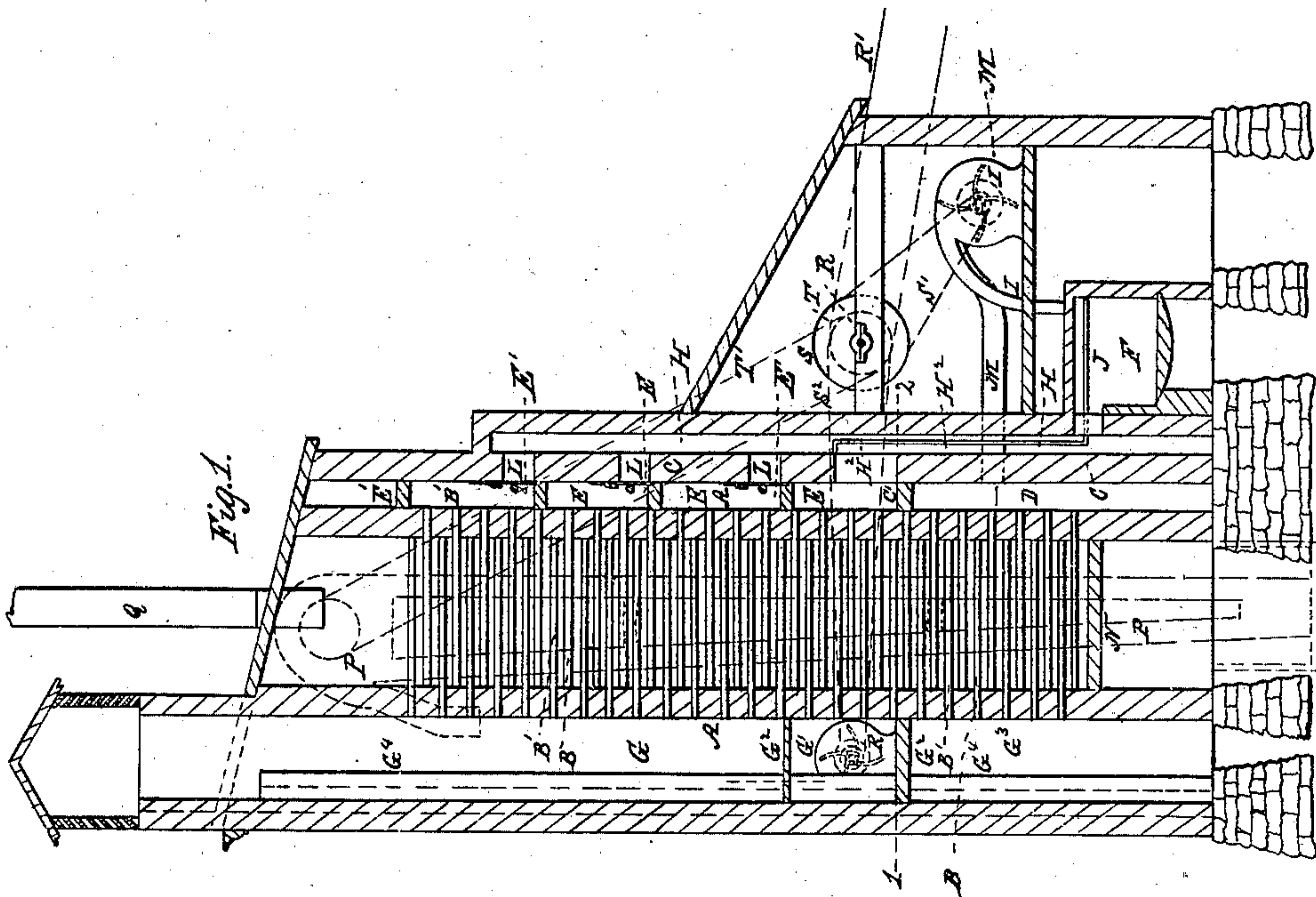
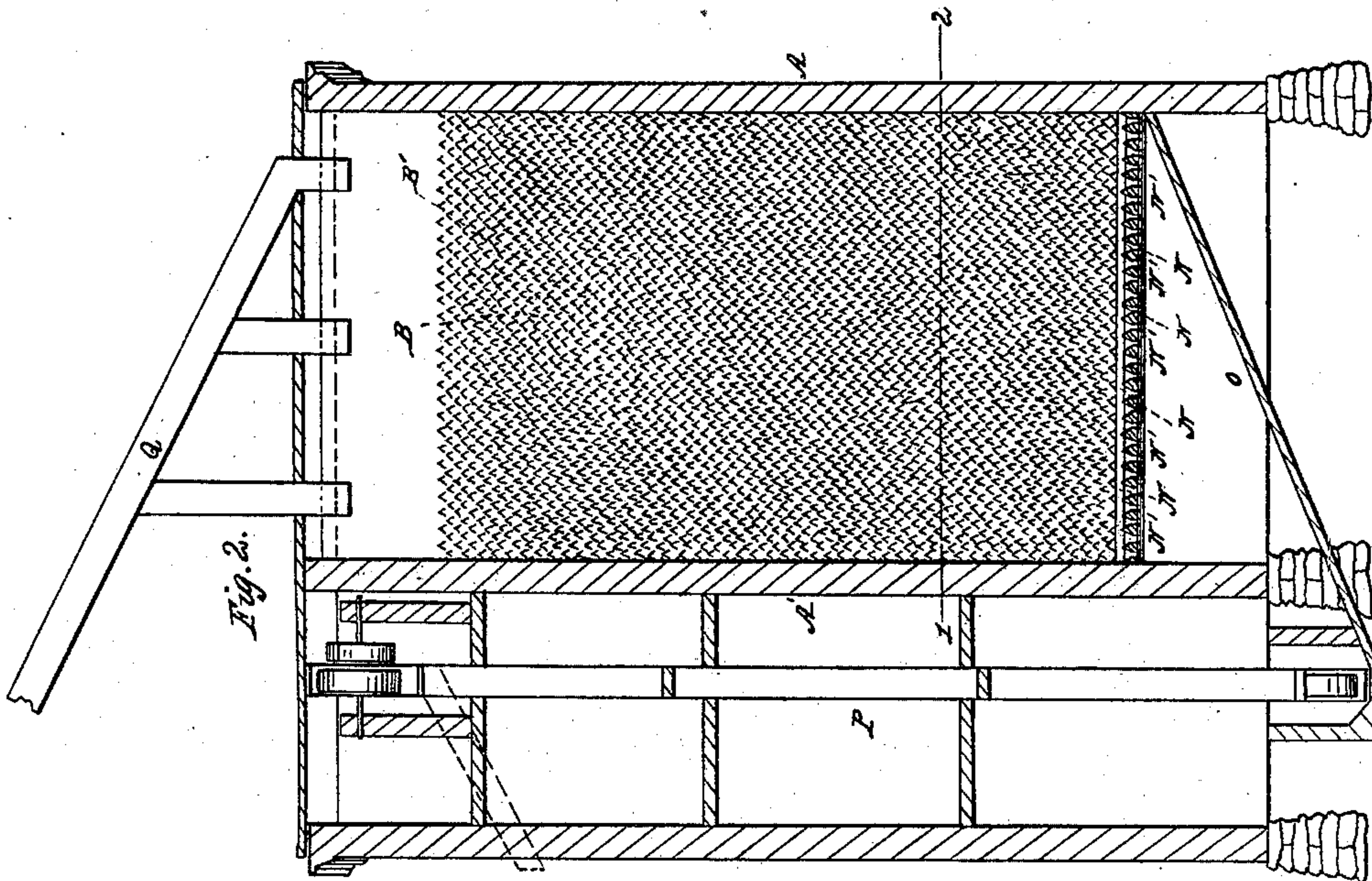


