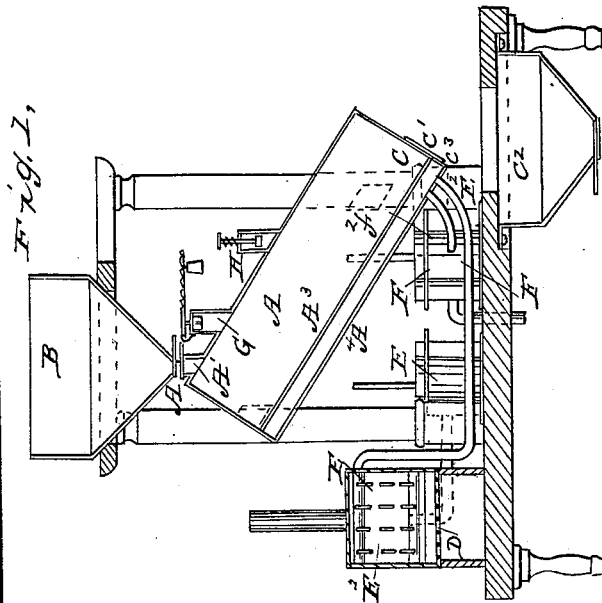
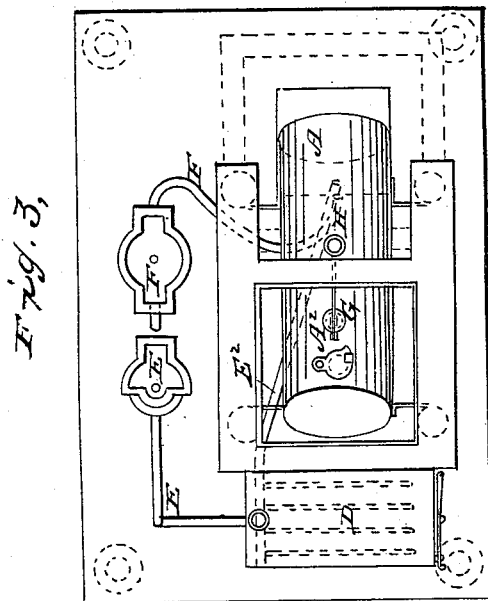
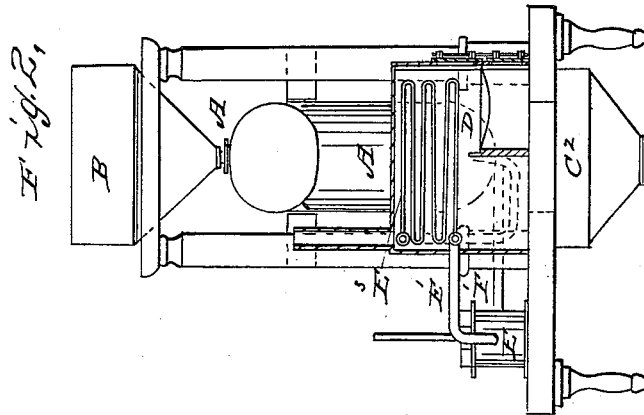


G. CLARK.

Grain Drier.

No. 53,575.

Patented April 3, 1866.



WITNESSES:

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INVENTOR:
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UNITED STATES PATENT OFFICE.

GEORGE CLARK, OF BUFFALO, NEW YORK.

GRAIN-DRIER.

Specification forming part of Letters Patent No. 53,575, dated April 3, 1866.

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 Pressure and Vacuum Grain-Drier; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure I is a sectional side elevation of my said drier. Fig. II is an end elevation of same, the hot-air furnace being shown in section, and Fig. III is a plan of same.

