G. CLARK.

Grain-Drier.

No. 199,793. Patented Jan. 29, 1878.

Fig. 1.

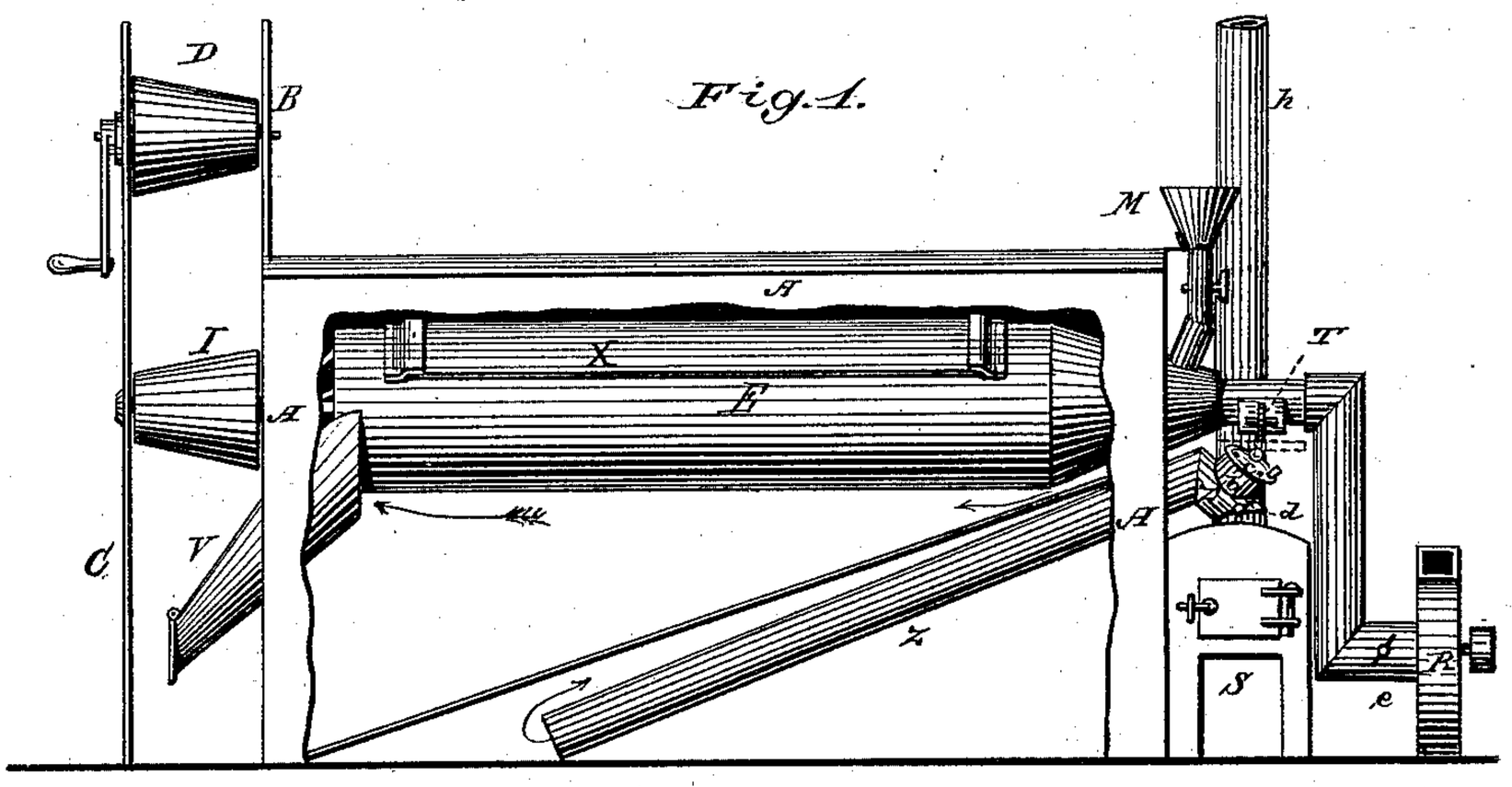


Fig. 2.

