

(No Model.)

3 Sheets—Sheet 1.

J. H. McDONALD.

GRAIN DRIER.

No. 368,298.

Patented Aug. 16, 1887.

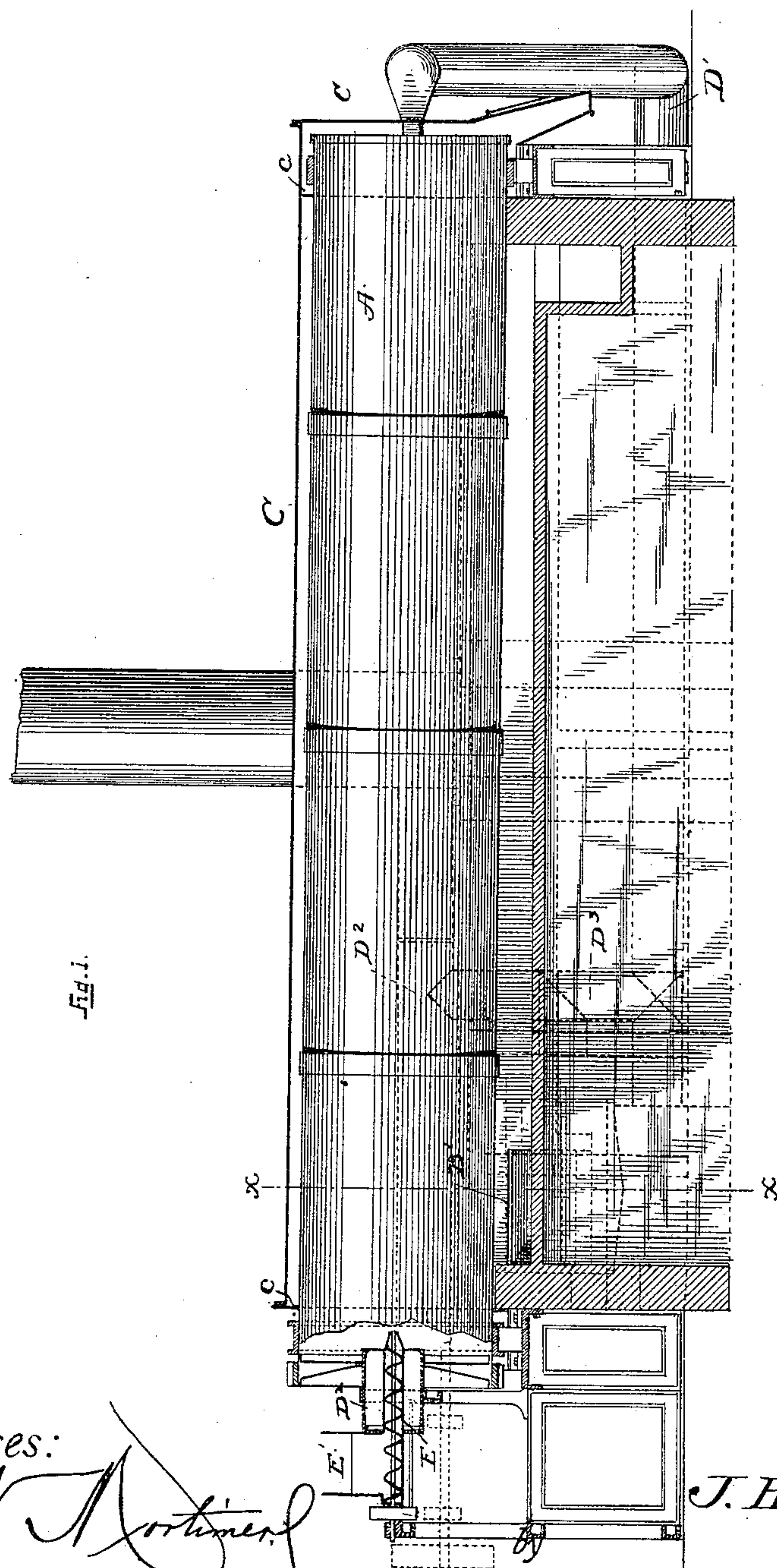


Fig. 1.

Witnesses:

W. H. Northrup
L. W. Hanning

Inventor :

J. H. McDonald

A. E. Dyrenforth
his Attorney.

(No Model.)

