

(No Model.)

2 Sheets—Sheet 1.

E. ROBINSON.

APPARATUS FOR DRYING TEA, SUGAR, OR OTHER SUBSTANCES.

No. 515,446.

Patented Feb. 27, 1894.

Fig 1.

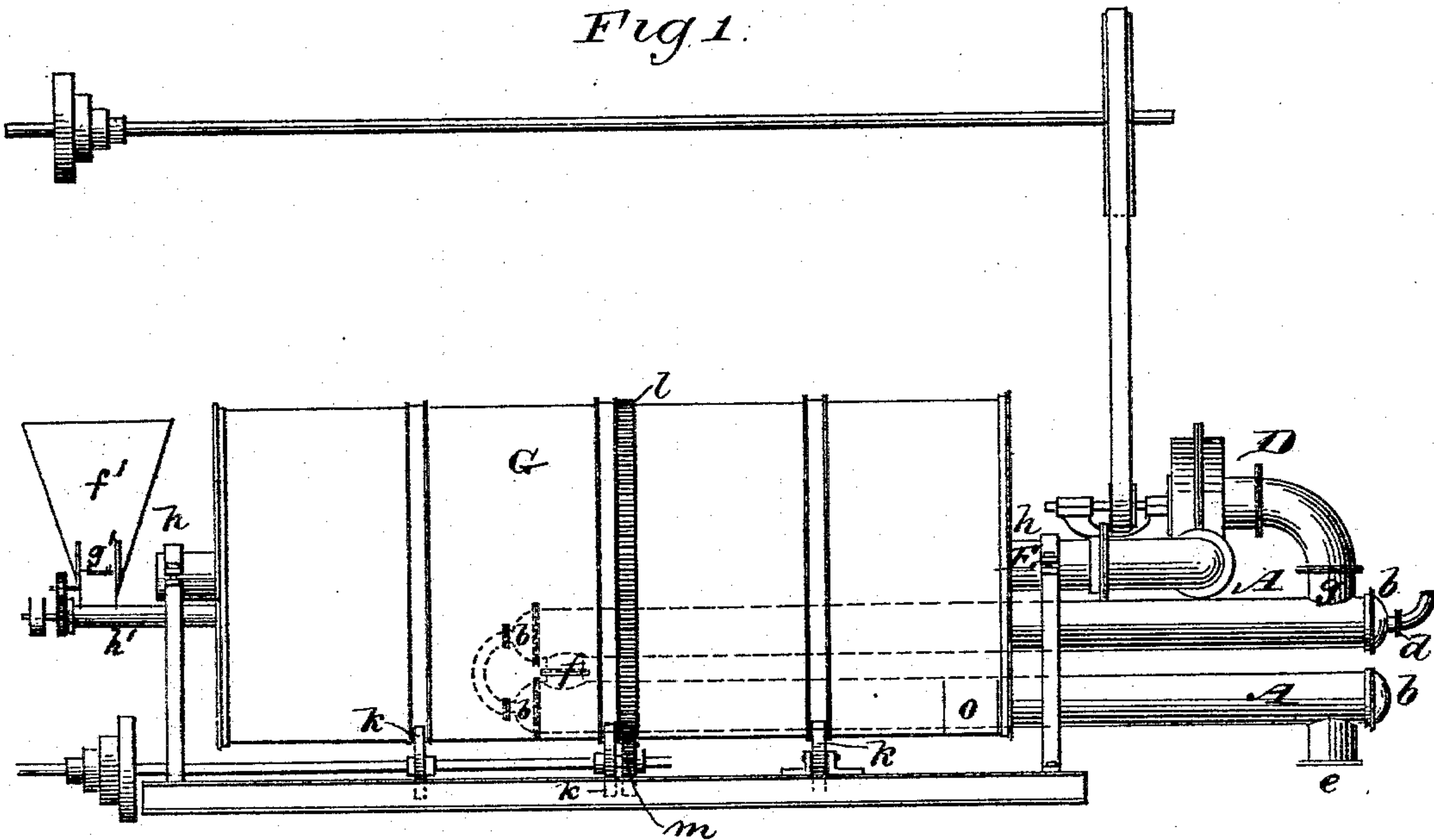


Fig 2.

