all directions from said trunks, and means for delivering air under pressure to said vertically-arranged air-trunks.

14. In a storing and ventilating house, the combination with an inclosed compartment, of a plurality of vertically-arranged air-trunks perforated on all sides throughout their length and adapted to extend through the material to be treated, means for varying the area over which air may escape from said ducts in all horizontal directions in accordance with the height of the material within the compartment, whereby the entire section of each of said trunks surrounded by said material may be exposed to permit the escape of air therefrom, and means for delivering air under pressure to said trunks.

15. In a storing and ventilating house, the combination with an inclosed compartment, of a plurality of vertically-arranged air-trunks perforated on all sides throughout

their length and adapted to extend through the material to be treated, said air-ducts having valved communication at their upper ends with the interior of said compartment and valved communication at their lower ends with the external air, means for varying the area over which air may escape from said ducts in all horizontal directions in accordance with the height of the material within the compartment, and means for delivering air under pressure to said vertically-arranged air-trunks.

16. In an air-duct for a ventilating system, the combination of walls forming the duct and perforated on all sides, and an adjustable casing inclosing said perforated walls and adapted to vary the escape area for air from the duct.

17. In an air-duct for a ventilating system, the combination of walls forming the duct and perforated on all sides, and an adjustable casing inclosing said perforated walls and vertically adjustable at will to vary the escape area for air from the duct.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN H. ELWARD.

Witnesses:
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E. R. ALEXANDER.