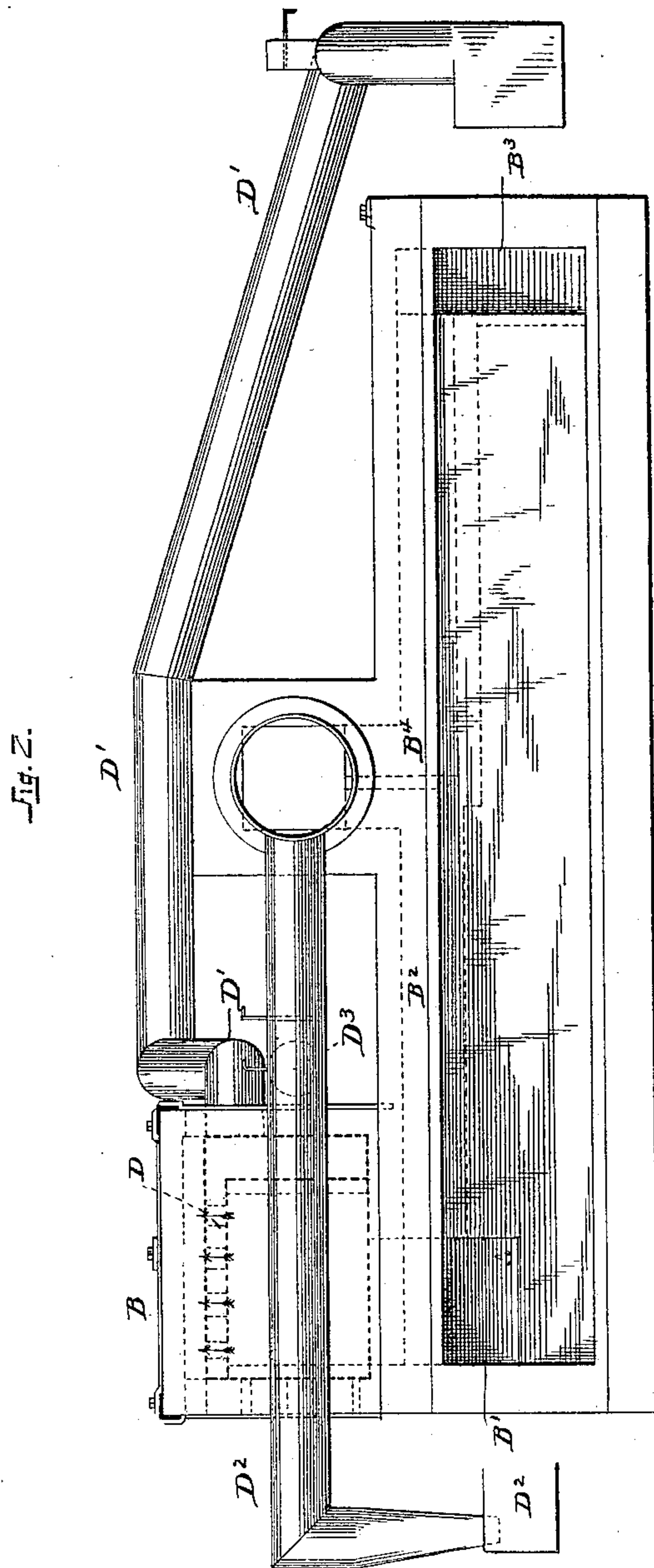
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No. 368,298.

Patented Aug. 16, 1887.



Witnesses:

W. W. Mortimer
L. W. Varnie

Inventor :

J. H. McDonald,

by

R. E. Dyrenforth.
his Attorney.

(No Model.)

