No. 685,336. Patented Oct. 29, 1901.

P. LEROY, J. & L. BERARD & J. A. DE LA FRESNAYE.

APPARATUS FOR DRYING GRAIN.

(Application filed July 31, 1900.)

(No Model.) 3 Sheets—Sheet 1.

FIG. 1.

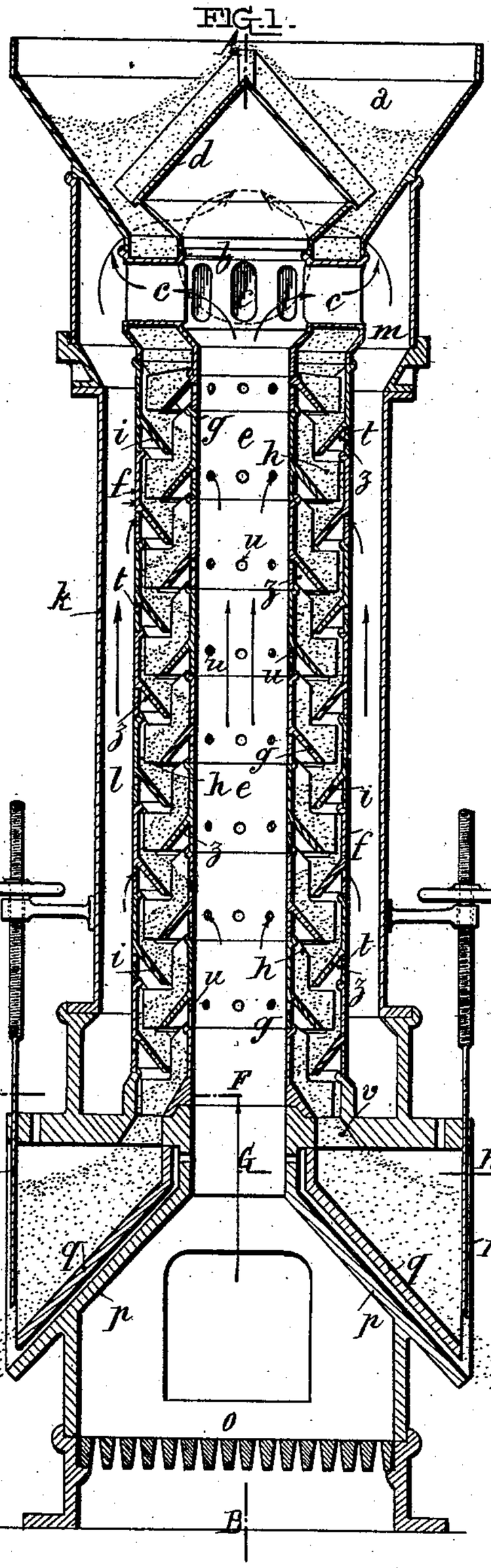

FIG. 2.

