No. 640,628. Patented Jan. 2, 1900.

J. F. BUSSELLS.

DRIER FOR FERTILIZER MATERIAL.

(Application filed Dec. 5, 1898.)

(No Model.) 2 Sheets—Sheet 1.

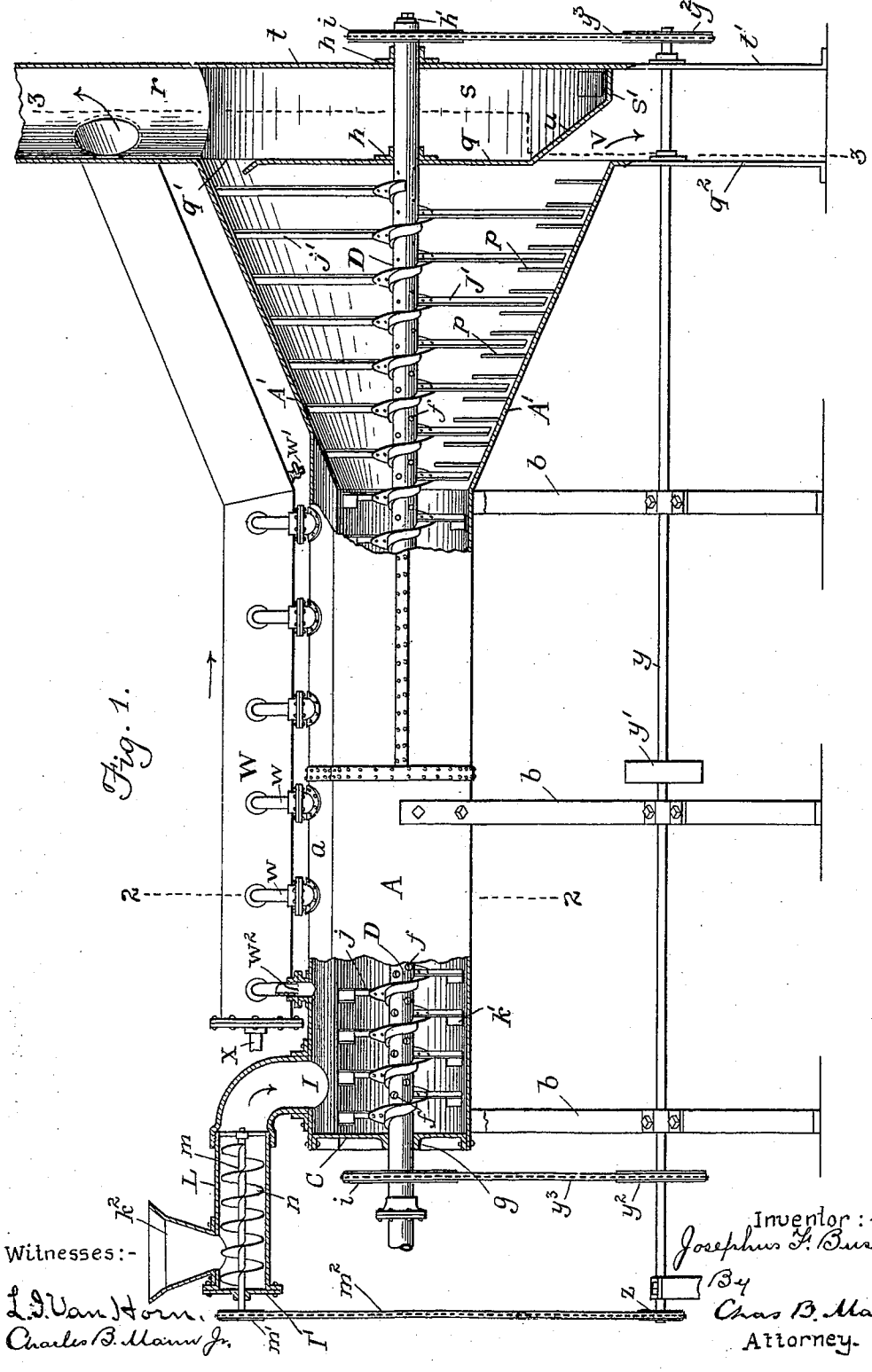

Fig. 1.