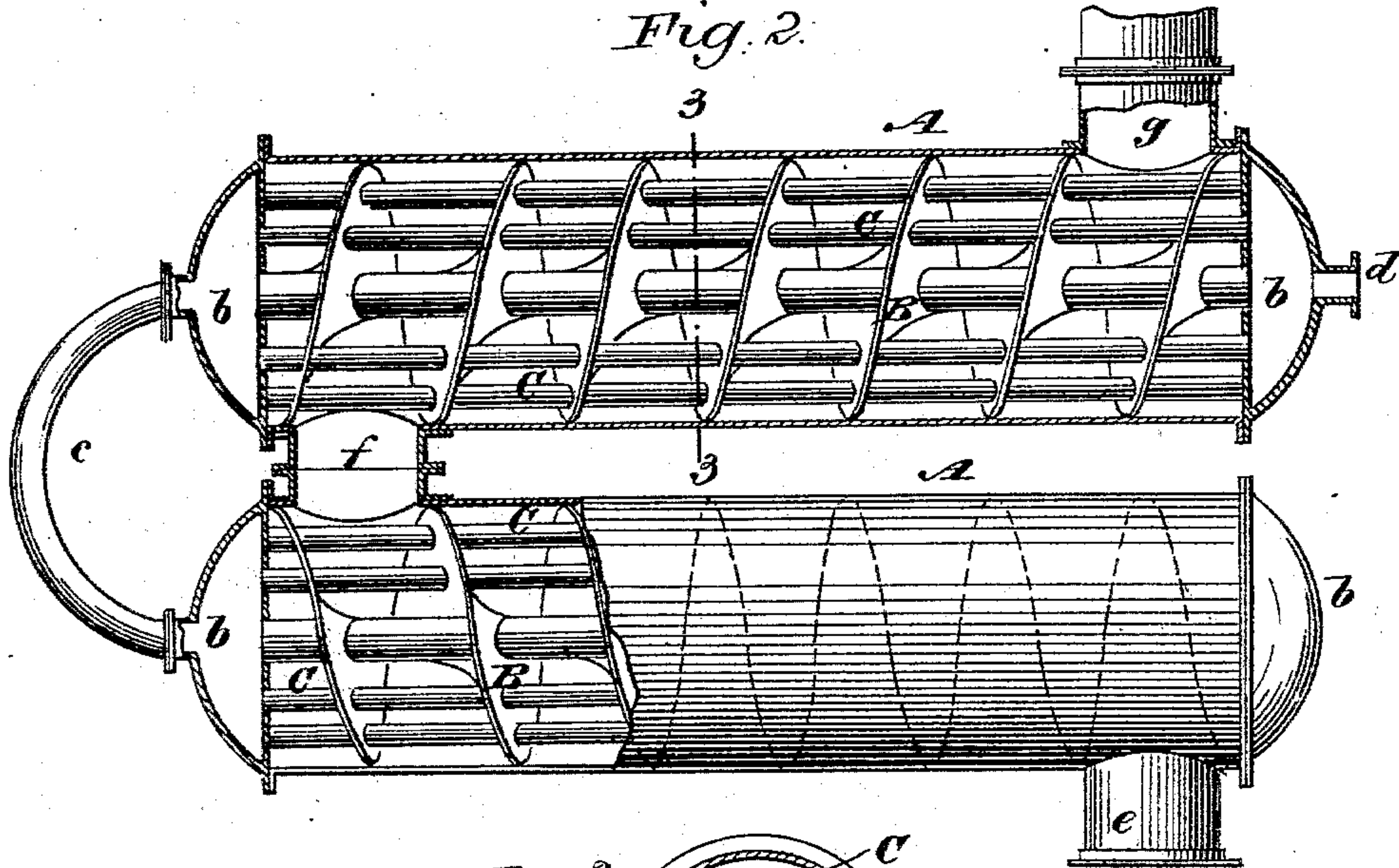
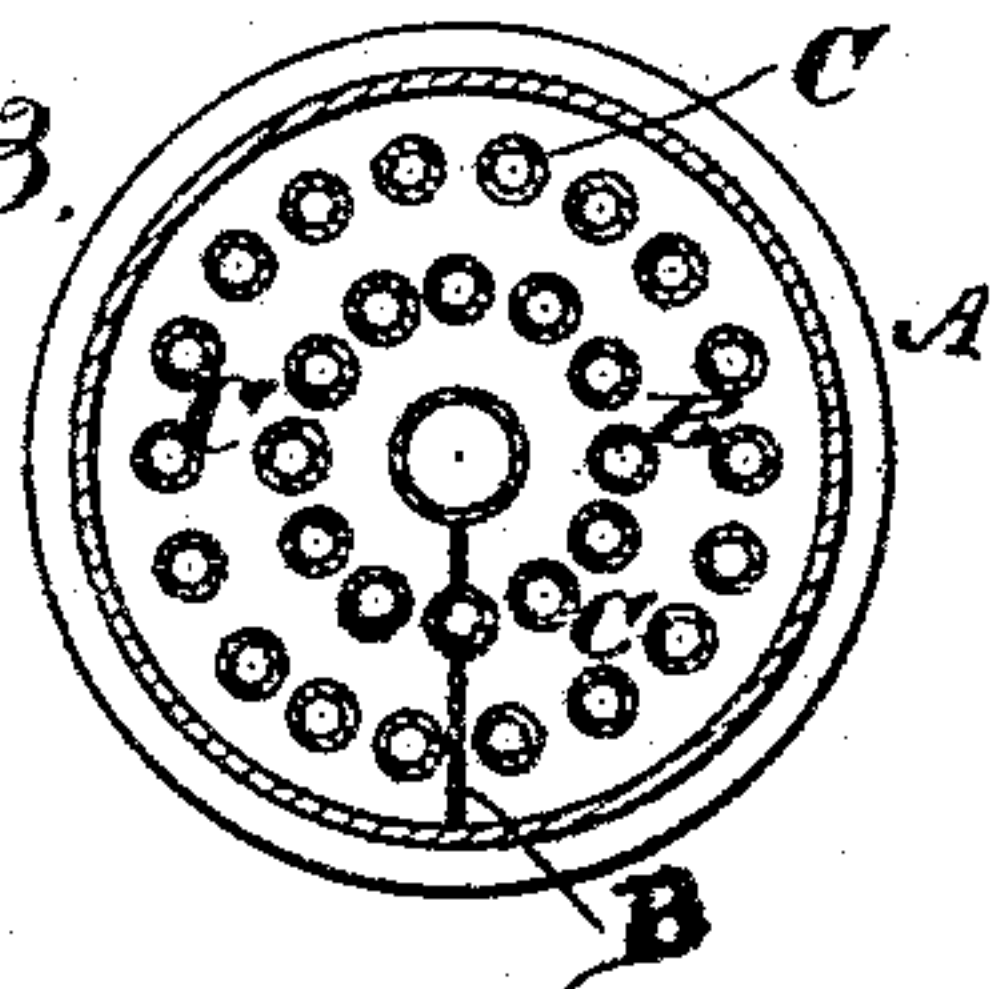