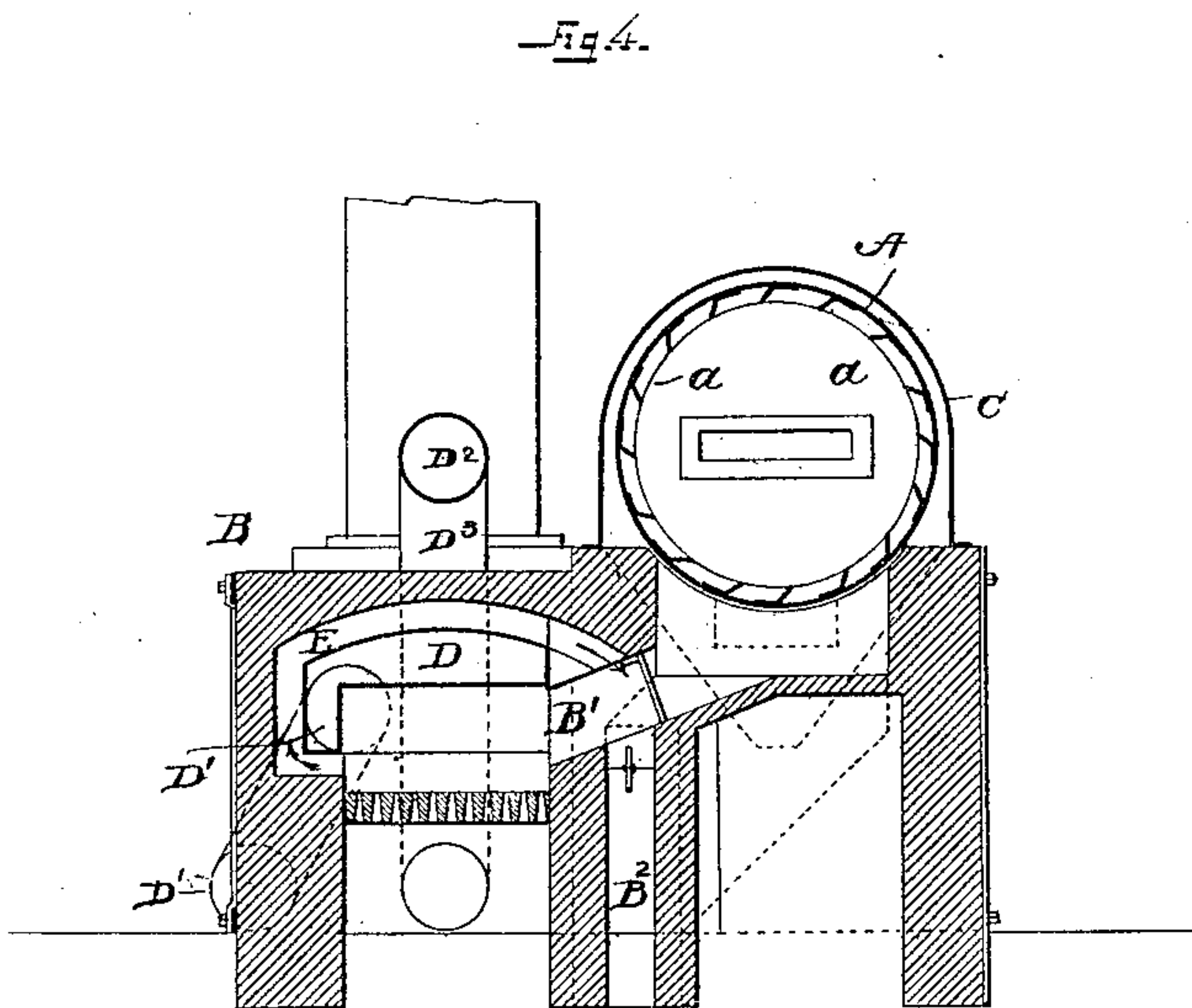
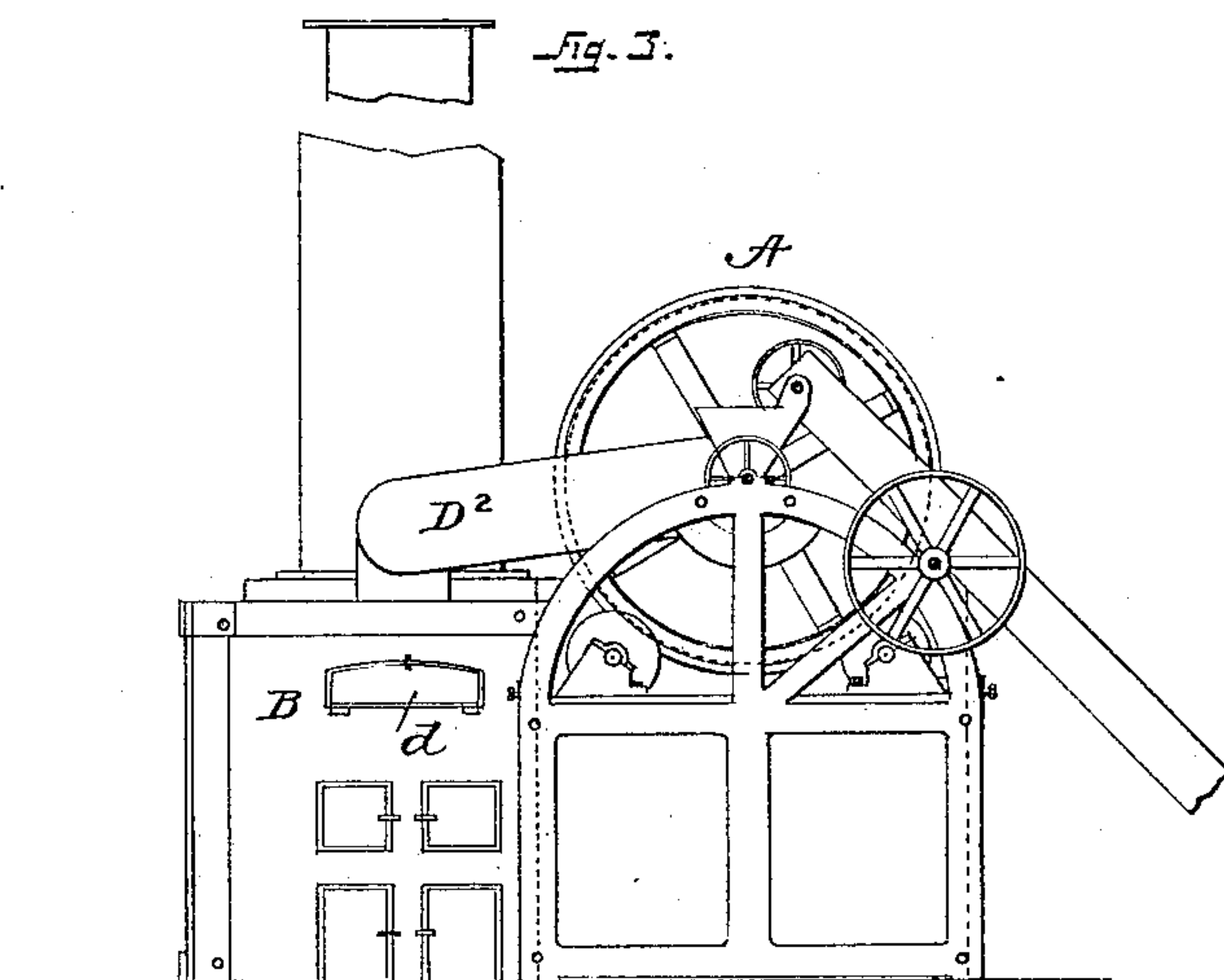
3 Sheets—Sheet 3.

