

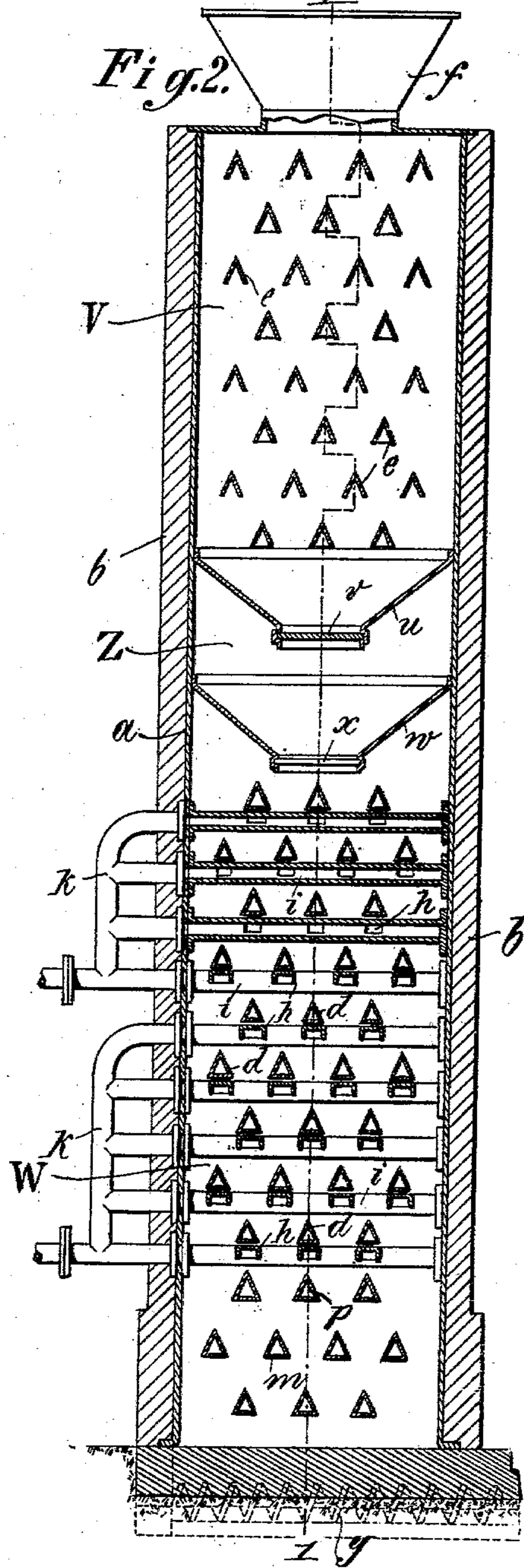
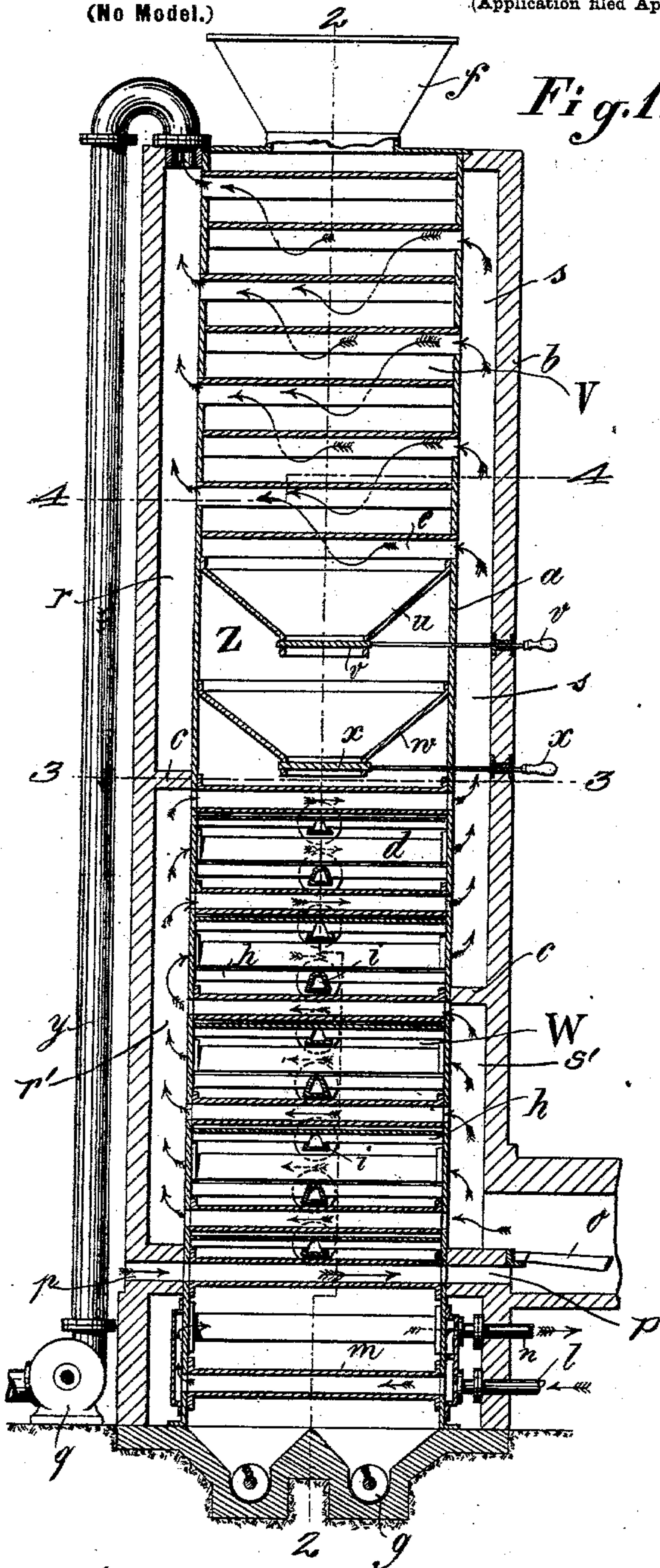
E. LARSEN.