Fig 3.



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Fig. 4.

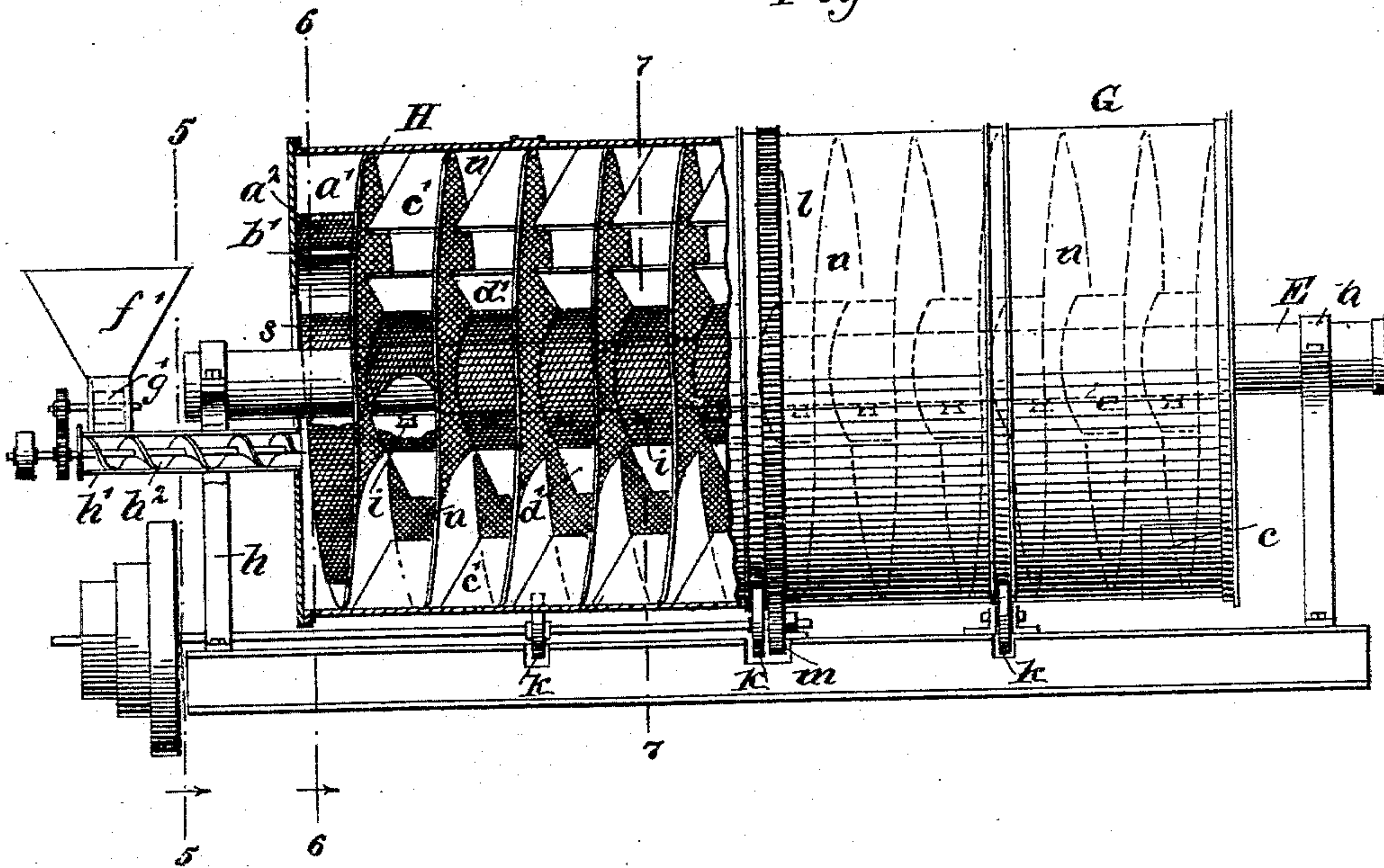


Fig. 5.

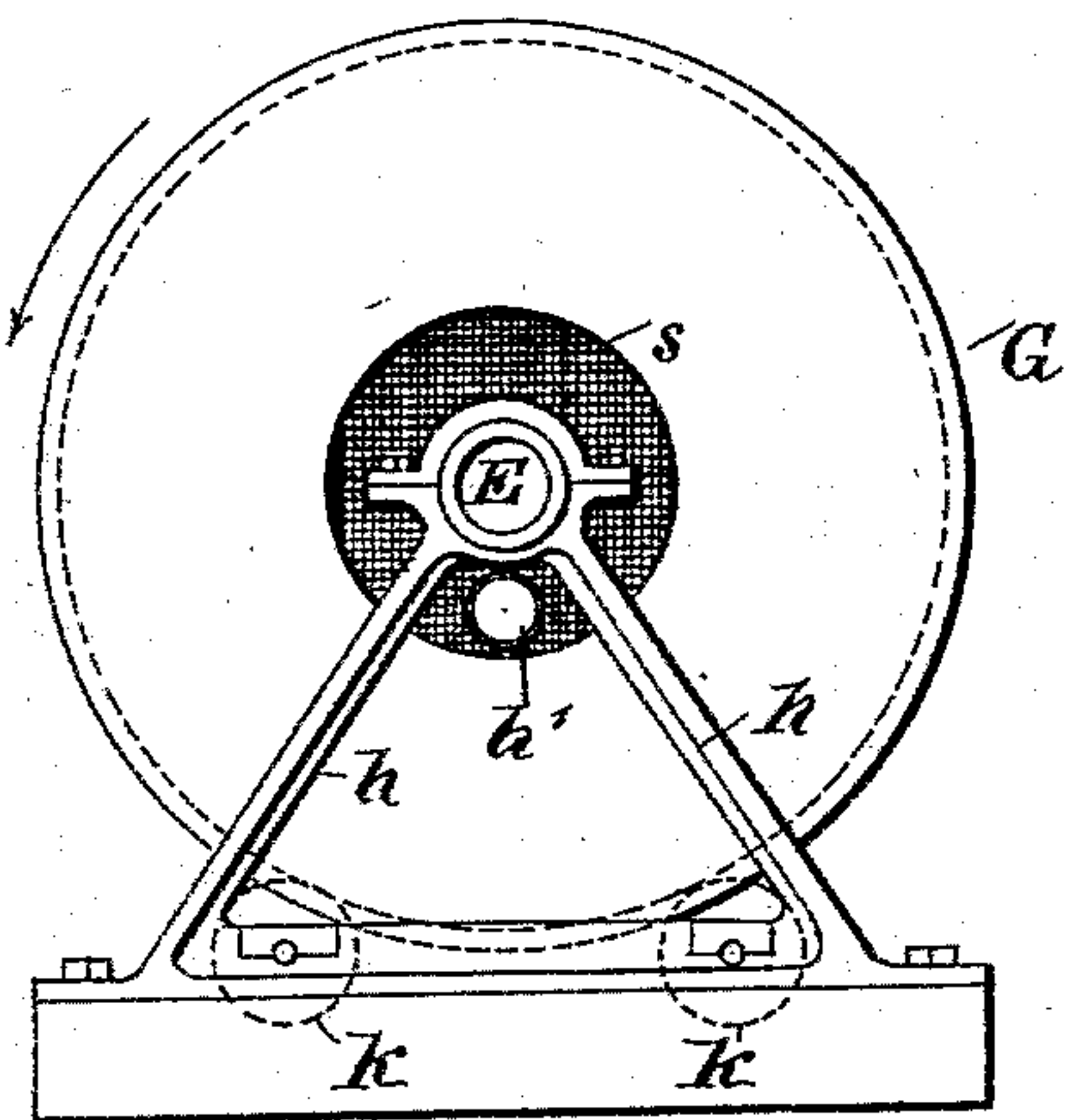


Fig. 6.