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THE NORRIS PETERS CO. PHOTO-LITHO., WASHINGTON, D. C.

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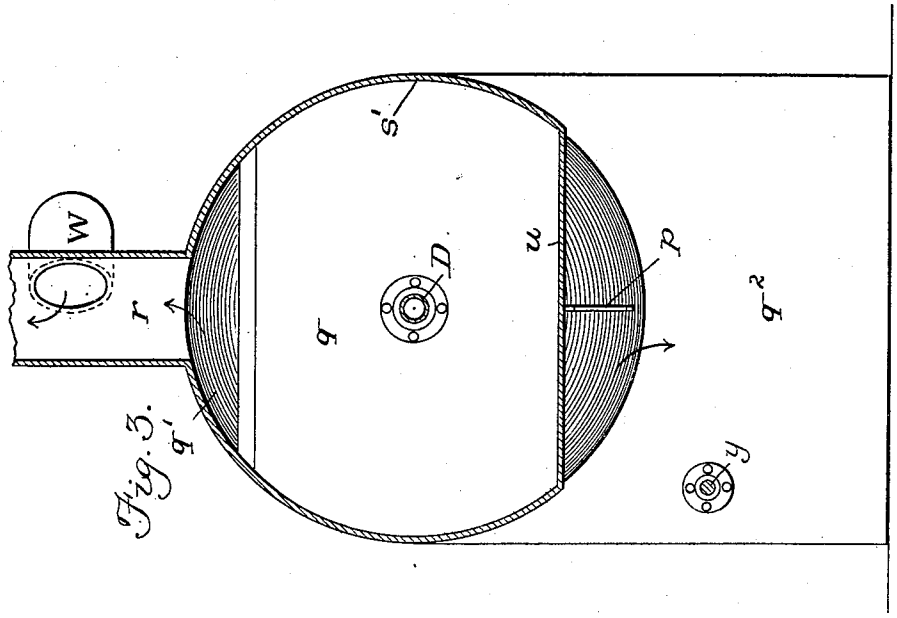

Fig. 3.

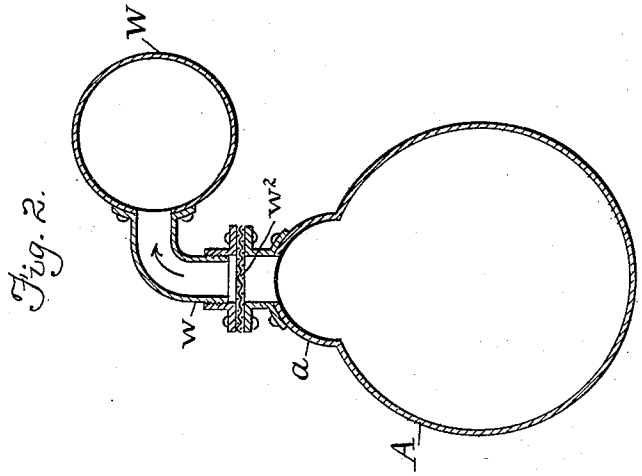

Fig. 2.

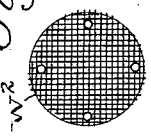

Fig. 4.

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UNITED STATES PATENT OFFICE.

JOSEPHUS F. BUSSELLS, OF IRVINGTON, VIRGINIA, ASSIGNOR OF ONE-HALF TO ALBRO J. MORSE, OF HARBORTON, VIRGINIA.

DRIER FOR FERTILIZER MATERIAL.

SPECIFICATION forming part of Letters Patent No. 640,628, dated January 2, 1900.

Application filed December 5, 1898. Serial No. 698,240. (No model.)

To all whom it may concern:

Be it known that I, JOSEPHUS F. BUSSELLS, a citizen of the United States, residing at Irvington, in the county of Lancaster and State of Virginia, have invented certain new and useful Improvements in Driers for Fertilizer Material, of which the following is a specification.

This invention relates to a drying apparatus for drying animal or vegetable substances rapidly and uniformly.