The nature of this invention consists, first, in the construction of a closed or air-tight grain-drying kiln or chamber, and the combination therewith of air-heating furnaces and blowing air pumps or fans, said furnaces supplying heated air of any required temperature and said pumps or fans forcing said heated air into said drying kiln or chamber with any amount of pressure required to cause it to penetrate and permeate equally the whole mass of grain contained in said chamber, and to heat the same uniformly throughout; second, in the combination, with said drying kiln or chamber, of a exhausting air pump or fan by which the evaporation occasioned by said heating process may be carried off and a vacuum more or less perfect may be produced therein, which vacuum will permit and facilitate a further evaporation of the water and moisture from the grain by the heat contained in said grain, and will carry off the same and leave the grain in a properly dried or cured state; third, in providing the drying-kiln with valves or doors, which may be opened after the drying is completed to admit cold air therein, so that a continued use of the exhausting-fan or air-pump will draw cold air through the grain until its temperature is sufficiently reduced to render it fit for storing or shipping; fourth, in the combination, with said drying kiln or chamber, of one or more evaporation-escape valves, which may be so adjusted that when the hot air forced into the kiln or chamber acquires over a given amount of pressure they will lift and permit its escape, and with it the evaporation arising from the grain, whereby the heating process may be continued for any required length of time, with a constant and uniform distribution of the hot air through the grain, the evaporation being carried off con-

tinually through the valves until the grain is thoroughly dried and cured; fifth, in the combination, with said drying kiln or chamber, (or with an auxiliary cooling-chamber,) and an exhausting air pump or fan, of a cold-air inlet valve or valves, which may be so adjusted that cold air will enter into the chamber, (when a given vacuum has been produced by the exhausting air pump or fan,) and by its passage through the grain reduce the temperature thereof to the required point, said reduction of temperature being materially facilitated by the maintenance of said vacuum.

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

A represents the kiln or chamber which receives the grain to be dried. It may be made of any form or size required, or of any suitable material. For strength and lightness I prefer the cylindrical form, and boiler or sheet iron for material. For convenience of discharge and for equal distribution of heat throughout, I incline its axis to an angle of about thirty degrees to the horizontal in preference to making it with its axis either vertical or horizontal, although it may be used in either of said positions. It is provided with a feed-orifice, A', at the top, through which it may be filled with grain from the hopper B, supplied by a spout from a store-bin, said orifice being closed, when the chamber is filled, by an air-tight cover or door, A².

The chamber is further provided with a discharge-orifice, C, at its lower end, through which the grain, when dried, may be drawn off, said orifice being also closed by an air-tight cover or door, C.

The grain as it issues from the kiln A is caught in a hopper or receiver, C², and from thence carried by a spout or elevator, as circumstances may require, to the receiving-store bin.

The kiln has a perforated bottom, A³, forming a longitudinal air-chamber, A⁴.

D represents an air-heating furnace, located in such proximity to the drying-kiln as circumstances may make convenient.

E represents a pressure air-pump for forcing air through the furnace and into the kiln. Its location with reference to the kiln or furnace is immaterial, and should generally be determined by convenience in applying motive power for its operation. It connects with the fur-

nace by a blast-pipe, E', which may open directly into the same or into a coil of air-heating pipes E³ contained therein. From the furnace the blast-pipe continues, as shown at E², to the drying-kiln, opening therein into the air-chamber A⁴. It is provided with a stop-cock or valve C³, by which its communication with the chamber may be opened or closed at pleasure.

The operation of the drier, as far as described, is briefly this: The kiln or chamber being filled with grain in the manner and by the means mentioned, and the orifices all closed, the air-pump, being set in motion, will force a current of air through the coil of heating furnace-pipe (where it will acquire the required temperature) and thence into the air-chamber A⁴ of the kiln, from which, as it accumulates in quantity and increases in pressure, by the continued action of the air-pump, it will distribute itself equally through the grain contained in the kiln until it penetrates and permeates the whole mass thereof and heats the same uniformly throughout.

F represents an exhausting air-pump, connecting with the kiln or chamber A⁴ by a pipe, F', provided with a stop-cock or valve, f², by which its communication therewith may be opened or closed. During the above-described operation of heating the grain this stop-cock is kept closed; but upon the completion of said operation is opened, and the stop-cock C³ in the blast-pipe E² is closed.

The air-pump F, by its operation, will now exhaust the heated air from the drying chamber or kiln, and with it the evaporation from the grain which said heated air has caused, and as the exhaustion continues and a vacuum is formed in the grain-chamber, will induce a further evaporation to take place by the action of the heat absorbed by the grain during the heating process, and will carry off such evaporation and leave the grain thoroughly dried and cured. As the grain, though dried, may still be too warm for storage or shipping, it can be cooled sufficiently and rendered in a fit state therefor by opening the door or cover A² to the orifice A' and permitting the entrance into the kiln of cold air, which, being exhausted through the grain for a sufficient length of time, will have the desired effect.