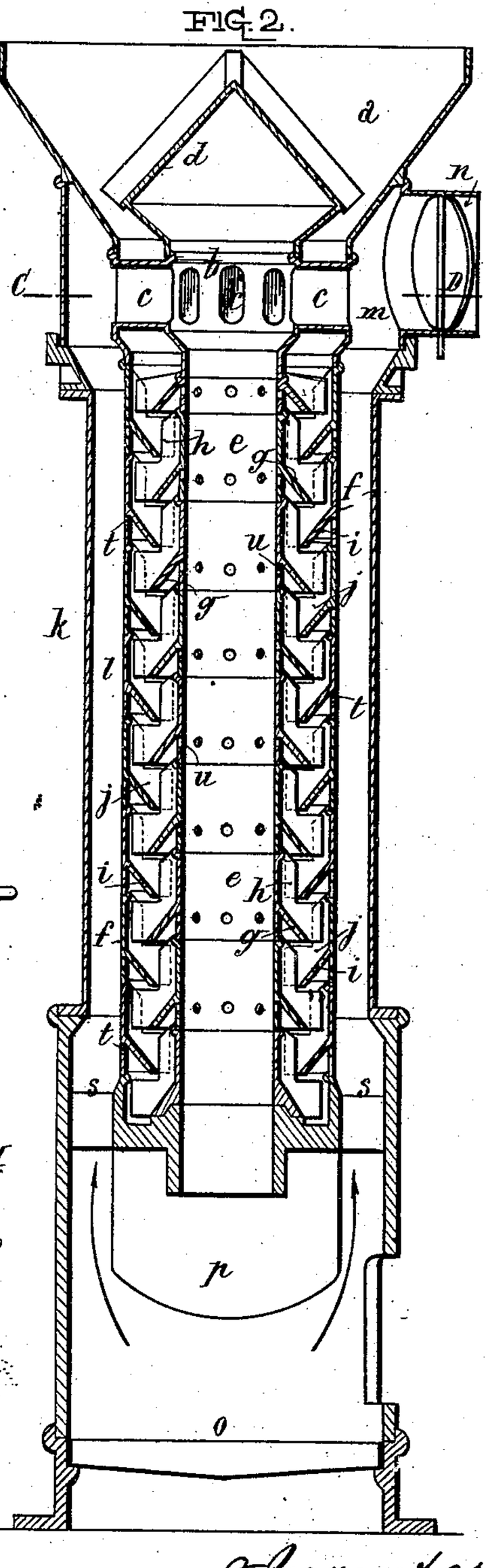

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FIG. 3.

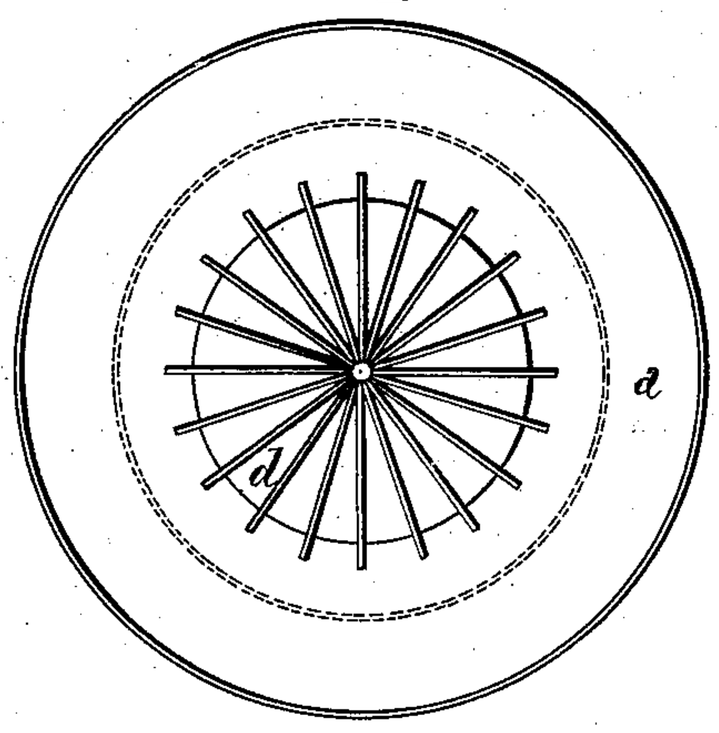


FIG. 4.

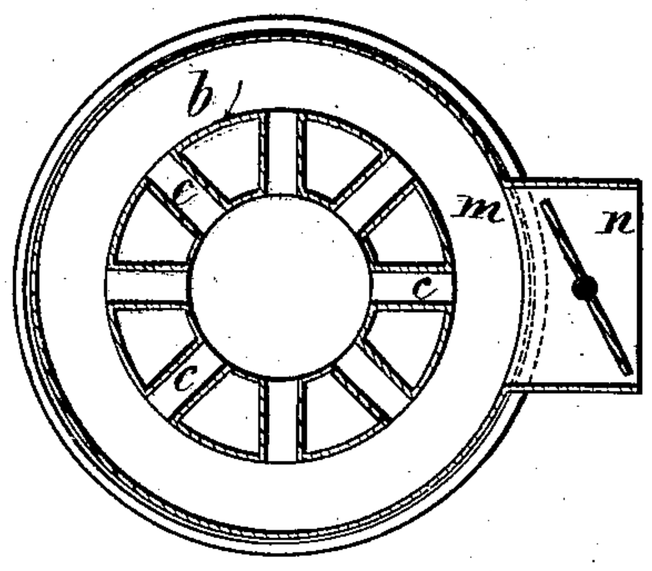


FIG. 5.

