5 Sheets—Sheet 1.

M. P. SMITH & W. W. WOOLFORD.

Grain-Drier.

No. 209,589. Patented Nov. 5, 1878.

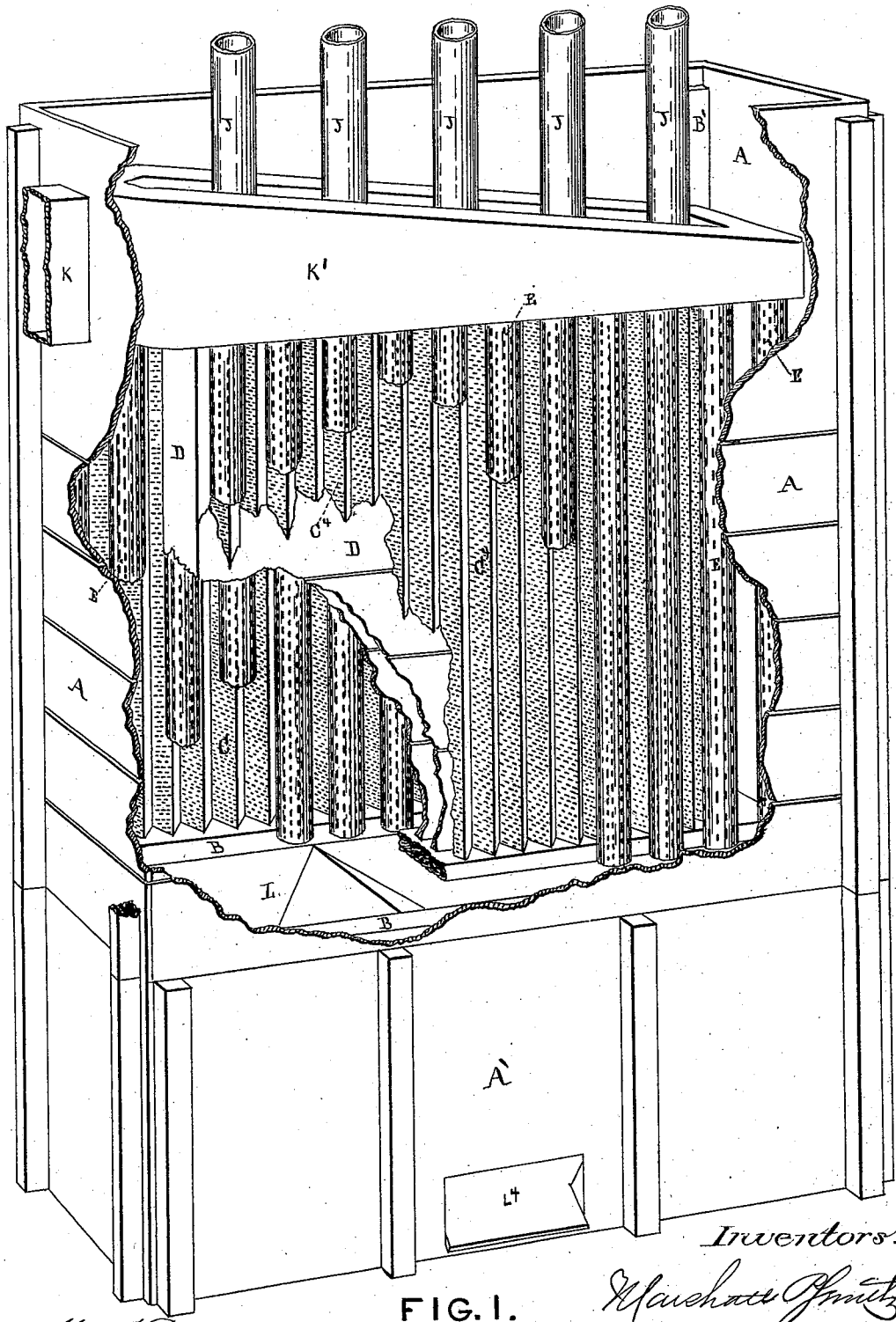

FIG. 1.