One object of the invention is to provide for increasing the cross-sectional area of the drying-receiver toward the discharge end in order thereby to lessen the pressure on the material that is being dried, to the end that fine and light particles of material will not be blown forcefully as the material is about to discharge, thereby saving such light particles from loss and waste.

The invention is illustrated in the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section of the apparatus. Fig. 2 is a cross-section on a larger scale of the drying-receiver and the vapor-conduit through one of the vapor-outlet pipes. Fig. 3 is an elevation in cross-section of the discharge end, taken on line 3 3. Fig. 4 is a view of one of the strainers employed in the vapor-outlet pipes.

Referring now to Fig. 1, the drying-receiver A is substantially horizontal, though it may be on an incline. It is cylindric in shape, but provided with a longitudinal swell or dome *a* on top. It rests on any suitable support *b*. At the feeding-in end the receiver is closed by a head C. A tubular shaft or pipe D extends lengthwise through the receiver and is revoluble in a bearing *g* in the closed head C and in another bearing *h* at the discharge end. At this end the tubular shaft is closed by a removable cap or plug *h'*. At both ends and on the outside of the receiver this shaft has a pulley *i* for a belt or chain by which the shaft may be revolved. Within the cylinder the hollow shaft has holes *f* for the steam or hot air to pass from the shaft to the receiver. These holes are of different sizes, the largest holes being in the pipe of the feeding-in end of the receiver, and the holes gradually diminishing in size as they progress toward the discharge end. By thus graduating the holes in the revoluble shaft provision is made for entering and applying the largest volume of heat to the moist substance immediately on such substance entering the receiver and then applying a progressively-decreasing volume of heat as such substance passes toward the discharge end. The holes may be of uniform size. Stirrer blades or arms *j* are fixed to the revoluble shaft D, and serve to tumble the substance that is undergoing drying and also to propel it along the receiver.

The device for feeding in the substance to be dried is constructed and arranged to permit the entrance to the cylinder of a continuous supply of fish or other material to be dried, and at the same time to prevent the escape at such device of any steam or hot air from the cylinder. This device consists of a horizontally-placed tube L, whose end connects with an opening I in the cylinder-wall. The other end of the feed-tube is closed by a head I', and near this end the tube has on top a funnel mouth or hopper k^2, and a shaft *m* extends horizontally within the feed-tube and projects through the head I', and on the outside has a pulley *m'* to be driven by a belt or chain m^2. A compressing-screw *n* is on the shaft *m*. This construction of horizontal tube with one end closed and its other end connecting with the cylinder on the side insures that a supply of the matter may be continuously fed into the cylinder under conditions that will keep the feed-tube so choked or jammed full of matter as to prevent escape of steam-pressure or hot air from the cylinder.

The walls of the receiver are parallel for a considerable distance—say, perhaps, about two-thirds of its length. Then the walls begin to flare or enlarge cone-shape fashion, as at A', and this expanded or cone-shaped part in length is equal to about half the length of the parallel or straight-walled part. The diameter of the cone part where it is largest is about three times the diameter of the straight part. The relative proportions here given for these parts are only approximate and are not stated in any sense as a restriction or a limitation on the invention.

The stirrer-blades j' on the tubular revoluble shaft D are of gradually-increased length in the expanded or cone part A', and the bottom side of the cone part has on its interior upward-projecting pins p, and in revolving the ends of the stirrer-blades j' sweep between these pins. The ends of these blades j' are straight; but the blades j in the straight-walled part of the receiver have their ends provided with angle-plates k'.

At the largest part of the cone end of the receiver is a vertical cross-wall q, and at its top there is an opening q' over or through it for the escape of vapors to the exhaust-pipe r, leading upward to the atmosphere. A circular chamber s is formed by said cross-wall q, the outside wall t, and rim s', and the exhaust-pipe leads up therefrom. This chamber s forms a sort of eddy below the exhaust-pipe and serves to receive and hold any fine particles of dried material that may pass the upper opening q' and then drop. The bottom of this chamber s is closed by an inclined plate u, connecting from the cross-wall down to the outside wall t and forming a discharge-opening v for the dried substance or material. The wall t extends to the ground, and a wall q^2 from the opening v also extends to the ground. The two walls t q^2 are parallel and form a space, open at each side, where the dried discharged material may collect and from which it may be shoveled or otherwise removed.