J. H. McDONALD.

GRAIN DRIER.

No. 368,298.

Patented Aug. 16, 1887.



Witnesses:

W. H. Northrup
L. W. Harris

by

Inventor :

J. H. McDonald,

A. S. Dyke,
his Attorney.

UNITED STATES PATENT OFFICE.

JOSEPH H. McDONALD, OF NEW YORK, N. Y.

GRAIN-DRIER.

SPECIFICATION forming part of Letters Patent No. 368,298, dated August 16, 1887.

Application filed November 24, 1886. Serial No. 219,836. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH H. McDONALD, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Rotary Driers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to driers, and particularly to that class designed for operation upon substances in a comminuted state.

The object is to produce a drier of comparatively uncomplicated construction, and one by which a perfect drying of substances can be accomplished.

The invention consists in a rotary drying-cylinder, rifled on its interior by flanges, buckets, or other suitable appliances, by which the material to be dried will be gradually advanced from one end of the cylinder to the other by a rotary motion of the same, and covered by a casing so arranged that there will be a space left between the cylinder and the casing, forming a jacket, and having entrance and exit passages for the admission and discharge of a suitable drying or absorbent aeriform fluid and provision for the admission and discharge of the material operated upon, combined with a furnace having a flue leading directly under the cylinder and extending as an enlarged fire-bay the whole length thereof, with its vent at the end opposite to that at which it first enters, and with a damper and a branch flue, so that the heat and gases can be shut off from it, if required, and be diverted through the branch flue directly up the chimney, the branch flue also containing a damper to prevent the escape of heat and gases through it when they are needed in the process of drying and the other flue is open; furthermore, in combination with a drying-cylinder, a furnace constructed with double walls, or with an air-heating chamber, so that into the space between the walls or into the chamber air can be introduced and there be heated, a conduit leading from this space between the walls, or from the chamber to the end of the cylinder opposite that at which the moist material to