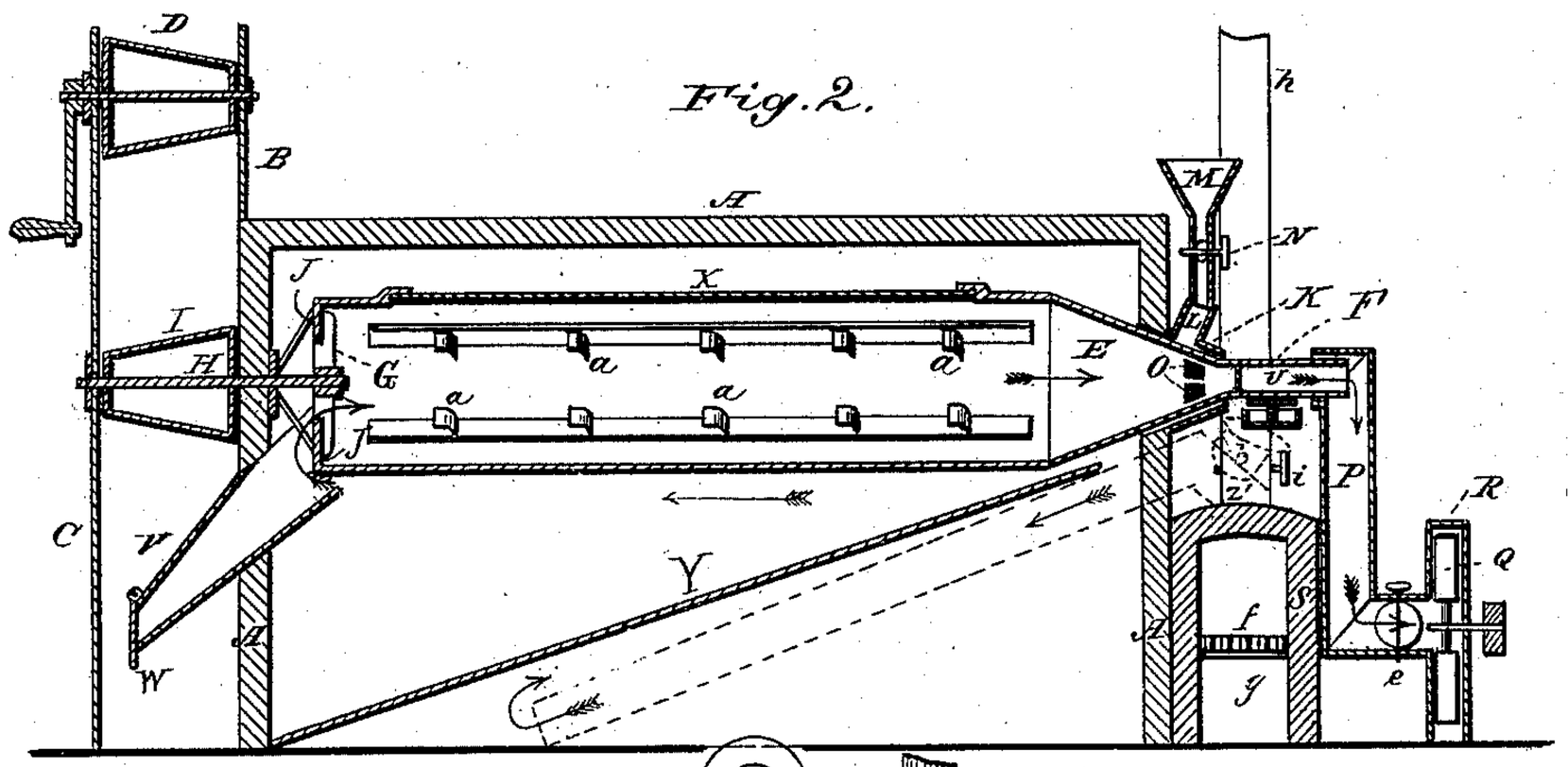
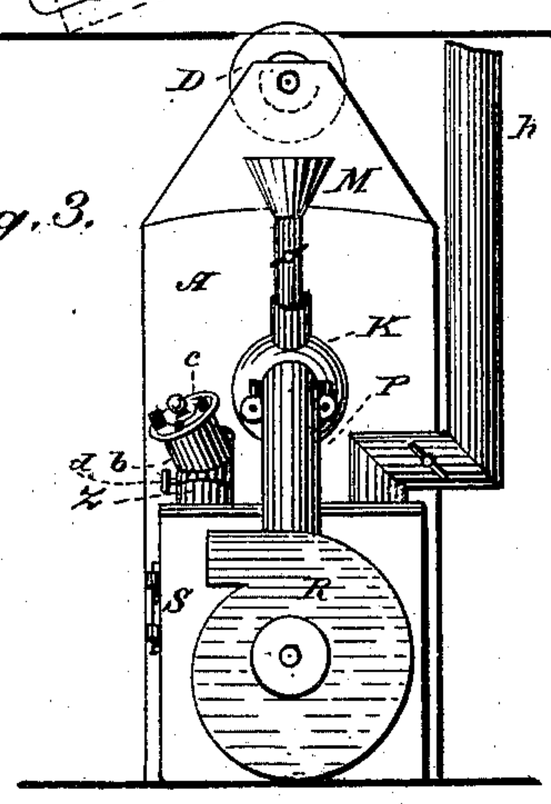


Fig. 3.