APPARATUS FOR DRYING AND DISTILLING WOOD, SAWDUST, PEAT, OR THE LIKE,
AND FOR TREATING OTHER SUBSTANCES.

(No Model.)

(Application filed Apr. 1, 1901.)

3 Sheets—Sheet 1.



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Fig. 3.

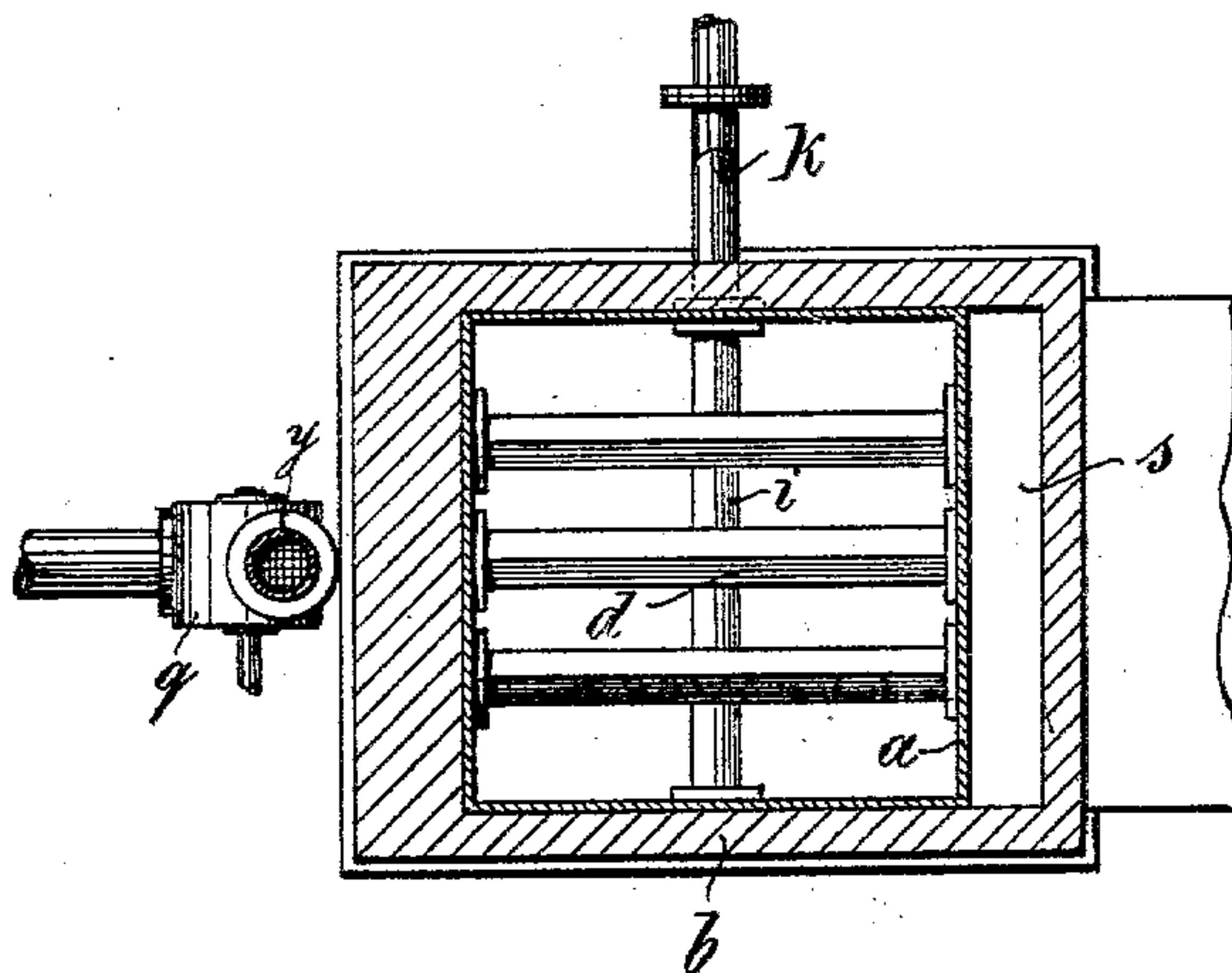
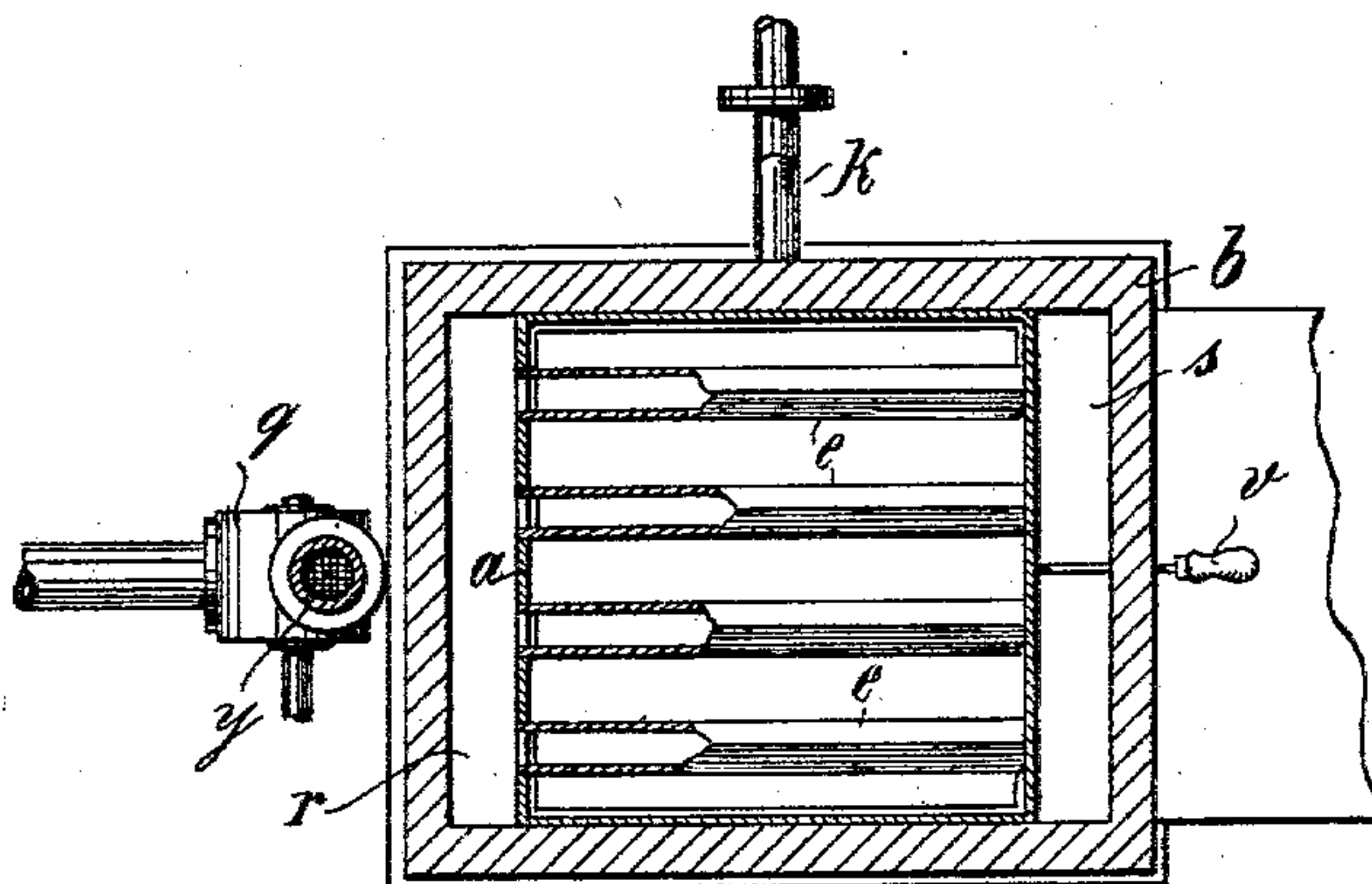


Fig. 4.