be operated upon is introduced, so that the heated air passes inside the entire length of the cylinder in a direction opposite to that in which the material under operation proceeds, and another conduit passing from the end of the cylinder, into which the moist material is introduced to the chimney-stack, or by a branch to the furnace, thence through main flue or fire-box to chimney-stack, whereby a draft is created through the hot-air chamber, through the conduit leading therefrom to the cylinder, and thence through the entire cylinder; and, finally, in certain details of construction, all as hereinafter more particularly described, and pointed out in the claims.

In the accompanying drawings, forming part of this specification, and in which like letters of reference designate corresponding parts, Figure 1 is a view of the drier in vertical longitudinal section, with the cylinder in elevation, showing the casing, provision for the admission and discharge of the material operated upon, part of the supply-conduit for the drying-fluid, and the furnace with its flue leading under the cylinder into the jacket, and, in dotted lines, the position of pipes and other parts of the apparatus. Fig. 2 is a plan view of the drying apparatus with the cylinder removed, showing the hot-fluid-supply conduit, or that leading from a metallic air-heating chamber in the walls of the furnace to a position at the end of the cylinder opposite to that at which the moist material to be operated upon is introduced; also the fluid-discharge conduit, or that which when the cylinder is in place leads from the end thereof at which the moist material is introduced to the chimney; also the dampers in these conduits, and also, in dotted lines, the situation of the branch conduit, which leads to the lower part, so that, if desired, the discharged aeriform fluid from the cylinder may be used to increase combustion in the furnace, this conduit also having a damper, showing, also, the entrance of the flue to the space beneath the cylinder; also, in dotted lines, the entrance of the flues or passages through which the heated gases pass under and over the air-heating chamber to the flue from furnace or to chimney; also, in dotted lines, the branch flue leading direct to the chimney; and also, in dotted lines, the escape-

passage for the hot air and gases from the opposite end of the space beneath the cylinder. Fig. 3 is an elevation of the end of the apparatus at which the material is fed, showing the means for feeding and rotating the cylinder, also showing the furnace with an entrance-port for the introduction of air into the metallic air-heating chamber, also showing the fluid-discharge conduit leading to the chimney from this end of the cylinder and the branch conduit leading from the fluid-discharge conduit to the furnace. Fig. 4 is a vertical cross-section of the apparatus taken on the line *x x* of Fig. 1, showing the cylinder with the flanges or buckets on its interior, the entrance-passage for the admission of the drying or absorbent aeriform fluid, and the casing covering the cylinder leaving the space between the two; also showing the flue leading directly from the furnace under the cylinder, extending as an enlarged fire-bay the whole length thereof, with its vent at the opposite end and its damper; also showing the branch flue with its damper; also showing, partly in dotted lines, the branch conduit leading to the furnace; also the metallic air-heating chamber with damper in entrance of passage for heated gases to main flue from furnace, and also, in dotted lines, the hot-air conduit leading from this metallic air-heating chamber to the cylinder.

This drier consists, primarily, of a cylinder, A, constructed to rotate on its axis, supported upon proper gearing, and arranged with suitable mechanism connected with power to give it the rotary motion. The interior of the cylinder is rifled by flanges or suitable buckets, *a*, or by other appliances by which the material to be dried is gradually advanced by the rotary motion from one end of the cylinder at which it is introduced by a conveyer in a small pipe surrounded by the exit-pipe to the other, from which it escapes in a dried state. To assist the progress of the material it has generally been found best to set the cylinder upon a slight incline.

Closely adjoining the cylinder, and as near as convenient to the end at which the wet, moist, or undried material is introduced, is constructed a furnace, B, with a flue, B', which leads directly under the cylinder at the end at which the moist material is introduced, and, extending as an enlarged fire-bay the whole length of the cylinder, it has its vent B³ at the opposite end to that at which it enters, and connects with the chimney in any usual manner, or, as shown in dotted lines in Fig. 2 of the drawings, by a flue, B⁴.