Inventors:
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W. W. Woolford

Witnesses.
Wm. A. Duvall
Wm. H. Emrich

5 Sheets—Sheet 2.

M. P. SMITH & W. W. WOOLFORD.

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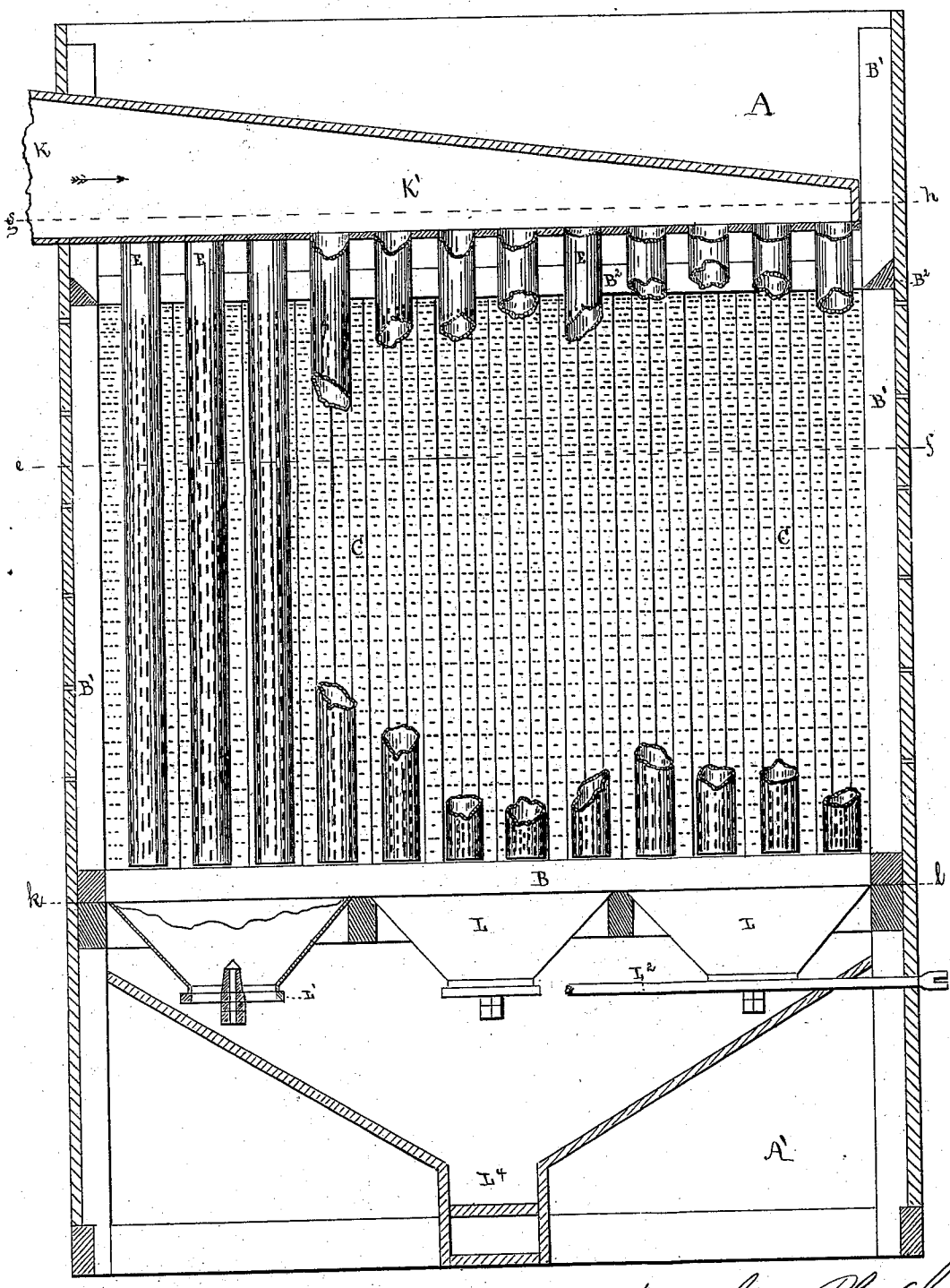

FIG. II.

Witnesses.
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5 Sheets—Sheet 3.