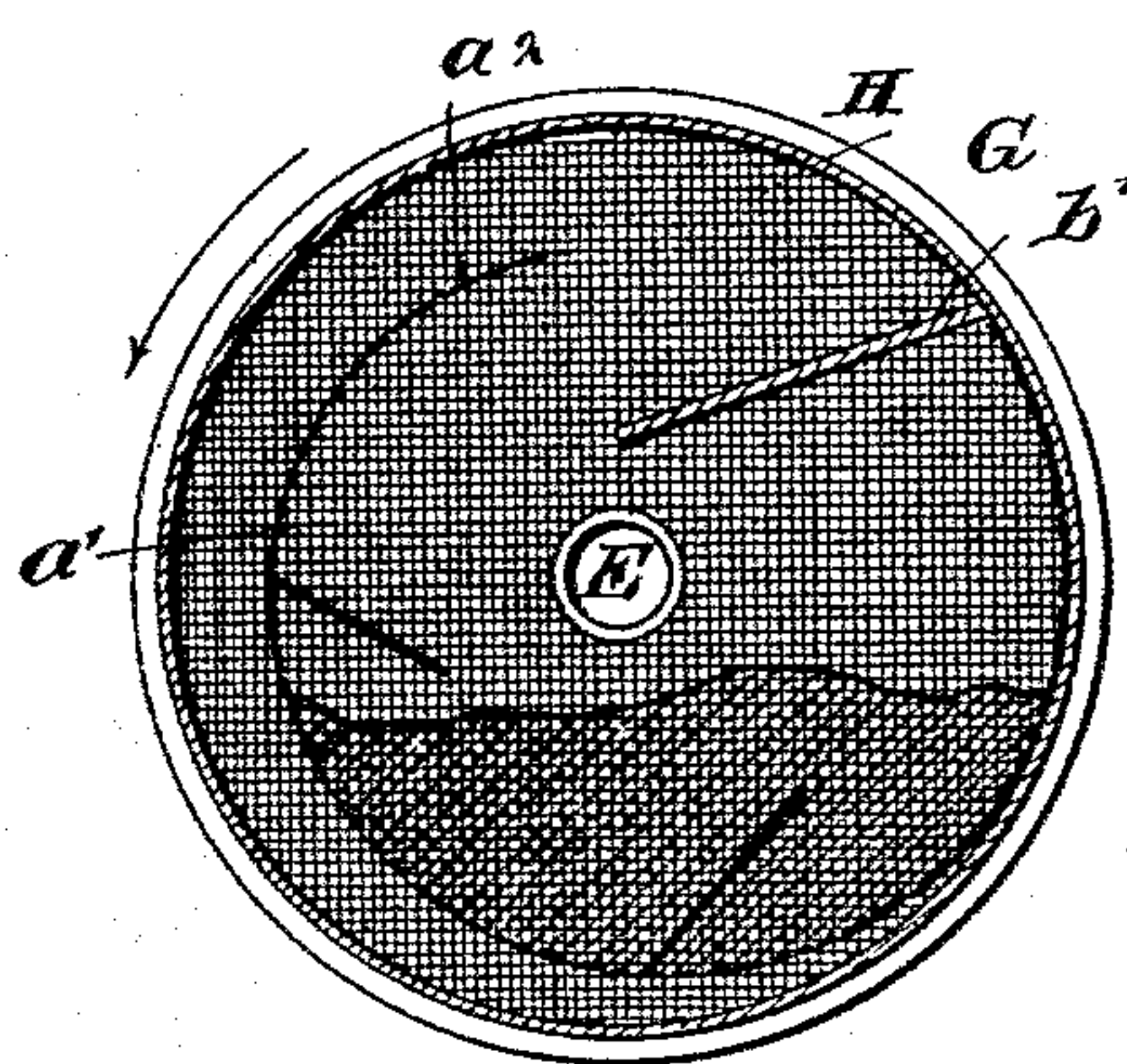
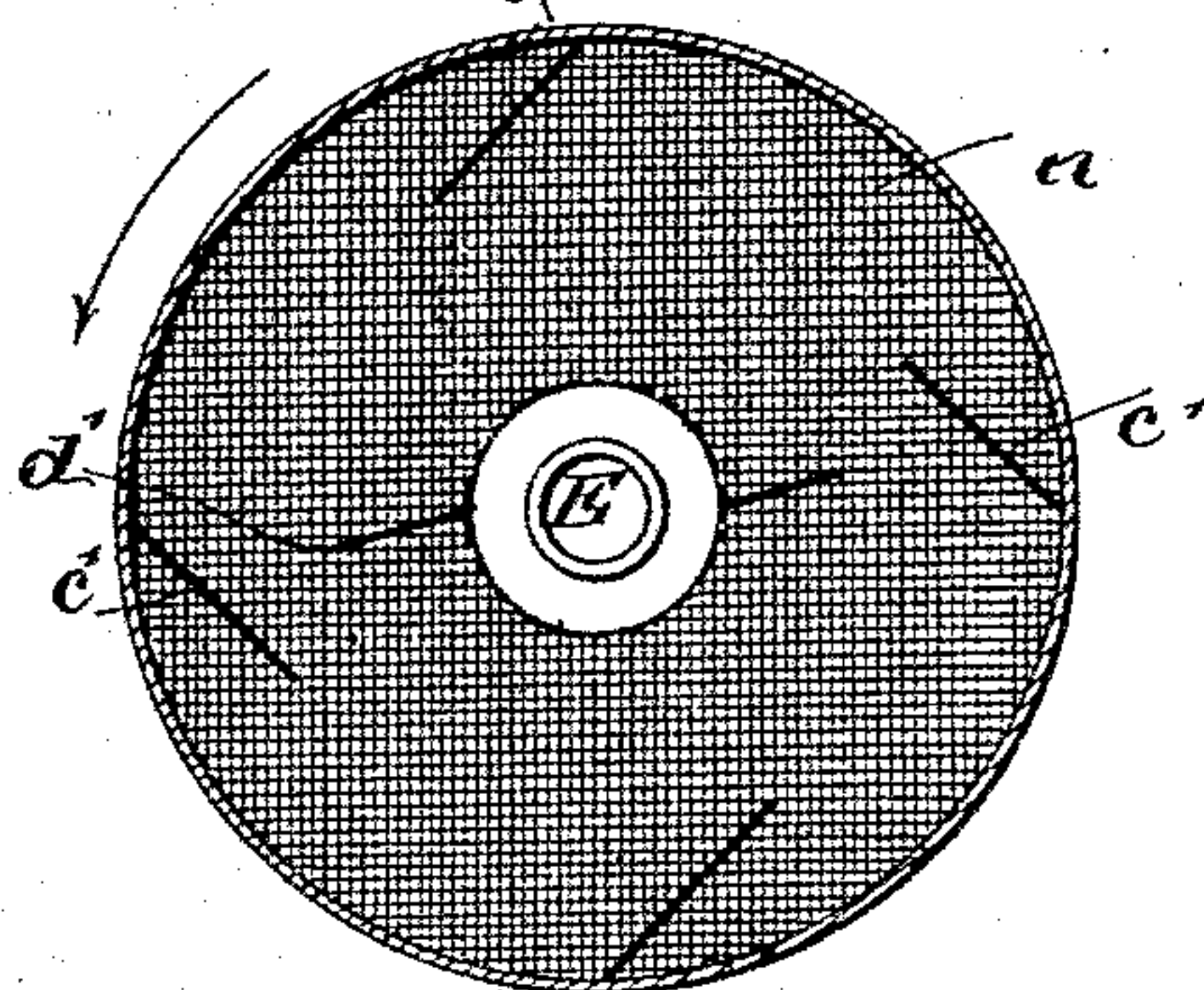