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UNITED STATES PATENT OFFICE.

GEORGE CLARK, OF BUFFALO, NEW YORK.

IMPROVEMENT IN GRAIN-DRIERS.

Specification forming part of Letters Patent No. **199,793,** dated January 29, 1878; application filed December 27, 1877.

To all whom it may concern:

Be it known that I, GEORGE CLARK, of Buffalo, in the county of Erie and State of New York, have invented certain new and useful Improvements in Grain-Driers; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, making a part of this specification.

My invention has for its object the thorough and rapid drying of grain, malt, or other material having natural or artificial moisture; and, with this end in view, my invention consists, generally, of a rotating cylinder within a closed case of brick or other suitable material, provided on its interior surface with short lifting scoops or buckets, adapted to lift and shower the contained grain or other material, and combined with a furnace and suction-fan, and system of hot and cold air pipes, all arranged and controlled to operate in the manner hereinafter more fully set forth; and my invention further consists in the several details of construction hereinafter more fully described.

The drying of damp or moist materials, and more especially grains of different kinds and natures, depends for its success upon an apparatus which shall be capable of operating differently upon different grains, or upon the same grain under different conditions. I have discovered from practical experience that a machine adapted to perform its functions in an unvarying and invariable manner will not answer the purpose, and in my present invention I have endeavored to produce an apparatus which may be regulated according to the altered or alterable conditions of the material it is designed to treat.

To enable those skilled to understand how to make and use my improved grain-drier, and to appreciate its advantages, I will proceed to describe the construction and operation of the same, referring by letters to the accompanying drawings, in which—

Figure 1 is a side elevation of an apparatus constructed according to my invention, the wall being broken away, exposing the interior mechanism. Fig. 2 is a longitudinal central section, and Fig. 3 an end view.

Similar letters indicate like parts in the several figures.

A represents a casing, preferably of brick, of quadrilateral or other form, and having an arched or other roof. At one end there is a vertical extension, B, and a parallel upright or wall, C, in both of which are arranged journal-bearings for the shaft of a cone driving-pulley, D, the exterior end of which shaft is provided with any suitable means for receiving motion and power.

E is the grain-cylinder, made preferably of boiler-iron, one end, or the head, terminating in a truncated cone and tubular bearing, E F, and the other open and provided with a spider, G, from which extends a shaft, H, having its bearings both in the walls A and C, and provided with a cone-pulley, I. The open tail end of the cylinder is furnished interiorly with a ring-dam, J, for the purpose to be presently explained. The cone-shaped head E of the cylinder passes through a correspondingly-shaped sleeve, K, which connects, by a short tube, L, with a hopper, M, in turn provided with a feed-valve, N, and the cone-head has a series of openings, O O, immediately in line with the center of the tube L, and with which they successively come in register during the rotation of the cylinder, to permit the feeding of grain from the hopper to the interior of the cylinder.

The tubular end F of the cylinder enters the mouth of an exhaust-pipe, P, which communicates, through a case, R, with an exhaust-fan, Q, arranged at one side of a heating-furnace, S, built at one end of the wall A.

The tubular end F of the grain-cylinder has its bearing upon anti-friction rollers T, journaled in a suitable bracket, and the rollers are prevented from becoming heated by revolving in a pan or tank arranged underneath, and supplied with cold water. Immediately behind the feed-openings O O in the cylinder-head is arranged a wire or gauze diaphragm, U, which, while it prevents the grain from working or being drawn into the exhaust-tube, at the same time permits a free circulation. V is a conveying or discharge spout arranged through the end wall of the case A, and immediately underneath the tail of the

cylinder. The inner end of said spout does not quite reach the cylinder, thus leaving a draft or air-space, for the purpose to be hereinafter explained. The exit end of the spout V is provided with a weighted or flap valve, W, which opens when the weight of the grain in the spout is sufficient to overcome its gravity, and immediately closes after the grain has escaped.

The cylinder E is also provided with a suitable man-hole or sliding door, X, for observation, ingress, &c., and the interior surface of the said cylinder is furnished with a series of short angular projections or buckets, *a a*, the lifting-wings of which are slightly inclined or bent upwardly, so that they will retain anything picked up by them until they have nearly reached a vertical line, whereby the grain will be dropped in a sort of shower. These buckets *a a* are quite short, and are designed to stir, move, and carry up only the layer or stratum of material lying immediately adjacent to the lower surface of the cylinder, and thus prevent it becoming overheated by the passing and radiated heat underneath the cylinder. The cylinder E is slightly inclined toward the tail end, so that its contents will tend to gravitate toward the discharge-spout V, and ring J serves to always maintain a given quantity of grain within the cylinder, in an obvious manner. Y is an inclined partition, its lowest end close against the end wall, and its sides in contact, and practically air-tight, with the side walls A A, the upper end falling short and leaving a space between it and the end wall. Immediately under said inclined partition, which is made of any suitable material that will radiate heat, is an inclined pipe or tube, Z, which, passing through the end wall A, connects with a short descending pipe, Z′, which communicates directly with the space over the fire in the furnace, and about at the intersection between the tubes Z Z′ is arranged an upward cold-air draft-pipe *b*, its top closed, and provided with several openings, which may be brought in register, or not, with corresponding openings in a rotating register-plate, *c*, whereby communication may or may not be had with the exterior atmosphere.