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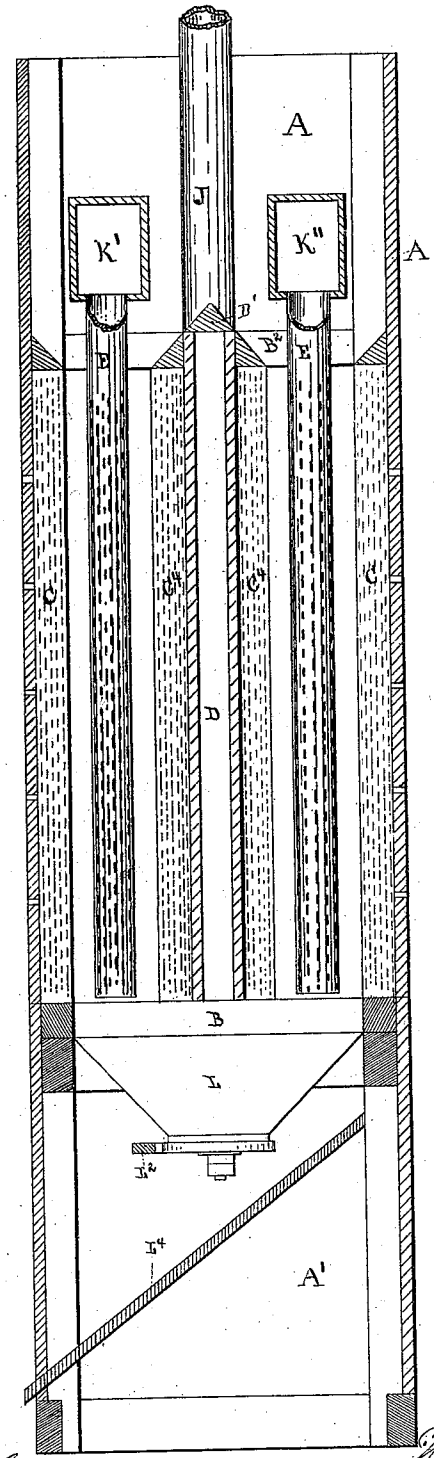

FIG. III.

Witnesses.
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Inventors
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5 Sheets—Sheet 4.

M. P. SMITH & W. W. WOOLFORD.

Grain-Drier.