Fig. 7.



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EDWARD ROBINSON, OF LONDON, ENGLAND.

APPARATUS FOR DRYING TEA, SUGAR, OR OTHER SUBSTANCES.

SPECIFICATION forming part of Letters Patent No. 515,446, dated February 27, 1894.

Application filed August 29, 1892. Serial No. 444,410. (No model.)

To all whom it may concern:

Be it known that I, EDWARD ROBINSON, of 4 Castelnau Gardens, Barnes, London, S. W., England, have invented a new and useful Apparatus for Drying Tea, Sugar, or other Substances, of which the following is a full, clear, and exact description.

This invention relates to apparatus for drying tea, sugar, grain and other substances.

10 The invention consists in a drying apparatus of novel construction in which volumes of heated air are obtained by means of a spirally constructed heater, and driven into a revolving spirally constructed drier adapted to carry and pass the material to be dried through it, substantially as hereinafter described and more particularly pointed out in the claims.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a side elevation of the apparatus complete; Fig. 2 a partly sectional and broken side elevation, upon a larger scale, of that portion of the apparatus which provides for the heating of the air to be used in the drier; and Fig. 3 a transverse section upon the line 3—3 in Fig. 2, of one of the tubular cylinders of the heater. Fig. 4 is a half or partially sectional side elevation of the drier and feeding devices; Fig. 5 a transverse section upon the line 5—5 in Fig. 4. Fig. 6 is a transverse section mainly upon the line 6—6 in Fig. 4; and Fig. 7 a transverse section mainly upon the line 7—7 in Fig. 4.