Should a single operation of heating the grain, as above described, be insufficient to dry it to the required standard, it may be repeated, either in whole or in part, until the desired result is accomplished.

The above-described operation evidently involves an intermittent application of the heating process, but by the combination and connection of two or more drying chambers or kilns it may be made in effect continuous—that is, by heating the grain in one chamber and at the same time exhausting from one previously heated, and so on continuously.

This mode of operation would, also, in many conditions of the grain to be dried, involve one or more applications of both the heating

and exhausting process to the same mass of grain before it would be properly cured. This may be avoided and a more satisfactory result obtained by the arrangement and connection, with the kiln, of an evaporation-escape valve or vales, G, (in this instance constructed and operating in the same manner as the common safety-valve of a steam-boiler,) which may be adjusted to open under any certain or desired pressure. These valves will prevent the escape from the kiln of the hot air forced therein, as before described, until it shall have acquired a pressure sufficient to open the valves, and which pressure, by their adjustment, should be sufficient to cause the heated air to penetrate and permeate the grain, as before stated. This pressure being maintained by the air-pumps, the hot air, and the evaporation and moisture contained therein will pass off through the valves, and thereby enable the heating process to be carried on continuously until the grain shall have become sufficiently dried.

The exhausting and cooling process may, in a like manner, be carried on continuously as long as may be necessary by the arrangement of a cold-air inlet valve or valves, H, in connection with the kiln, which valve may be so adjusted as to open and admit cold air to the kiln at such time as the exhausting-pump shall have produced a given degree of vacuum therein, which cold air, so admitted, will be drawn through the grain by the pump until the same shall be properly cooled and rendered in a fit state for storage or shipping. The cooling of the grain is materially assisted by the maintenance of the said vacuum, as the temperature of the air passing through the grain is considerably reduced thereby below its atmospheric temperature.

It may be found preferable to carry on the cooling process in a separate or auxiliary chamber, to save the necessity of alternately heating and cooling the kiln and to make the operation more expeditious and economical. If used, this auxiliary chamber should be so located and arranged that the grain may be easily and expeditiously transferred thereto from the drying-kiln.

When a drier of large capacity is to be built it may be necessary to use a number of kilns or chambers, arranged and operating together; or, the kiln, if single and of large size, may be divided and subdivided by perforated floors or partitions, or may contain horizontal or vertical perforated tubes or flues which will divide the mass of grain and carry the hot air to all parts of the kiln equally.

In all grain-driers heretofore invented, so far as my knowledge goes, the hot air has been simply passed through the grain, and although, in several instances, both pressure and exhaust fans have been used to facilitate its passage through and escape to the atmosphere with the evaporation it produces in its passage, yet in none has any resistance been opposed to its passage other than that of the

grain itself, so that it has been a matter of great difficulty to so regulate and apply the air-currents as to distribute the heated air equally through the grain, and has made necessary the use of complicated and expensive devices and machinery to stir up and keep the grain in motion to prevent its scorching or burning.

By the application of the heated air under pressure, according to the principle of my invention, above described, these difficulties are entirely avoided, and a grain-drying kiln produced comparatively simple and inexpensive in its construction, and, as is believed, of unequalled efficiency in its operation.

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

1. A closed or air-tight grain-drying kiln or chamber combined and operating in connection with air-heating furnaces and blowing air pumps or fans, for the purpose and in the manner substantially as described.

2. In the combination with said air-tight

grain-drying kiln or chamber, of an exhausting air pump or fan, operating in the manner and for the purpose set forth.

3. Providing said air-tight grain-drying kiln or chamber, having an exhausting air-pump combined therewith, with valves or doors, which may be opened to admit cold air therein, for the purpose set forth.

4. The combination, with said air-tight drying kiln or chamber, of one or more evaporation escape-valves, G, or other equivalent device, operating in the manner and for the purpose substantially as herein described.

5. In the combination with said air-tight drying kiln or chamber, or with an auxiliary cooling chamber, of a cold-air inlet valve or valves, H, or other equivalent device, operating in the manner and for the purpose substantially as herein described.

GEORGE CLARK.

Witnesses:

W. H. FORBUSH,

F. A. LANGWORTHY.