No. 209,589. **Patented Nov. 5, 1878.**

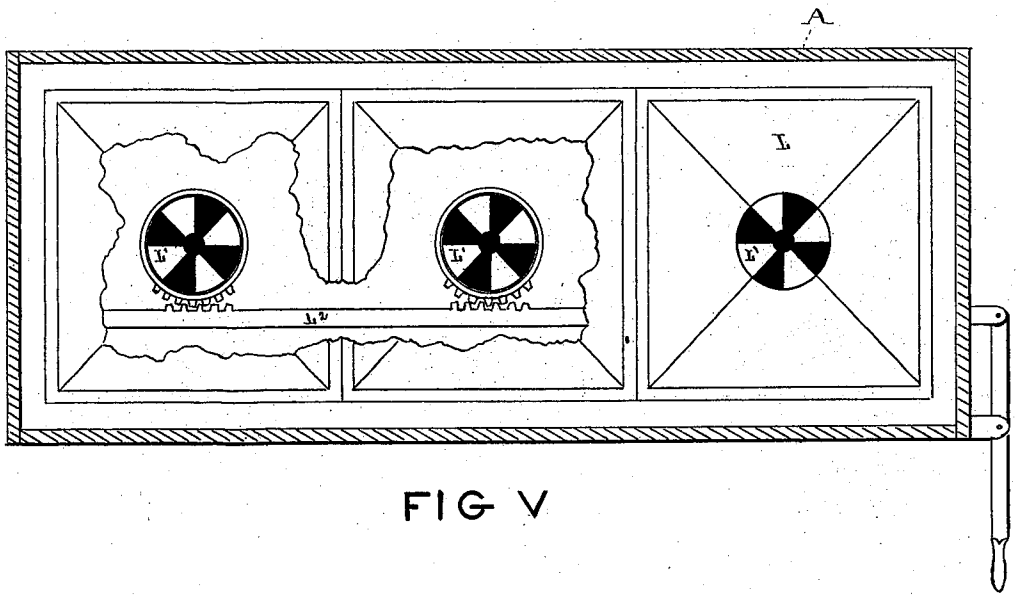

FIG V

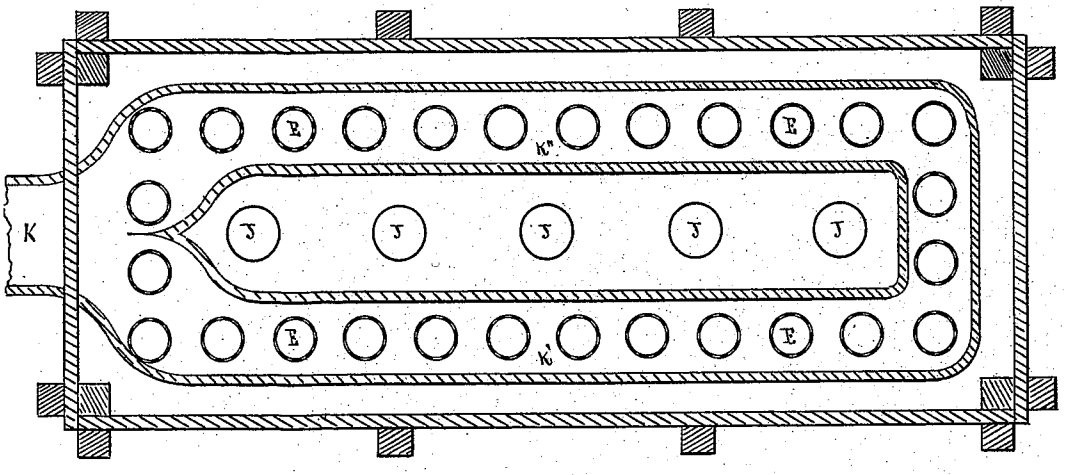

FIG VI

Witnesses.
Wm B Duvall
Wm H Emrich

Inventors:
M Marshall P Smith
W W Woolford

5 Sheets—Sheet 5.

M. P. SMITH & W. W. WOOLFORD.

Grain-Drier.

No. 209,589. Patented Nov. 5, 1878.

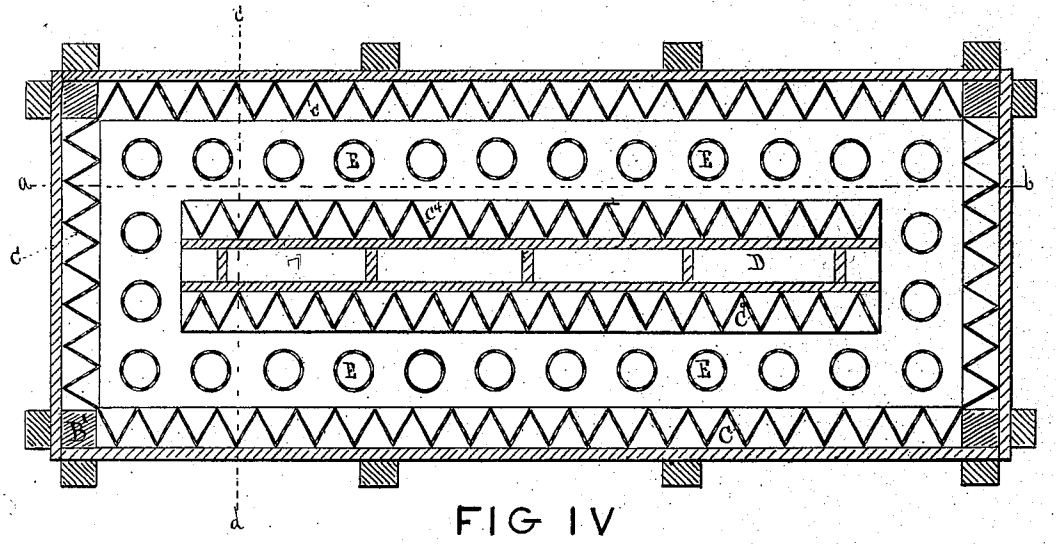

FIG IV

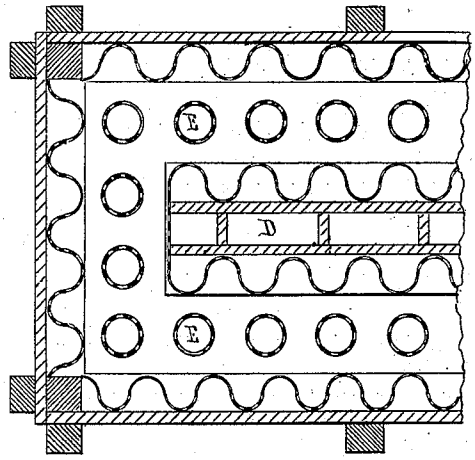

FIG VII

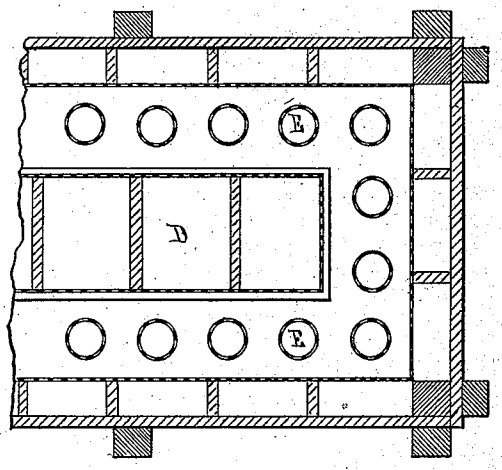

FIG VIII

Witnesses:
Wm B Duvall
Wm H. Emrick

Inventors:
Marshall P Smith
W W Woolford

UNITED STATES PATENT OFFICE.