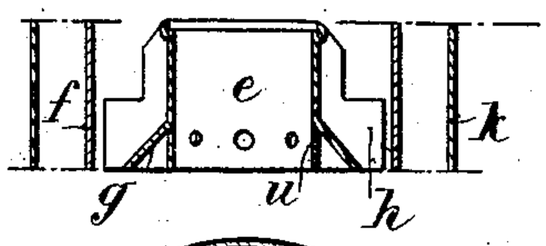
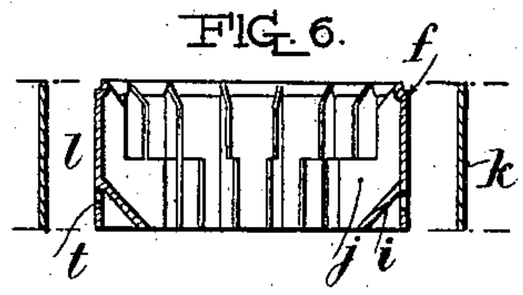


FIG. 6.



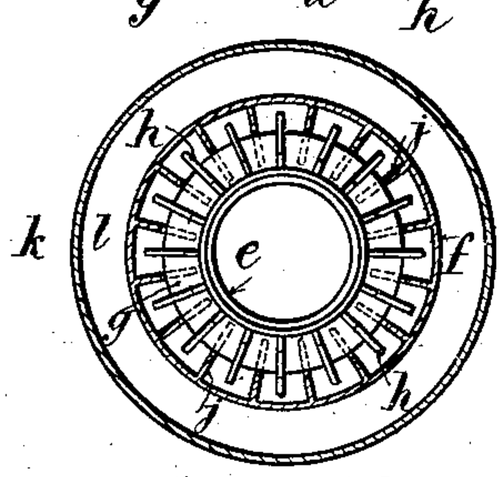


FIG. 5a

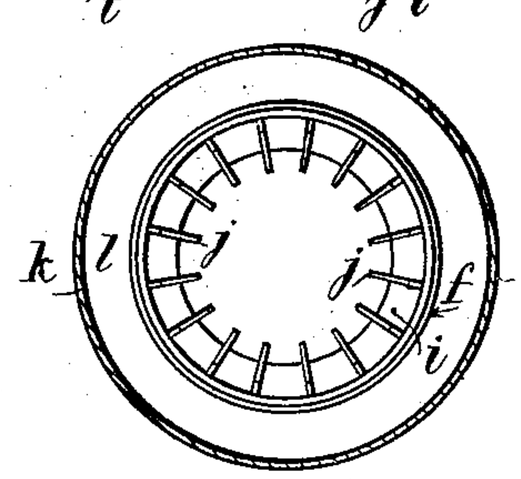


FIG. 6a

FIG. 7.