Witnesses

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No. 704,886.

Patented July 15, 1902.

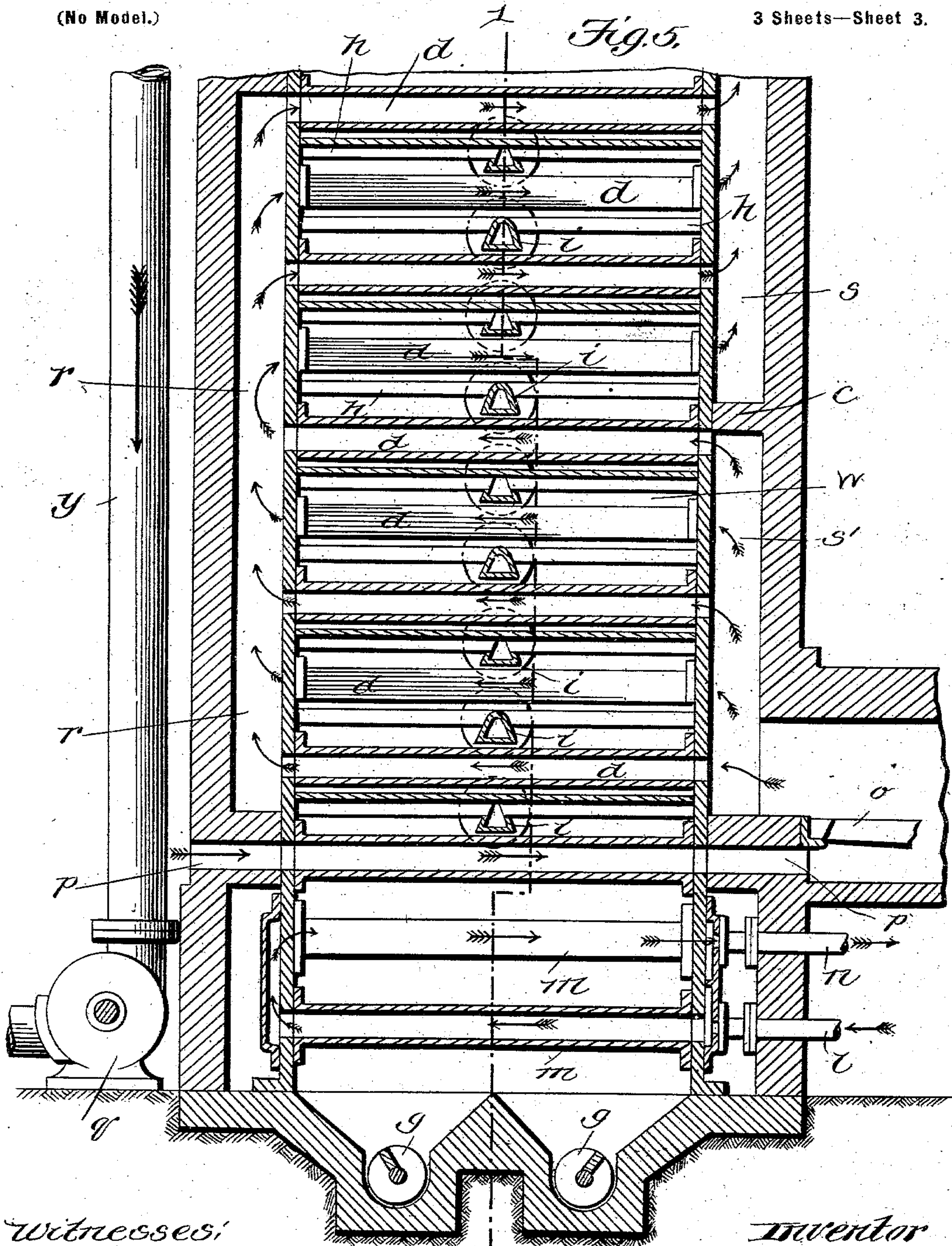
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3 Sheets—Sheet 3.