MARSHALL P. SMITH AND WILLIAM W. WOOLFORD, OF BALTIMORE, MARYLAND; SAID WOOLFORD ASSIGNOR TO SAID SMITH.

IMPROVEMENT IN GRAIN-DRIERS.

Specification forming part of Letters Patent No. **209,589**, dated November 5, 1878; application filed April 30, 1878.

To all whom it may concern:

Be it known that we, MARSHALL P. SMITH and WILLIAM W. WOOLFORD, of Baltimore, Maryland, have invented an Improved Grain-Drier, of which the following is a specification:

This invention relates to improvements in driers for grain, coffee, rice, &c.; and its special features are great simplicity in construction and operation, portability, superior quality of product, economy in first cost and in repairs, great capacity in proportion to first cost, and absolute security against fire.

This invention consists in certain improvements in the construction and arrangement of the linings, exhaust-flues, air-passages, and blast-pipes of a drying-chamber, as will be hereinafter fully described and specifically claimed.

This apparatus is to be placed in a storehouse or other suitable building, and is to be provided with an elevator or other means for discharging grain into the top and conveying it away at the bottom.

It is intended that the grain shall be kept in constant motion, flowing through the chamber quite rapidly, and being several times returned to the top thereof until the desired degree of dryness is attained. The air being heated by steam radiation, its temperature is under perfect control, and can never be so high as to injure the grain; and being pure and free from all gases or foul odors, no trace of its action can be detected upon the grain other than its noticeable sweetness, freshness, and renovated appearance. Its milling qualities are not impaired, and if planted it will grow. It is not "kiln-dried" in any sense.

It is well known to every one engaged in drying grain that a degree of heat which is harmless when applied to Indian corn is utterly destructive to wheat. It is also true, but not so generally understood, that grains of different degrees of dampness require different temperatures in drying to attain the best results. By the method adopted by us this temperature is raised or lowered in a moment by the mere turning of a valve. Once fixed, it remains uniform as long as may be desired. Wheat may be dried by exhaust-steam at no cost for fuel. When dry it may be cooled in the same chamber by simply opening a valve and diverting the steam from the heater. Inasmuch as the heat can never reach the point of combustion, there is an absolute immunity from danger of fire, and the rate of insurance is not increased by its use. There being no shelves or flues to obstruct the descent of the grain, it cannot become fouled or clogged, and it is peculiarly fitted for the drying of sunken grain, coffees, &c.

In devising this drier special attention has been given to its use in small inland elevators and warehouses where but a moderate amount of damp grain is received at a time, and where the question of first cost is an overshadowing one. It can be set up in the place of an ordinary grain-bin and be worked by the same carriers and elevators. It can be removed from place to place, erected in a few hours as easily as a thrashing-machine, and run by unskilled labor. It is compact, complete, and ready for use, needing only to attach the power. We prefer to construct the chamber of wood, it being all that is required; but other materials may be used instead.

In the drawings, Figure I is a perspective view, certain parts being cut away to show the interior construction. Fig. II is a vertical longitudinal section through the line *a b*, Fig. IV. Fig. III is a vertical cross-section through the line *c d*, Fig. IV. Fig. IV is a horizontal longitudinal section through the line *e f*, Fig. II. Fig. V is a horizontal longitudinal section through the line *k l*, Fig. II, showing top view of hoppers, partly cut away to show valves and rack movement for discharging grain. Fig. VI is a horizontal longitudinal section through the line *g h*, Fig. II, showing the connection of the vertical blast-pipes to the transverse main conduit for hot air. Figs. VII and VIII are horizontal longitudinal sections through the line *e f*, Fig. II, showing other modes of applying the perforated metal.