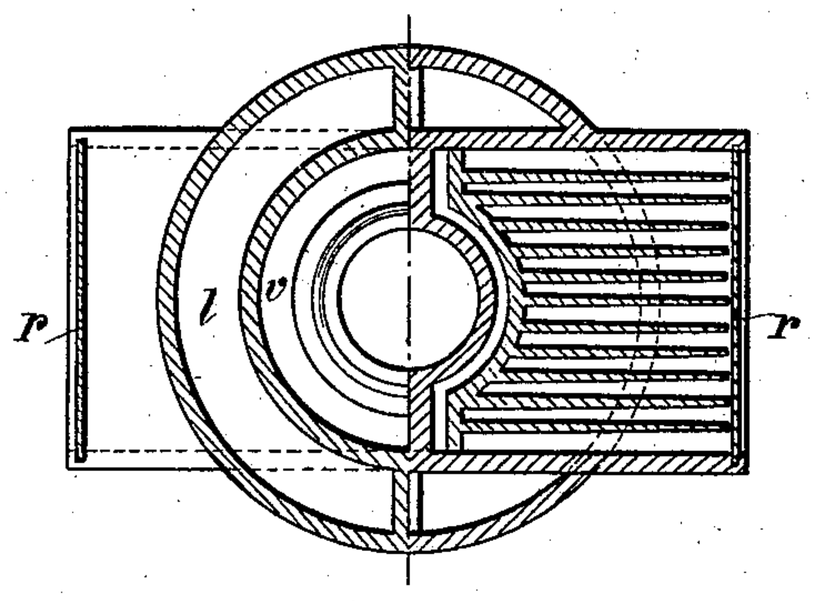


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FIG. 8.