35 The air heating portion of the apparatus is constructed mainly as follows: A A are parallel cylinders or shells each of which is fitted internally with a spiral divider B resembling in shape an Archimedean screw and extending throughout the diameter and length of the body of the shell. Tubes C of brass or other suitable material are arranged to pass through the spiral dividers in directions parallel to the axes thereof, and the ends of said tubes are expanded into the tube plates at the ends of said shells or otherwise made steam tight. These tubes C pass through orifices throughout the whole length of the spiral dividers B, and the shells or cylinders A A are provided with distributing chambers b at their ends, two of which at adjacent ends are connected by a pipe c, while the one of

them at the opposite end is provided with a steam inlet d, whereby steam is made to circulate through the series of tubes in both cylinders or shells for the purpose of heating the air to be passed to the drier, which air enters at an inlet e near the one end of one of the cylinders A, passes in a spiral course and about the spiral divider B in said cylinder, thence out through a branch pipe f to one end of the air space in the other cylinder A, through or about the spiral divider B in that cylinder, and out through an outlet g at the other end of such cylinder, from whence it may be drawn by a fan D to supply the drying portion of the apparatus. Instead, however, of the air being exhausted from the heater to supply the drier, it is evident that the air may be driven through the heater for that purpose; nor is the heating portion of the apparatus restricted to two cylinders fitted with spiral dividers and tubes running through the dividers, which virtually form a unit, the same as if one cylinder of twice the length similarly fitted were used, and it will suffice to speak of the two cylinders as one. In the fitting up of this heater it is preferred to arrange a central tube of larger size through the cylinder and its spiral divider and to place the other tubes of smaller size in circles around it. The number and size of the tubes however must be adapted to the work to be done. By means of the spiral divider, the air to be heated is made to circulate around the tubes and its passage through the heater is prolonged through its spiral course of travel, so that large volumes of air can be heated to about the same temperature of the steam passing through the tubes, if required.

Any suitable means can be employed for carrying off the water of condensation, which water may again be used in the boiler.

If desired, instead of supplying the heat by steam, the gaseous products of combustion from a furnace may be passed through the tubes of the heater, and if advisable, be returned through a flue on the outside of the cylinder. It is unnecessary, however, here to describe in detail these and other changes and details or how the heater may be set in brickwork, as others skilled in the art of utilizing heat as derived from furnaces either directly or through the intervention of steam, live or exhaust, will readily understand how such may

be done. The main feature of this part of the apparatus is the action of the spiral divider which prolongs the travel of the current of air while being exposed to the action of the heat or heated gases or steam, thus utilizing and economizing the absorption of the heat to the greatest extent, but this advantage would be lost or largely diminished were such heated current of air not applied or distributed and imparted to the material to be dried in a like prolonged and efficient manner, consequently I cause said heated current of air to be similarly applied by subjecting the material to be dried to a confined spiral course of travel while under exposure to the heated current or currents of air passing through the drier as the same is transferred thereto, by the fan D, for instance, for distribution within and through the material to be dried.

The construction of the drier or drying portion of the apparatus will now be described in connection with the operation of the same. Thus, the blast or current of heated air passes, as it is sucked or driven from the heater, into a horizontal tube E, carried by opposite end standards or bearings *h h*, which tube is provided with orifices or nozzles *i*, for distribution of the heated air within a cylinder G, carrying the material to be dried as hereinafter described, said tube being concentric with the cylinder. This cylinder is a revolving one, carried upon rollers *k k*, and may be driven by a circular rack *l*, on said cylinder in gear with an operating pinion *m* on a shaft below, which may be driven by pulleys from an overhead shaft that may be used to also drive the fan D as shown in Fig. 1, but these driving arrangements may be changed as desired. The apertured tube E is stationary and its nozzles *i* are arranged at equal distances apart for the uniform distribution of the heated air within the cylinder.

Loosely surrounding the central tube E and attached to the shell of the revolving cylinder G is a spirally constructed divider H, running throughout the length of the cylinder and constructed to form a continuous series of spirally constructed and connecting chambers *n n*, preferably made of reticulated material and having intervening spaces between them to provide for the free circulation of the heated air within the cylinder, and of a suitable pitch to provide for the onward movement of the material to be dried through the cylinder for ultimate delivery through an opening *o* at the one end of the cylinder.

The material to be dried is admitted through an opening *s* at the opposite end of the cylinder near to the center tube E, and is received within a round upright or transverse chamber *a'*, bounded by a partition *a²* virtually forming an end extension of the spiral divider H said chamber being also provided with a diaphragm partition *b'*, attached to the outer shell and vertical end of the cylinder, nearly at right angles to its axis of rotation, and at each turn of the cylinder the material