The cylinder is covered with a casing, C, so arranged that the hot air and products of combustion from the flue B' can circulate in a space left between the casing and the cylinder, and so warm the entire cylinder. This casing or jacket is provided with packing collars or flanges *c c* near the ends of the cylinder, made with proper material to fit closely to the cylinder and retain the heat within the

jacket, while at the same time the ends of the cylinder project sufficiently to allow its gearing and the mechanism for its rotation to be in the cool atmosphere.

A damper is placed in the flue B', so that the heat and gases can be shut off from beneath the cylinder, if required, and a branch flue, B², is constructed in such manner that under these circumstances the heat and products of combustion can be diverted and drawn directly up the chimney. A damper in this branch flue prevents the escape of heat and products of combustion through it when it is required that these should pass through the flue B' to the place about the cylinder.

The furnace B is constructed with an air-heating chamber, D, preferably metallic, so that air introduced, as by a door or port, *d*, may be heated. This space or chamber constitutes a hot-air box, which forms the arch, side, and back end of the furnace, with passages or flues E under and over it for the circulation of the heated gases, so that air introduced into the chamber D may be readily heated to a high temperature. A conduit, D', leads from this chamber or hot-air box to the end of the cylinder opposite to that at which the wet material is introduced, and by this means the air which has been heated is conducted to the cylinder. This passage D' constitutes a hot-air-supply conduit. Another conduit, D², leads from the end of the cylinder into which the wet material is introduced to the chimney-stack, and by this means a draft is created through the hot-air box, through the hot-air-supply conduit, along the entire length of the cylinder, and thence to the open air. The passage D² constitutes a fluid-discharge conduit.

The pipe E, containing a screw conveyer, *e*, leads from a hopper, E', through the beginning or an elbow of the fluid-discharge conduit, and as the gases and vapors which find their exit through this conduit will be hot, the material to be dried as it passes through the feed-pipe E will be heated before its introduction into the cylinder, thus utilizing waste heat, and presenting the material in a condition immediately to commence parting with its moisture. Furthermore, by the arrangement of the hot-air-supply conduit and the fluid-discharge conduit with the cylinder, a current of heated air passes through the cylinder in a direction opposite to that to which the material is carried in the drying process, and this heated air, like a sponge, absorbs the moisture from the material under treatment and carries it away.

From that part of the fluid-discharge conduit which leads to the chimney-stack there may be a branch, D³, leading into the lower part of the furnace fire-box, so that, if desired, the moistened air and gases given off from the material under treatment may be led to the furnace to increase combustion therein. If this branch conduit be employed, proper dampers should be placed therein and in the fluid-discharge conduit, so that the moist air and

gases given off from the material in process of treatment can be sent directly to the stack of the chimney, or into the fire-box, as desired.

If the evaporation of the moisture in the material treated requires a greater amount of heat than can be supplied by a single furnace, a second furnace may be built adjoining the cylinder at the same end as the one shown, and on the opposite side, or at the other end of the cylinder, care being taken that the flues are so arranged that no conflict in the draft shall arise.

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

1. A jacketed rotary drying-cylinder rifled on its interior by flanges or buckets, having entrance and exit passages for the admission and discharge of a suitable drying or absorbent aeriform fluid and provision for the admission and discharge of the material operated upon, in combination with a furnace having a flue containing a damper and leading to the space about the cylinder, and a branch flue, also containing a damper and leading directly to the chimney, the furnace having an air-heating chamber, and there being a conduit leading from the air-heating chamber to one end of the cylinder, and another conduit pass-

ing from the other end of the cylinder to the chimney-stack or by a branch to the furnace, substantially as and for the purpose described.

2. The combination, with a jacketed drying-cylinder, of a furnace constructed with an air-heating chamber having passages or flues under and over it, a conduit leading from the chamber to the end of the drying-cylinder, and another conduit leading from the cylinder directly to the chimney, both conduits being provided with dampers, whereby the heated air may be passed into the cylinder and directly up to the chimney or to the fires and flues B' B², into which the products of combustion may pass, both flues being provided with dampers, whereby the products of combustion employed in heating the chamber may be used to heat the exterior of the cylinder, and thus aid the hot air supplied to the interior for drying or be passed off direct to the chimney, substantially as described.

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

JOSEPH H. McDONALD.

Witnesses:

WM. H. STOCKWELL;
ROBT. M. JOHNSTON.