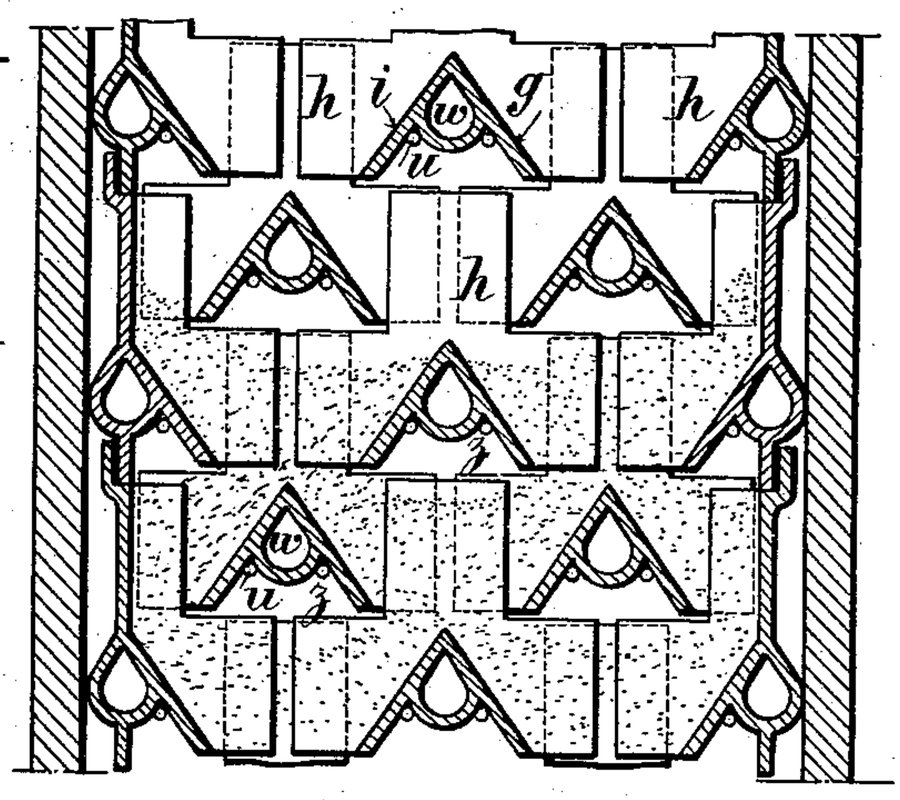
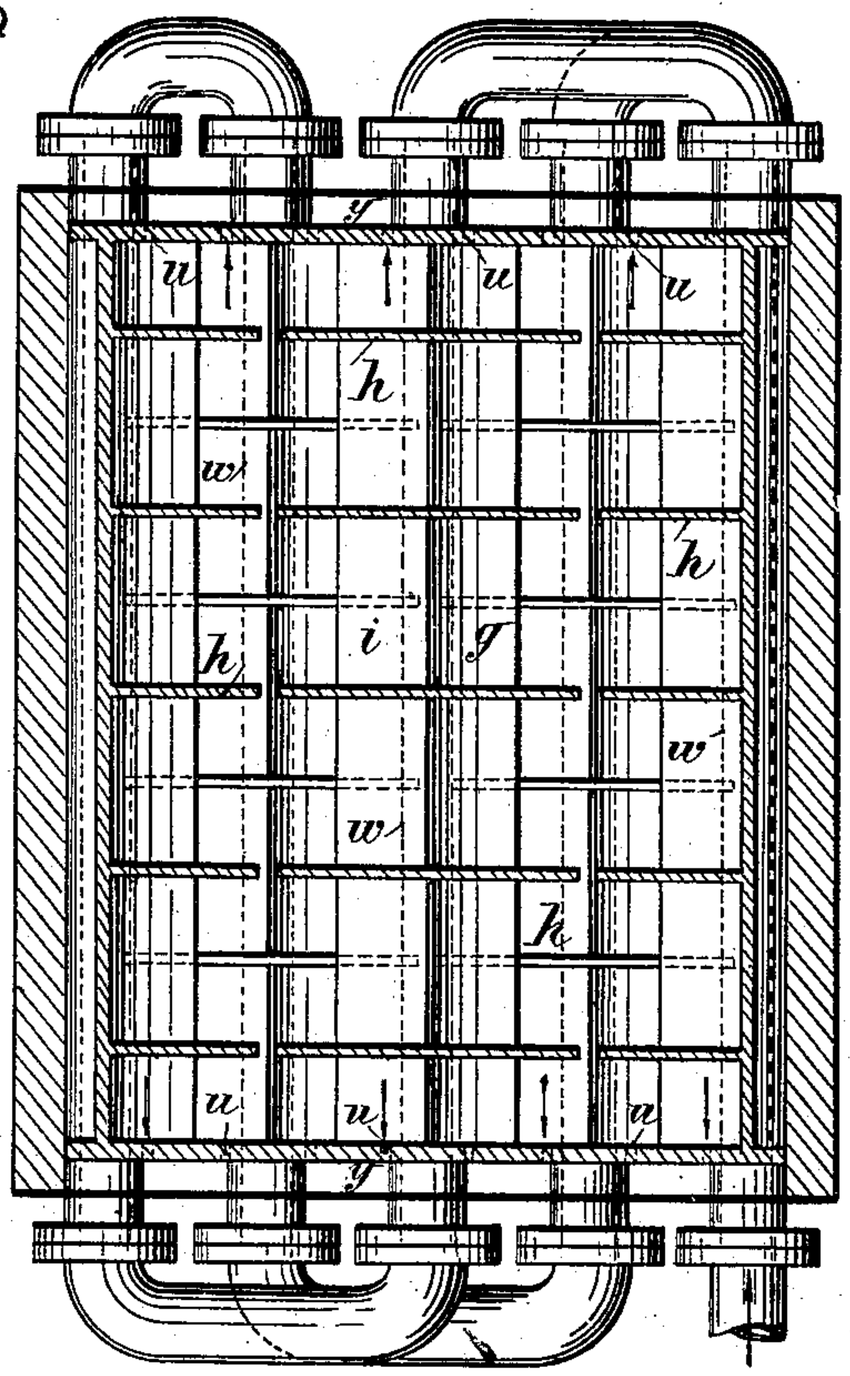