The descending draft-tube Z′ is furnished with a damper or valve, *d*, and the exhaust-pipe P is also provided with a similar one, *e*. *f* is the grate of the furnace, and *g* the ash-pit, through which the air-supply to the furnace is furnished. The rear end of the furnace is provided with a suitable smoke stack or pipe, *h*, having a damper, *i*, which is closed when the fire is thoroughly started, and the fan-shaft is furnished with a suitable exterior pulley, to which motion is imparted by a belt or otherwise.

Having described the construction of the several devices embodied in my apparatus, I will now describe the operation and effects. The fire having been started completely and the damper *i* closed, the grain is fed to the hopper M, motion imparted to the cylinder and fan, the grain is gradually and systematically fed into the head of the cylinder, traveling gradually and by centrifugal force toward the tail of the cylinder, and the portion lying in contact with the bottom of the cylinder is continuously picked up and again showered down by the peculiar buckets *a a*, until it passes over the dam G and drops into the mouth of the escape-spout V, from whence it is delivered or conveyed to a suitable receiver. The fan Q, within its case, by its rotation, produces an exhaust, and causes the heat generated in the furnace to be drawn out by the pipes Z Z′ into the space underneath the inclined partition Y, along up the under side thereof, around and between its upper end and the end wall, back under the cylinder E, toward its tail, and between it and the mouth of the escape-spout V, and through the spider J into the interior of the cylinder and among the grain, through which it travels on up to the head of the cylinder to the exhaust-pipe P, and into the fan-case at the eye of the fan, extracting in its passage all the moisture, and ejecting it from the fan-case in the form of vapor, the course of the currents being clearly indicated by the arrows at Fig. 2.

The valve in the exhaust-pipe P, leading to the eye of the fan, serves to perfectly graduate or control the volume of hot or cold air currents drawn through the grain, in an obvious manner. The flap-valve W, as before described, is kept closed, except when it is automatically opened to permit the discharge of accumulated grain, and hence no hot air can escape at that point.

By means of the damper *d* and register-damper *c* the temperature of the currents drawn through the cylinder E is perfectly controlled, which is a great desideratum, as in some instances a high degree of heat is necessary, and at others only a moderate degree of heat, or simply pure air in large quantities. This may be accomplished by entirely or partially closing the register-damper *c* and moving the damper *d*, or entirely opening the register *c* and partially or entirely closing damper *d*, so that the currents passing through the grain may be hot and cold air combined in any proportion, or either separately.

It will be observed that by the construction and arrangement shown the currents of air must travel as indicated by the arrows, and that I am enabled to utilize them at the most effective points and for the longest time, and that I also heat the partition Y, and obtain a radiated heat therefrom immediately underneath the cylinder. The feed of the grain to the cylinder from the hopper M is also under perfect control and adjustment, and by the cone-pulleys D I the speed of the cylinder may be made commensurate with the rapidity or quantity of the feed, or the length of time it may be desirable to keep a given quantity under the influence of the permeating currents of air.

My drier is designed more particularly for grain; but it will be manifest that by immaterial changes or duplication of parts it may be used for the treatment of guano or other materials of different characters.

Having described the construction and operation of my improved grain-drier, and its advantages, what I claim as new, and desire to secure by Letters Patent, is—

1. The revolving cylinder E within a close case, in combination with a furnace, exhaust-fan, partition Y, and pipes Z, Z′, and P, whereby the currents induced by exhaust are compelled to travel in the direction specified, and for the purposes hereinbefore set forth.

2. In combination with the cylinder and exhaust-pipe, arranged as described, the pipes Z Z′ *b* and dampers *d c*, whereby currents of different temperatures are caused to travel in the manner and for the purposes specified.

3. The cylinder-head formed with openings O, in combination with the feed-hopper and valve for controlling the feed, as set forth.

4. The discharge-spout V, provided with flap-valve W, and arranged as described with reference to the cylinder, whereby the discharge takes place without affecting the currents, as hereinbefore set forth.

In witness whereof I have hereunto set my hand this 22d day of December, A. D. 1877.

GEORGE CLARK.

In presence of—

WM. C. MCINTIRE,

ARTHUR L. MCINTIRE.