

(No Model.)

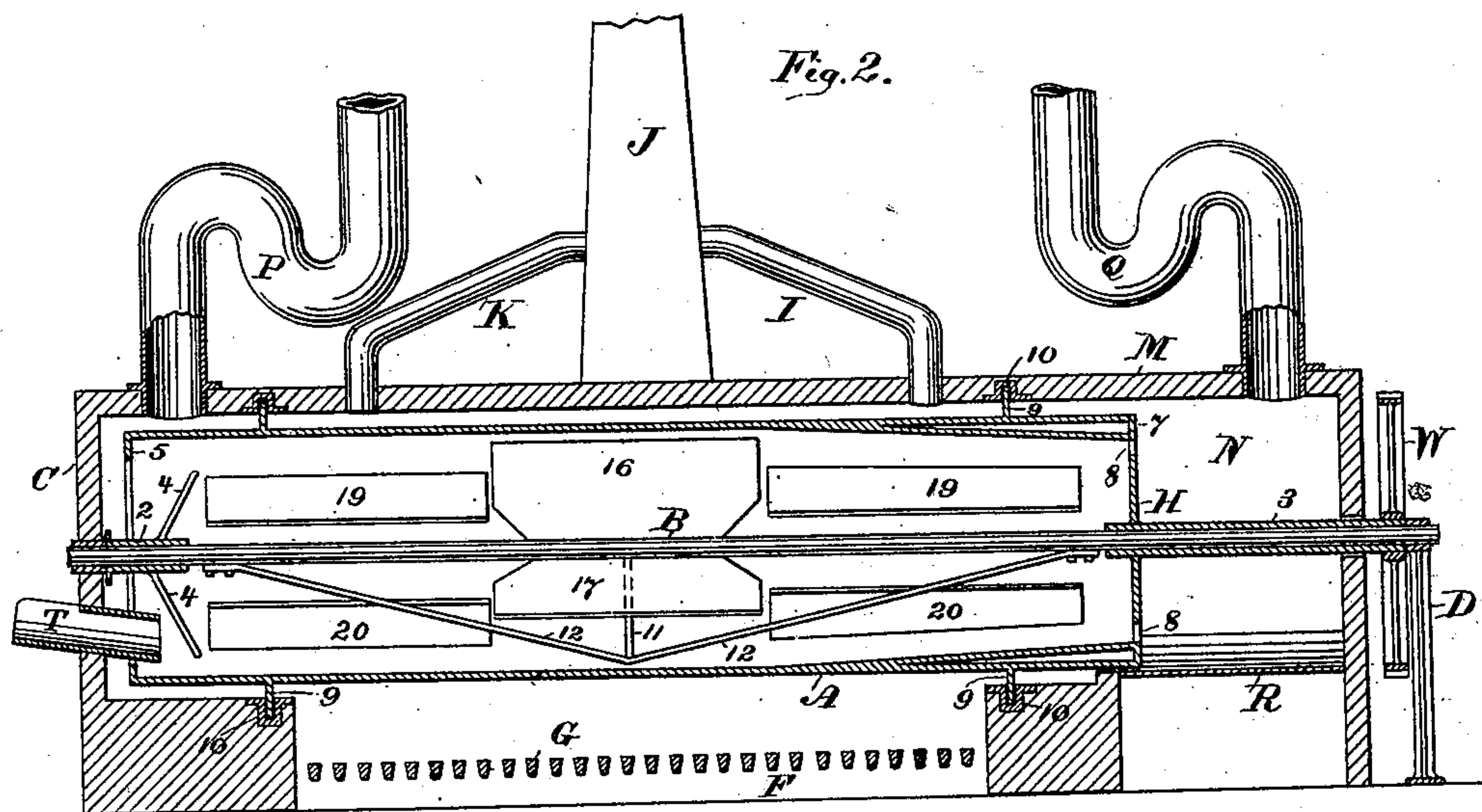