G. CLARK.
Grain Drier.

No. 42,348.

Patented April 19, 1864.



Witnesses:
Chas. D. Timble
Geo. W. Vescott

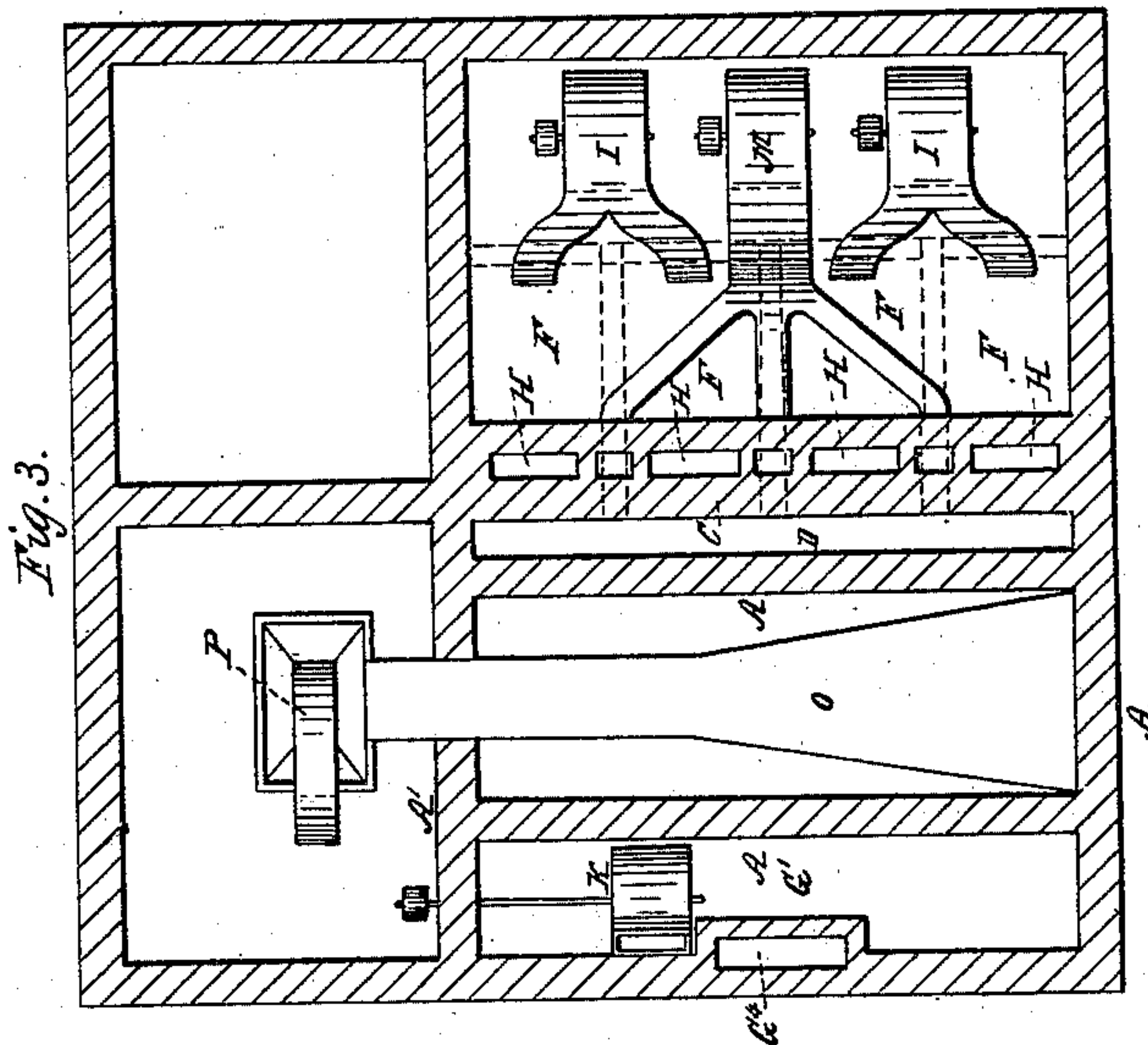
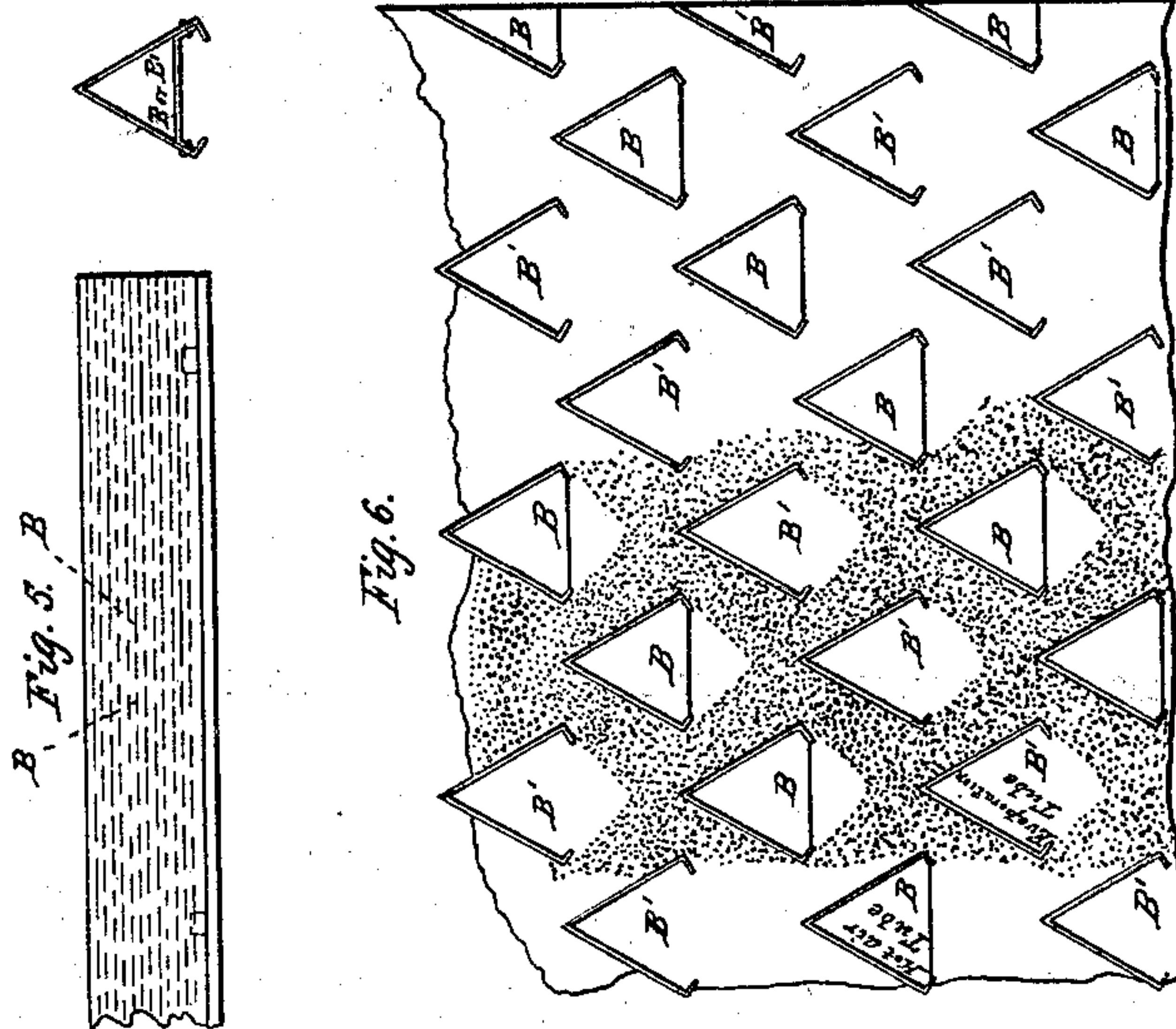
Inventor:
George Clark