FIG. 9.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR DRYING GRAIN.

SPECIFICATION forming part of Letters Patent No. 685,336, dated October 29, 1901.

Application filed July 31, 1900. Serial No. 25,381. (No model.)

To all whom it may concern:

Be it known that we, PROSPER LEROY, JEAN BERARD, LOUIS BERARD, and JEAN ANDRÉ DE LA FRESNAYE, citizens of the Republic of France, residing at Paris, France, have invented certain new and useful Improvements in or Relating to Apparatus for Drying or Heating Grain, Pulverulent or Small Material, or the Like, (for which we have made application for Letters Patent in France, dated May 3, 1900,) of which the following is a specification.

The present invention relates to apparatus intended for drying or heating all kinds of pulverulent or small material or corn, such as vegetable substances, (especially all kinds of corn,) salts, powdered cement material, and the like.

In order to render the nature of the invention clearer, we have represented, by way of example, a construction of the apparatus in question in the accompanying drawings, in which—

Figure 1 is a vertical section. Fig. 2 is a vertical section on the line A B of Fig. 1; Fig. 3, a plan view of the apparatus. Fig. 4 is a horizontal section on the line C D of Fig. 2. Fig. 5 shows a vertical section, and Fig. 5ª a sectional plan, of one of the two sectional elements of which the column of the apparatus is built up, the plan view showing the intercalation of the wings or ribs of the two sectional elements. Figs. 6 and 6ª represent the second outer sectional element in section and sectional plan, respectively. Fig. 7 is a horizontal section on the lines E F G H of Fig. 1, while Figs. 8 and 9 represent, by way of example, another form of construction producing the same effect.

The apparatus comprises a hopper *a*, arranged on the upper part of the heating-chamber and placed on a ring *b*, provided with draft-passages *c*. In this hopper is arranged a dividing or feeding cone *d*, having wings or ribs in the direction of its generatrices, Figs. 1 and 3.

The ring *b* is placed on the top of a series of pairs of intercalating elements *e f*, preferably cylindrical, each provided with dividing wings or ribs and fitting on the one underneath in such a manner as to form a vertical or inclined column of any required height. The small inner cylinders *e*, forming the central tube of the apparatus, are provided externally with a conically-inclined flange or extension *g* and radially-arranged wings or plates *h* above said flanges, while the larger outer cylinders *f* are provided internally with similar conical flanges *i* and radial wings or plates *j*, projecting inward above said flanges, the outer cylinders *f* surrounding the inner cylinders *e*. The radial wings of the two cylinders are so arranged as to intercalate or break joint, so as to form a kind of baffling or dividing device, as illustrated in Fig. 5.

The column constituted by the sectional elements *e* and *f* is surrounded by a cylindrical jacket or casing *k* in such a manner that between it and the outside of the column a space *l* is formed, which serves for the circulation of the hot gases and terminates in a box, surrounding the ring *b* and communicating with an exit-tube *m*, provided with a regulating valve or damper.

The lower part of the apparatus is arranged over a furnace *o*, heated in any known manner, the top of which is constituted by two inclined planes *p*, surmounted by other inclined planes *q*, also provided with vertical ribs, as represented in Fig. 7, a free space being provided between the parts *q* and *p*. Finally the part of the apparatus is completed by two slides or doors *r*, which are actuated by means of a screw-threaded spindle and hand-wheel or in any other convenient manner in order to control the outflow of the heated material, which is fed into the hopper at the top and descends by gravity between the ribs and flanges of the cylindrical structure and thence down the outwardly-inclined walls *q* to the outlets.

The apparatus works in the following manner: The furnace *o* having been started, the hot gases generated pass partly through the central flue formed by the sectional cylinders *e*, Fig. 1, and partly through the outer annular space *l*, which the gases reach through passages *s*, Fig. 2. On their way through the central passage the gases radiate the heat over the whole interior surface, which thus absorbs and transmits it to the series of in-