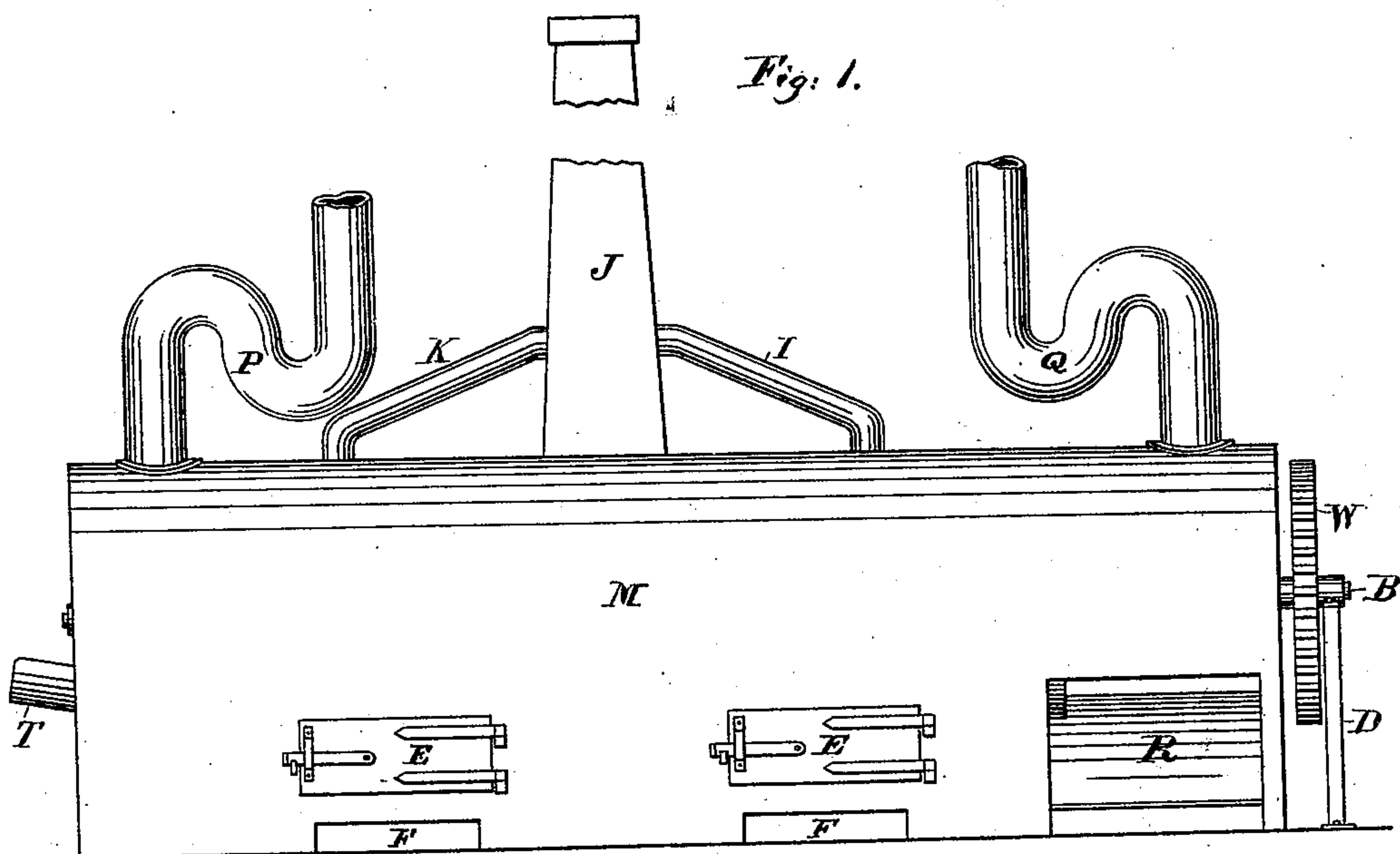
2 Sheets—Sheet 1.