A vapor-conduit W of ample size extends along and exterior of the drying-receiver, and numerous outlet-pipes w connect between the longitudinal dome a of said receiver and the conduit. The vapor-conduit may terminate or discharge wherever preferred. In the present instance it is shown as connecting with the exhaust-pipe r. It will be seen that by thus providing a separate and independent vapor-conduit and connecting the receiver A with said conduit by numerous outlet-pipes the moisture that is extracted from the material being dried and converted into vapor or steam will be promptly and effectually separated from the receiver and carried away. The vapor-pipes w do not enter the bottom of the conduit, but enter its side above the bottom, or may enter the top side of the conduit. Thus provision is made internally along the conduit-bottom for the collection of the water of condensation. This water may be drawn off from the conduit by a cock located at any suitable point, as w'.

At the closed end of the conduit a pipe x is entered, and this pipe serves as a connection for an air-blast to enter the conduit and assist in driving out or expelling the steam that accumulates therein.

A strainer w^2 of wire-gauze is secured in each vapor-pipe connection. The strainer is circular and is clamped between flanges, as shown in Fig. 2. This strainer permits the vapor and steam to pass, but prevents particles of material from passing.

A shaft y extends along the supports b of the machine and has a pulley y', which receives motion and power from any source. At each end this shaft has a sprocket-wheel y^2. A drive-chain y^3 connects at each of said wheels and passes over the wheel i on the tubular shaft D and imparts motion to the latter. A sprocket z is on the extremity of the shaft y and the chain m^2 connects therefrom to drive the feed-screw of the feeding-in device.

The operation, briefly, is as follows: The material is fed into the receiver A continuously, and upon its entrance is at once subjected to the effect of heat and is agitated. The vapor and steam thus generated fills the longitudinal dome a at the top of the receiver and passes therefrom through the numerous pipe-outlets w to the conduit W. By thus promptly diverting the moisture in the form of vapor as fast as it is separated or extracted from the material and leading it to an independent conduit the process of drying is greatly expedited. When the material in progressing through the receiver A reaches the point where the enlargement or cone flare begins, the moisture will be very largely extracted. The nearly-dried material then enters that part A' of the receiver which has a greater cross-sectional area. Here the material is not so closely confined, and the bulk of the material begins to be loosened up as the area or space is larger, and consequently the pressure on the material is lessened. The drying process under these changed conditions is now rapidly completed. Any light particles that become separated from the bulk or mass are carried against the cross-wall q and are stopped, and then settle down and pass out at the discharge-opening v. Heretofore in other apparatus these light particles have been blown forcefully out and have been wasted in the open air. This waste has heretofore resulted in very material loss, which my improvement avoids.

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

1. The combination of a drying-receiver having parallel walls for a distance from the feeding-in end and flared or cone-shaped walls toward the discharge end; and a revoluble agitator-shaft extending longitudinally through the receiver.

2. The combination of a drying-receiver having parallel walls for a distance from the feeding-in end and flared or cone-shaped walls toward the discharge end; a revoluble agitator-shaft extending longitudinally through the receiver; stirrer-blades on the revoluble shaft, those blades on that part extending through the cone-shaped portion of the receiver having a gradually-increased length.

3. The combination of a drying-receiver having parallel walls for a distance from the feeding-in end and flared or cone-shaped

walls toward the discharge end; a vertical cross-wall partly closing the large end and having an upper opening for the escape of vapors and steam and a lower discharge-opening for the dried material; a revoluble agitator-shaft extending longitudinally through the receiver; stirrer-blades on the revoluble shaft, those blades on that part extending through the cone-shaped portion of the receiver having a gradually-increased length.

4. The combination of a drying-receiver having parallel walls for a distance from the feeding-in end and flared or cone-shaped walls toward the discharge end; a revoluble agitator-shaft extending longitudinally through the receiver; a separate chamber at the large end of the receiver for collection of light particles of dried material; and an opening below said chamber for the discharge of the dried material from the receiver.

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

JOSEPHUS F. BUSSELLS.

Witnesses:

CHARLES B. MANN, Jr.,

GEO. KOETHER.