In all the drawings, A represents the body or casing of the drier, which preferably is rectangular in form, and of dimensions varying according to capacity required. This casing we prefer to make in five sections, in order

that it may be portable. In this form it is composed, first, of a base or lower part, A′, solidly framed together, resting on the floor, reaching as high as the dotted line *k l*, Fig. II, and containing the hoppers L and the rack mechanism L′ L″; and, secondly, of the four sides A B, resting upon the base, each of which sides is separately framed, and secured in place by bolts entering into the four corner-posts B^1. These bolts being removed, the whole machine can be readily taken apart. The interior of the upper chamber thus formed is lined with perforated sheet metal, which we prefer to use of an angular or V-shaped corrugated form, laid on vertically, as shown in Figs. II, III, and IV; or the corrugations may be rounded or U-shaped, as in Fig. VII; or the casing may be "furred off" and the metal laid on flat, as in Fig. VIII, and the corrugations may also lie horizontally or inclined. The spaces behind these corrugations form conduits for the escape of the moist waste air, which passes off through holes bored in the casing; or the seams of said casing may be left open for the same purpose, as shown in Fig. I. The metal lining is closed and protected below by the scantling B and above by the beveled scantling B^2, which also serve to strengthen the casing. The perforated metal lining therefore covers the interior of the casing between these two scantling, B and B^2.

Instead of the perforated metal lining and the outer casing above described, the sides of this part of the chamber, and also of the central exhaust-flue, D, next below described, may be constructed of "louvered" frames, similar to ordinary window-shutters, the slats thereof being sufficiently close together to prevent the grain from escaping through.

In the center of the drier is an exhaust-flue, D, Figs. III and IV, also covered with perforated sheet metal, laid on in similar manner to the sides. The drawings show only the vertical V-shaped corrugated form; but the U form, or the flat sheets on "furring," as above described, may be used instead. The bottom of this exhaust-flue may be closed or left open. The grain cannot rise into it. The top is closed by a beveled cover, D′, Fig. III, and out of it rise a number of waste-air escape-pipes, J J, extending some distance above the top of the drier. This central exhaust-flue should be about the same height as the perforated lining of the sides.

In the space thus formed between the central exhaust-flue and the sides of the drier a series of perforated metal vertical hot-blast pipes, E, are placed at suitable distances apart. These pipes may be open or closed at their lower ends, and their upper ends communicate with the main conduit-pipe K, Fig. VI. This conduit K we generally make of wood, and rectangular in section. It should enter the chamber at one end, and then, dividing into two pipes, K′ K″, as shown, Fig. VI, pass across each side of the chamber over the rows of vertical blast-pipes E E, which connect with and open into these conduits, and be joined together at the farther end of the chamber, thus forming a continuous pipe in the form of an ellipse or loop. The size of this conduit decreases in area in proportion as the number of pipes supplied by it diminishes, being largest where it first enters the chamber and smallest at the farther end, where the two pipes K′ K″ are joined together.

This form of construction causes an equal quantity of hot-air to be delivered to each blast-pipe.

L L is a series of hoppers, with rotary valves L^1, on one side of the outer rim of which are cog-teeth, which mesh into a rack, L^2, which is operated by a lever or its equivalent. As the grain falls from these hoppers it is received by the large hopper L^4 and carried to the front of the drier, whence an elevator conveys it to the top of the drier again. This arrangement causes the grain to descend with great regularity over the whole chamber.

In operation this drier is filled to the top with grain, and the fan and elevator are set in motion. The hot blast, entering the chamber through the main conduits, is distributed throughout the mass of moving grain by the perforated pipes E E, and, after being loaded with the moisture thereof, escapes partly through the perforated lining of the chamber and partly through the perforated covering of the central exhaust-flue. The grain, being all the while kept in rapid motion, is soon dried to the required degree. The steam is then shut off from the heater, and, as the fan now delivers cold air through the same pipes, the grain is rapidly cooled. The drier is now emptied and the operation repeated.

We claim as our invention—

1. A drying-chamber having an interior lining of perforated and corrugated sheet metal, the spaces behind the said corrugations, in combination with openings in the walls of the chamber, forming conduits for the escape of the moist waste air, substantially as set forth.

2. The central exhaust-flue, D, covered with perforated and corrugated sheet metal, the spaces behind the said corrugations, in combination with openings in the walls of the chamber, forming conduits for the escape of the moist waste air, substantially as set forth.

3. A drying-chamber having an interior lining of perforated metal, in combination with one or more central exhaust-flues covered with perforated metal, operating substantially as set forth.

4. The main conduit K, in combination with the series of vertical blast-pipes E E and the drying-chamber lined with perforated metal, substantially as set forth.

Witness our hands this 11th day of April, 1878.

MARSHALL P. SMITH.
W. W. WOOLFORD.

Witnesses:
EMIL JOHN,
ERNST SCHMEISSEY.