T. E. WORTHINGTON.

Rotary Drier.

No. 230,980.

Patented Aug. 10, 1880.



Attest:

Geo. H. Graham.
L. C. Crowell.

Inventor:

Thomas E. Worthington,
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attys.

2 Sheets—Sheet 2.

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UNITED STATES PATENT OFFICE.

THOMAS E. WORTHINGTON, OF NEW HAVEN, CONNECTICUT, ASSIGNOR OF
ONE-HALF OF HIS RIGHT TO ANDREW J. RAMSDELL, OF SAME PLACE.

ROTARY DRIER.

SPECIFICATION forming part of Letters Patent No. 230,980, dated August 10, 1880.

Application filed June 23, 1880. (No model.)

To all whom it may concern:

Be it known that I, THOMAS E. WORTHINGTON, a citizen of the United States, residing in the city of New Haven, county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Rotary Driers, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

In said drawings, Figure 1 illustrates a front elevation of an apparatus embodying my invention. Fig. 2 shows a longitudinal sectional elevation thereof; Fig. 3, a horizontal section; Fig. 4, an elevation of the feeding end, and Fig. 5 a cross-sectional elevation, the last two figures being made to an enlarged scale.

Rotary driers as heretofore constructed have many defects, the principal one of which arises from structures that permit the products of combustion to have contact with the material being dried, whereby great injury or destruction of the latter results.

It is the main object of my improvements to overcome this and other defects both in structure and operation of rotary driers; and the invention consists in providing the cylinder with cut-off rings, whereby the heating medium is confined so that while passing around the cylinder it cannot escape toward the ends thereof; in mounting the cylinder upon an inclined axis to cause the feeding movement of its contents; in a supporting-shaft strengthened by a sustaining-truss; in providing the delivery end of the cylinder with an internal lining; and in specific constructions of parts too fully hereinafter set forth to need preliminary description.

The cylinder A, through which the material to be treated is automatically carried, is mounted to revolve upon an inclined axis or shaft, B, that is fixed in one end wall, C, of the brick-work or other suitable housing, M, for the furnace, and at the other in a standard, D, the latter being provided to admit the mounting of a driving-wheel, W, in a suitable position to receive motion from a driving mechanism. This cylinder A is provided with journals 2 3, by which it is seated so as to ro-

tate upon said shaft B. The journal 2 is secured to the cylinder by means of stay-rods 4, whereby the head of said cylinder may be diminished so as to consist of a strengthening-flange, 5, and thus provide a feeding-opening through which the stationary feeding-trough T may extend. The journal 3 is secured to the opposite end of the cylinder by stay-rods 6, that connect the cylinder-head H with its flange 7, between which head and flange an eduction opening or passage, 8, is provided for the treated material. This cylinder is mounted within the walls or housing M of a furnace, that is provided with doors E, draft-flues F, grate or fire surface G, and with conducting-pipes I K, leading from the arch of said housing to the chimney J.

One great difficulty existing in the structure of such rotary driers is the difficulty of confining the products of combustion so that the heat and smoke from the fire shall not only pass around the cylinder to heat the same and be conducted out through the chimney, but at the same time be prevented from following the cylinder longitudinally, and thus becoming mixed with the material being introduced into the cylinder for treatment or delivered therefrom in its finished condition. When the products of combustion thus escape or are conducted laterally, so that they may combine with the material undergoing treatment, they either destroy that material or so injure it as to greatly reduce its value. This improper action is detrimental to all materials treated, but is especially injurious to malt and scrap.

By my construction this defective operation is entirely prevented, and the means whereby it is accomplished consists in providing the cylinder-body with the annular rings 9, which embrace the exterior surface of the cylinder A and protrude therefrom so as to run in circular bearings 10, provided by cast-iron rings set in the brick-work, which rings might have substituted for them recessed bearings formed in the brick-work. These rings 9 act as cut-offs, and form, with the periphery of the cylinder A, a practically-tight compartment, within which the heat is confined, and one

that will direct the products of combustion around said cylinder to the pipes I K, thus properly directing the heating medium, so that it is not only perfectly utilized but at the same time prevents improper egress of the injurious gases and products of combustion at the ends of the cylinder, where they would have contact with the material being treated and produce a deleterious effect.

At its delivery end the apparatus is provided with a chamber, N, inclosed by the housing M, in which a fixed inclined plate, R, is arranged so as to underlie the end of the cylinder A, and thus receive the material discharged therefrom and conduct it from the apparatus.