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No. 42,348.

Patented April 19, 1864.



Witnesses:
Chas. E. Smith
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Inventor:
George Clark

UNITED STATES PATENT OFFICE.

GEORGE CLARK, OF BUFFALO, NEW YORK.

IMPROVEMENT IN GRAIN-DRIERS.

Specification forming part of Letters Patent No. 42,348, dated April 19, 1864.

To all whom it may concern:

Be it known that I, GEORGE CLARK, of the city of Buffalo, county of Erie, and State of New York, have invented a certain new and Improved Tubular Grain-Drying Kiln; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation thereof, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure I is a vertical longitudinal section of my improved drier. Fig. II is a vertical transverse section. Fig. III is a plan. Fig. IV is an end elevation of the hot-air and exhaust tubes on an increased scale, showing their relative position and arrangement; and Fig. V is a side view and transverse section of a single tube.

Letters of like name and kind refer to like parts in each of the figures.

The nature of this invention consists, first, in causing the heated or wet grain to be dried to pass through a rectangular kiln or bin containing an arrangement of horizontal perforated tubes, by which alternate hot-air-supply passages and evaporation-escape passages are formed through the body of the grain, the hot-air passages opening through the kiln-wall at one end and being closed at the other, and the evaporation-passages opening at one end through the opposite kiln-wall and closed at the other, whereby the hot air which enters the supply-tubes is caused to pass through the thin stratum of grain (lying between the tubes) into the evaporation-passages, and from thence into the atmosphere; second, in the formation of a hot-air chamber divided into compartments and combined with a hot-air-conducting flue leading from the furnaces, the openings of the flue into the different compartments of the hot-air chamber being provided with registers by which the amount of hot air entering the different compartments may be regulated in a manner to distribute the air equally to the compartments, and consequently to the tubular passages through the grain; third, in the construction of a triangular or V-shaped tube with an open bottom, with or without perforations, so that the dirt or grain or other matter will not lodge, clog, or fill the tube to form a combustible material, which material, if allowed to collect, would be liable to take fire from or be scorched by