introduced is carried upward by the diaphragm and is made to fall into the first of the spiral series of chambers *n* for onward travel through the whole series of continuous spiral chambers toward the delivery end of the cylinder. These chambers are divided into four, more or less, equal spaces by means of inward angular or tangential diaphragms *c'* attached to the periphery of the cylinder, and supplemented by a second series of smaller diaphragms *d'* placed nearly opposite the first series *c'* and secured to the chambers *n* near to the center air distributing tube E. These several diaphragms are placed at such angles as to carry the material being dried round in a complete circle at each revolution of the cylinder, thereby gently passing said material from an upper elevation into the next succeeding spiral chamber and so on throughout the whole length of the spiral divider H and only advancing the material one quarter of each spiral circle or portion of the divider at each turn of the cylinder. By these means the material being dried is slowly carried through the whole series of spiral chambers or baskets, equally distributed round the cylinder and kept in constant motion and allowed to trickle down in thin streams freely exposed to the drying action of the heated air passing through the cylinder, and the contents of each spiral section of the divider is delivered in succession at each turn of the cylinder through the terminal delivery outlet *o* in the cylinder.

The several continuous spiral chambers *n* of the divider H are made of wire of such gage, texture or mesh as may be best suited to the nature of the commodity to be dried; or thin perforated plates, such as of tin or zinc for instance, may be used in the construction of said chambers, the main object being to secure the most free action of the current of heated air on the material under operation, compatible with such mesh or texture, as will prevent the material from falling through said chambers.

Suitable special openings may be made at both ends of the cylinder G, or central openings similar to the one *s*, shown, be provided at opposite ends of the cylinder, to admit of the escape of air charged with moisture from the material being dried and which will be rapidly expelled by the incoming heated air from the central tube E.

By employing pulleys of different sizes as shown in the drawings, the apparatus can be driven at any required speed, so as to pass the material quickly to be dried, or to prolong the operation according to the time required to complete the work.

A self acting contrivance is applied to feed the material into the cylinder G which can be regulated at will. It consists of a hopper *f'* in which revolves a corrugated drum *g'* or tines as the case may require, feeding the material into a horizontal tube *h'* fitted with a small spiral propeller *h²*. This feeding tube

is placed in proximity to the central tube E so as to drop its contents into the receiving chamber of the spiral divider H. But no claim is here made to any special feeding device of the material, and for heavy granular matter, such as will readily run down a chute, other and simpler feeding contrivances may be used.

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

15 1. In an apparatus for drying granular and other substances, the combination with a rotatable drying cylinder having a receiving compartment at its forward end, and a spiral divider secured to said cylinder and adapted to be rotated therewith, of a device for feeding the material to the receiving compartment near the center thereof, a diaphragm secured 20 within said receiving compartment and adapted to pass the material to the spiral divider, and a series of diaphragms within the reticulated spiral chambers for carrying the material upward and conveying it from one end 25 of the cylinder to the other, substantially as specified.

30 2. In an apparatus for drying granular and other substances, the combination, with a rotatable drying cylinder having a receiving compartment at its forward end, and a spiral divider secured to the said cylinder and adapted to be rotated therewith, of a device for feeding the material to the receiving compartment near the center thereof, a diaphragm secured 35 within the said receiving compartment and adapted to pass the material to the spiral divider, a series of diaphragms secured to the said cylinder and projecting inwardly therefrom between the convolutions of the spiral divider, and another series of diaphragms secured to the central portion of the said spiral divider, substantially as and for the purpose 40 specified.

45 3. In an apparatus for drying granular and other substances, the combination, with a rotatable drying cylinder and a reticulated spiral divider secured within the same, a receiving compartment at the forward end of the cylinder and a diaphragm adapted to pass

the material to the said reticulated spiral divider, of a central heated air distributing tube having nozzles or apertures for the distribution of said air, and means for feeding the material to the receiving compartment near the center thereof, substantially as specified. 50 55

4. In an apparatus for drying granular and other substances, the rotatable drying cylinder provided internally with a spiral reticulated divider rotating in common with said 60 cylinder, and constructed to form a continuous or connected series of spiral reticulated chambers adapted to carry and advance the material to be dried through said cylinder, and provided with a receiving compartment 65 or chamber at its forward end having a diaphragm adapted to pass the material to the first of the series of spiral reticulated chambers, in combination with a central heated air distributing tube within the cylinder, hav- 70 ing nozzles or apertures for the distribution of said air, and a series of diaphragms within the reticulated spiral chambers, operating to agitate and control the movement of the material from each spiral reticulated chamber 75 to the next in succession, substantially as specified.

5. The combination of the rotating drying cylinder G, with its internally fitted spiral reticulated divider H, constructed to form a 80 continuous or connected series of reticulated spiral chambers adapted to carry and advance the material to be dried through said cylinder, the central heated air distributing tube E, within the cylinder, having nozzles 85 or outlets *i*, and an air heating cylinder or structure A, provided with a spiral divider B, arranged in direction of its length, and with a series of steam or other heating tubes C, passing through said spiral divider B, and 90 means for passing the current of heated air through the drying cylinder, essentially as described.

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Witnesses:

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