The shaft B of the cylinder, in consequence of the weight it is required to support, and for the reason that it must be of such small dimensions as not to greatly abridge the working-space within said cylinder, is provided with a supporting truss or brace, which, in the present instance, is composed of a post, 11, and a brace, 12, the latter having its ends riveted to the shaft and resting centrally upon the post 11, and though the whole truss or brace is shown as depending from the shaft, it may bear any other relation to it; but as arranged it not only performs the function of adequately strengthening the shaft, but co-operates to some degree with the stirrers with which the cylinder is provided. These stirrers consist of stationary wings 16 17 18, more or less in number, that are fixed to project radially from the shaft B to a suitable distance toward the inner periphery of the cylinder, and of a suitable number of similar wings, as 19 20 21 22, that are fixed to and project centrally from the interior walls of the cylinder. The wings 16 17 18 occupy a central position, while the wings 19 20 21 22 are arranged near the ends of the cylinder, the first-named wings being held stationary, while the latter move with the cylinder. The purpose of these wings is to cause the material fed into the cylinder to be stirred or turned as it is passing through the same, in order that all parts of it may be equally exposed to the action of the heat, and thus cause the mass to be uniformly dried, while the overheating or burning of any portion of it is prevented. It may therefore be observed that any number, shape, or form of both stationary and movable wings may be adopted, and that a spiral arrangement, in some cases imparting a constantly-increasing feed movement, may be adopted when the machine is to be used in the treatment of material that requires to have a more positive forward movement through the cylinder than will be effected by the mere inclination of said cylinder.

In order to adapt the apparatus to the treatment of material that is readily injured by overheating, as malt and the like, the delivery end of the cylinder is provided with an internal lining, 25. This lining will extend from

about the center of the cylinder to the head H, as practice and the character of the said material may require, and thus provides a supporting-surface, between which and the medium an air-space is formed, which air-space affords the necessary protection from overheating or burning the material, which, in being conducted to this point, has been ridded to a great extent of its moisture and become so dry as to be easily affected by the heat, and therefore very liable to injury if subjected to the same degree of heat during its entire passage through the cylinder. By this contrivance I am enabled to keep up the same degree of heat throughout the furnace and yet regulate its application to the material within the cylinder.

In operating the apparatus, rotary motion of proper speed suited to the material to be operated upon is imparted to the cylinder B by properly driving the wheel W. The material to be dried is then fed, in suitable quantity, into the receiving end of the cylinder by means of the trough T. As soon as it rests upon the bottom of the cylinder it takes up its rotary motion, and by means of the wings 19 20 21 22 and the inclination of the cylinder is gradually moved toward the delivery end of the cylinder, thus passing over the furnace and being stirred or turned in such passage by the combined action of its rotative movement through the wings 19 20 21 22 and the arresting action of the wings 16 17 18. When it is first entered into the cylinder it is surcharged with moisture, which is evaporated by the heat, and this evaporation is increased and becomes complete by the time the material reaches the delivery end of the cylinder, where it is discharged through the openings 8, and falls upon the inclined plate R, and may thence be conveyed in any common manner for packing or use.

The products of evaporation rising from the material under treatment pass out of either end of the cylinder, and are conveyed to the chimney J or otherwise discharged by means of the pipes P Q, which are provided with traps, as shown, to prevent the water of condensation flowing back, and thus discharging upon the material being treated.

Having thus described my improvements, what I claim is—

1. In a drying-machine, the combination, with the housing of the furnace and the rotating cylinder, of cut-off rings, as 9, whereby the products of combustion are confined, so as not to escape at the cylinder ends, substantially as described.

2. The combination, with the cylinder, of a stationary shaft strengthened by a truss, substantially as described.

3. A drying-machine the rotating cylinder whereof is provided at its delivery end with an internal lining, as 25, whereby an air-space is provided, as set forth.

4. The combination, with the drying-cylinder,

der, of its fixed wings, as 16 17 18, and moving wings, as 19 20 21 22, substantially as described.

5 The combination, with the cylinder and furnace housing, of the rings 9 and seats or bearers 10, substantially as described.

In testimony whereof I have hereunto set

my hand in the presence of two subscribing witnesses.

THOMAS E. WORTHINGTON.

Witnesses:

CHAS. S. HAMILTON,

SAMUEL H. BARROWS.