the heat, and thus taint or render the grain unfit for use; fourth, in so arranging the hot-air-supply and evaporation-escape tubes or passages that the grain in its downward movement through the kiln will pass over an evaporation-tube after passing over a hot-air tube, so that it is impossible for the same grain to pass over two hot-air tubes in succession; fifth, in giving a downward movement to the grain through a kiln filled with hot-air and evaporation tubes so arranged as to effectually cut up and divide the descending body of grain, in combination with regulating valves at the bottom of the kiln.

A A' represent the walls of the drying kiln or bin. These walls may be either iron or brick, as desired. In this kiln or bin are placed the perforated air-tubes B B', the ends of which rest in the side walls A.

C is a wall built at a short distance from and parallel to the side wall A of the kiln; the space between is divided by the floor c' into two chambers, D and E, the chamber E being subdivided into several compartments by the floors E'. Hot air is admitted to the chamber E for drying, and cold air to the chamber D for cooling, so that that portion of the kiln which is above the line 1 2 or division-floor c' forms the drying-kiln, and that portion below said line and floor forms the cooling-kiln.

In the drying-kiln, B represents hot-air-supply tubes, and B' evaporation-exhaust tubes. To distinguish them, the hot-air tubes B are drawn in black ink, and the evaporation-tubes B' in blue ink. The rows of hot-air tubes are parallel with the rows of evaporation-tubes; but both rows run diagonally to a horizontal plane. This diagonal arrangement of the tubes causes each vertical row of tubes to be composed of alternate hot-air and evaporation tubes—that is, it causes an evaporation-tube to come directly over each hot-air tube, so that in the downward movement of the grain through the kiln such grain as lies in contact with a hot-air tube will pass over an evaporation-tube before coming in contact with a second hot-air tube, so that the heat received from the hot-air tube and the evaporation caused by it will be carried off by the evaporation-tube. In each horizontal row of tubes the apex of each tube comes in line with the space in the row of tubes directly above, so

that the descending body of grain is continually divided and cut up in a manner to bring all the grain passing through the kiln in actual contact with hot-air and evaporation tubes alternately during its descent. The V-shaped form of the tubes is seen on an increased scale in Fig. IV, also the manner in which the grain lies upon and around the tubes, also the formation of a bottom to the tube by the grain itself, as shown. The hot-air-supply tubes all open at one end through the kiln-wall A into the hot-air chamber E; but at their opposite end they are closed or butt up against the kiln-wall, so that hot air from the chamber E is free to enter them, but can only escape by passing out through their perforations or open bottom into the surrounding body of grain.

G is an evaporation-chamber on the opposite side of the kiln to the hot-air chamber, into which chamber all of the evaporation-tubes B' open, said tubes being closed at their opposite ends, similar to the hot-air tubes. These tubes receive and conduct in the chamber G all of the heat, moisture, and evaporation caused by the passage into the grain of the hot air from the hot-air tubes, as before described.

F F represent the furnaces in which the hot air is generated.

H represents a hot-air-conducting flue which conveys the hot air generated in the furnaces to the different compartments of the hot-air chamber.

I represents pressure fan-blowers situated above the furnaces, and used for forcing air into and through the furnaces, and thence through the flue H and hot-air chamber into the hot-air tubes, and through the grain into the evaporation-tubes. The air from the blowers is not allowed to come in direct contact with the fires, but passes through a flue over the fires, formed by the iron plate J, and is heated by the contact with said plate. The object in not allowing the fans to blow directly into or over the fires is to prevent the reaction of the air in the flue H and chamber E, which, upon opening the furnace-doors when feeding the fires, would permit the air to rush out of the doors and carry coals and smoke into the furnace-room. At the same time it is necessary to provide a means of regulating the fires and supplying them with the proper quantity of air for combustion. This is accomplished as follows: A portion of the flue H is cut off by the partition H', extending up to the first compartment of the hot-air chamber E, forming a second flue, H², communicating directly from the fire to said first compartment, so that all the air which passes up through the fires is conducted to this first compartment and through the hot-air tubes opening therein into the grain, and thence taken by the evaporation tubes into the chamber G' cut off from the main evaporation-chamber G² by the floors G². In this chamber G' is located a suction-fan, K, by which the air is exhausted therefrom and a partial vacuum formed, to supply which vacuum the

air must take the course above described. By this means the amount of combustion in the fires and the amount of air passing through them may be easily regulated without danger of the reaction before mentioned.