clined annular flanges g and the vertical wings h, the gases finally reaching the upper part of the apparatus and transferring their remaining heat or part of it to the inner surface of the dividing-cone d, from which it passes to the outer wings of the said cone, the gases finally passing out through the passage c of the ring b into the box f, heating the hopper a before finally leaving the apparatus by way of the tube m. The hot gases passing around the outer cylinders f produce an effect similar to that produced on the sectional cylinders e and finally reach the box f, giving up what heat still remains to the hopper a before passing out through the tube m. Thus the heat of the gases is effectively absorbed by the great number of wings and annular flanges or inclined roofs, the temperature being always higher at the base of the apparatus than at the top, which is a necessary condition for the effective drying or dehydration of the material to be dried. Let us suppose, for example, that the apparatus is to be used for drying gypsum in powder for the purpose of employing it as plaster-of-paris. In such case the apparatus is first heated to the temperature required for the complete dehydration of the material, after which the powder is thrown into the hopper a, either by hand or by some mechanical means. The material thus becomes divided on the whole surface of the ribbed cone and heated to a slight degree. It then falls on the ring b, is divided by the parts forming the passages c, and falls, again being divided by the wing h of the first small inner cylinder e and falls on the first annular conical flange or roof g. It then strikes against the first larger cylinder f, is divided by the wings j of the latter, and falls on the annular conical roof i of the latter. Here the material meets the wings h of the second small cylinder e, falls on the annular roof g of the latter, strikes against the second larger cylinder f, is divided again by the wings j of the latter, and falls on the next annular roof i of the latter. This zigzag movement is repeated until the material reaches the bottom, thus continually falling in a broken line through the apparatus until it reaches the bottom, where it is removed either by hand or some mechanical means. The material, although thus striking and falling against the various sectional cylinders, does not enter the inner part formed under the annular roofs h and i, where free spaces z are left, which form chambers to receive and allow to escape through holes t and u, provided for that purpose, the vapors generated during the process of drying the material, which are thus carried off by the flue in such a manner that the upper portions of the material do not come in contact with the vapors generated in the lower portion. When the material arrives at the base of the apparatus through the openings v, it falls on the inclined plates q, the under side of which is separated from the top p of the furnace, thus allowing air to pass between. The free space between the top of the furnace and the plates q may be regulated so as to modify the current of air passing between the two parts with a view of so regulating the temperature of the plates q and the wings arranged on it as to effect the complete dehydration of the material. The material is finally allowed to pass out in a continuous stream from the apparatus through slides r, of any suitable description, the extent of opening of which is regulated according to the speed at which the complete drying of the material is effected, the material thus treated being collected finally in a suitable receiver. The process of drying is therefore very regular and is effected gradually and continuously with great economy as regards work, time, and fuel. We may observe here that in this apparatus the material does not come in contact with the smoke, with which it therefore is not contaminated, plaster, for instance, passing out from the apparatus in a state of perfect whiteness.

The apparatus need not be necessarily constituted of annular elements. It may be constructed, for instance, in the manner represented in Figs. 8 and 9, according to which the apparatus comprises a series of straight roof-shaped baffling and dividing elements, each being formed of two inclined plates i and g, provided with dividing wings or ribs h, intersecting or breaking joint with each other in the same manner as shown in Figs. 1 and 2. In this case the vapors or the hot gases intended for drying pass along passages w, provided at the angle formed by the two inclined planes i and g. The vapors resulting from the drying of the material collect in the chambers z beneath the inclined planes and escape through holes u into outside chambers y, from which they pass out of the apparatus. The arrangement of these elements in no way interferes with the principle of the apparatus. The elements always act accordingly in the same manner as dividers and bafflers and differ only in shape.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. Apparatus for drying or heating material in the shape of powder, grain or the like comprising a series of superposed elements provided with inclined sides and vertical ribs, the ribs of one element intercalating with those of the next element, means for supplying heated air to said elements without allowing it to come in contact with the material operated upon, recesses beneath the inclined sides to receive the vapors given off by the material on drying and means for preventing said vapors from coming in contact with the material substantially as described.

2. Apparatus for drying or heating material in the shape of powder, grains or the like comprising a series of superposed cylindrical elements, each element consisting of an inner and outer cylinder, each provided with conical flanges and vertical ribs, said parts of the

elements intercalating or breaking joint, the annular conical flanges being adapted to let the material fall from one to the other in a zigzag path and forming beneath them annular chambers, in which the vapors given off by the material collect and from which they pass out through small holes communicating with a central flue substantially as described.

3. In combination with apparatus of the kind described a series of superposed cylindrical elements, each element consisting of an inner and outer cylinder, each having inclined sides and vertical ribs, said parts of the elements intercalating or breaking joint, a closed casing surrounding the series of drying elements, a furnace, central and outer passages for the combustion-gases for heating the elements together with their wings and inclined parts, communicating passages between the vapor-collecting spaces beneath the inclined parts and the center and outer flues, an upper ring with radial passages, for leading the combustion-gases from the central flue to a smoke-chamber, a feed-hopper provided with a dividing-cone with upwardly-extending ribs and means for regulating the discharge of the treated material substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

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JEAN BERARD.
LOUIS BERARD.
JEAN ANDRÉ DE LA FRESNAYE.

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