It may be found advisable to dispense entirely with the pressure fan-blowers I and use instead exhaust-fans located in the evaporation-chamber and exhausting through all instead of one of the sections. The openings of the flue H into the hot-air chambers E are provided with registers L, by which the size of said openings may be regulated, so as to supply an equal amount of hot air to each compartment or section of hot-air tubes. It may also be found advisable to increase the width of the hot-air chambers until it shall equal, or nearly so, their height, for the purpose of making the distance of hot-air tubes from the opening of the flue into the chamber as nearly equal as may be, and thus lessen the liability of the tubes nearest the center to receive more than their proportion of the hot air entering the chamber.

In the cooler the arrangement of the tubes is precisely the same as described for the drier, except that the hot-air-supply tubes become cold-air-supply tubes. The cold air is forced into the cold-air chamber D, and thence into the cold-air tubes and through the grain into the evaporation tubes, and into the chamber G³, from which it is taken by the flue G⁴ by the fan-blower M. A suction-fan may be used instead of this fan-blower, if desired, the same as described for the drier.

To regulate the passage of the grain through the kiln, a floor is formed at the bottom of the cooler by the timbers N, the upper edges of which are beveled so as to leave hopper-spaces between, which spaces are closed by sliding valves N'. A reciprocating motion is given to these valves by the proper machinery, so that they are made to open and shut at regular intervals, the distance which they open and the time of their remaining open being variable, so that the velocity with which the grain moves through the kiln may be regulated in a manner to insure its being properly and sufficiently dried and cooled. By this construction of the floor and valves an even and uniform movement of the grain through the kiln is effected. As the grain falls through the opening in the floor, it strikes upon the inclined plane O, which carries it to the foot of the elevating-leg P, by which it is elevated to the proper height to spout back into the store-bin or such other receiver as may be desired. Where large drying capacity is required, the cooler of greater capacity may be placed at one side of the drier, in which it will be necessary to interpose an elevating-leg between them, by which the grain, after passing through the drier, may be re-elevated and passed through the cooler. This drier is intended to be used in connection with large storage and transfer grain-elevators, from which it receives the grain to be dried. The

supply-spout represented at Q is supposed to lead from such an elevator, and discharges the grain to be dried into the kiln, and the elevating-leg P re-elevates the grain after it has passed through the kiln, and spouts it back into said elevator or into store bins or other receivers.

R represents a line-shaft, which receives its motion by the belt R' from an engine or other motive power located without the building, and gives motion to the fans and elevating-buckets.

S represents the pulleys on the line-shaft R, by which motion is given to the pressure-fans I and M through the belts S' and through the belt S² to the suction-fan K.

T represents the elevator driving-pulley, and T' the elevator driving-belt, by which motion is given to the elevating-buckets in the leg P.

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

1. The formation of hot-air-supply and evaporation-escape passages through a body of grain by means of the horizontal perforated tubes B and B', the hot-air tubes opening at one end through the kiln-wall into a hot-air chamber, E, and closed at the other end, and

the evaporation-tubes opening at one end into an evaporation-chamber, G, on the opposite side of the kiln, and being closed at the other, substantially as described.

2. The formation of a hot-air chamber, E, divided into compartments by the floors E', and the combination therewith of a hot-air-conducting flue, H, leading from the furnaces, the openings of the flue into said compartments being provided with regulating-registers, substantially as described.

3. The triangular or V-shaped tubes B B', having open base, (with or without perforations,) for the purposes and substantially as described.

4. In so arranging the alternate rows of hot-air-supply and evaporation-escape tubes or passages that the grain in its downward movement through the kiln will pass alternately over hot-air and evaporation tubes, substantially as described.

5. The combination of the hot-air supplying and exhausting tubes B B', constructed and operating as described, with the regulating-valves N', substantially as set forth.

GEORGE CLARK.

Witnesses:

CHAS. B. TRIMBLE,
IRA WESCOTT.