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UNITED STATES PATENT OFFICE.

EDUARD LARSEN, OF COPENHAGEN, DENMARK.

APPARATUS FOR DRYING AND DISTILLING WOOD, SAWDUST, PEAT, OR THE LIKE, AND FOR TREATING OTHER SUBSTANCES.

SPECIFICATION forming part of Letters Patent No. 704,886, dated July 15, 1902.

Application filed April 1, 1901. Serial No. 53,899. (No model.)

To all whom it may concern:

Be it known that I, EDUARD LARSEN, engineer, of 12 Norrevoldgade, Copenhagen, in the Kingdom of Denmark, have invented certain new and useful Improvements in Apparatus for Drying and Distilling Wood, Sawdust, Peat, or the Like and for Treating other Substances; and I do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following specification, reference being had to the accompanying drawings and to the letters marked thereon.

My invention relates to an apparatus for simultaneously drying and charring or distilling wood, sawdust, peat, and the like and for treating other substances and with which these processes may be carried out without any arrangements for moving the material, the same passing through the apparatus solely by its own weight. A further essential feature is that the products of distillation generated in the coking or distilling chamber are carried away immediately after formation and in accordance with the temperature of their generation without passing other parts of the apparatus or the material therein. By these means I am able to carbonize the wood and the like in such a manner that decomposition and condensation of the products of distillation are entirely prevented. Moreover, in the drying-chamber the heating-flues are so arranged that the heating-gases need only pass through a certain number thereof and then leave the apparatus in order to cause the moisture developed from the wood being immediately carried away.

To enable others skilled in the art to construct and use my improved apparatus, I will proceed to describe its construction and arrangement and in connection therewith explain its operation as applied to the distillation of wood. For this purpose are made the accompanying drawings, in which—

Figures 1 and 2 are two vertical sectional views of my improved apparatus, taken at right angles to each other and respectively being sections taken at line 1 1 of Fig. 2 and at the line 2 2 of Fig. 1. Fig. 3 is a horizontal

sectional view taken at line 3 3 of Fig. 1. Fig. 4 is a similar view taken at line 4 4 of Fig. 1; and Fig. 5 is an enlarged vertical sectional view of the lower part of Fig. 1, taken on the lower part of the line 1 1 of Fig. 2.

Like letters of reference denote the same parts of the apparatus in each of the figures.

My improved apparatus consists of an upright shaft *b* of masonry or the like and of rectangular shape. Within this shaft *b* a second shaft *a* of iron or the like is arranged and constructed in such manner that two opposite sides are as wide as the inner sides of the outer shaft, whereas the other two sides are narrower than the respective sides of shaft *b*, thereby leaving between the narrower sides of the shaft *a* and the opposite sides of the shaft *b* the flues denoted by *r r'* and *s s'*. The flues *r r'* are separated from each other by a partition *c* and the flues *s s'* separated from each other by a similar partition. The inner shaft is divided into an upper part, the drying-chamber *V*, and a lower part, the distilling, charring, or coking chamber *W*, connected by a port-chamber *Z*, provided with a sliding door *v* for closing the lower end of the drying-chamber *V* and with a sliding door *x* for closing the upper part of the distilling-chamber *W*. The port-chamber *Z*, with the doors *v x*, will permit the material dried in the chamber *V* to fall into the distilling-chamber *W* without allowing the products generated in the latter to pass into the former.

In the drying-chamber *V* heating-flues *e* are arranged in a horizontal manner. They are substantially triangular in contour and open at their under side. In consequence of this peculiar construction of the heating-flues they offer no obstacle to the material in its way down the shaft, causing it to slide down upon the sides of the flues when the sliding door *v* is opened or when fresh material is charged into the hopper *f*. As will be seen from Fig. 2, the heating-flues are arranged alternately in horizontal rows in such manner that the flues of one row will not be in vertical alinement with the flues of the other rows. The distance the flues of each row are arranged apart varies according to the material to be treated. These flues communi-

cate with the flues through which pass the heating-gases coming from the distilling-chamber and with the flue *r*, through which these gases are carried away. The upper end
 5 of the latter flue is connected by a pipe *y* with an exhaust-fan *q* or other similar device. By this arrangement the heating-gases after leaving the distilling-chamber *W* through the flues *r'* and *s* are caused to enter the flues
 10 *e*, communicating with flue *s*, and thence through the chamber *V*. The gases are exhausted from the chamber *V* through flue *r* and pipe *y*, as is indicated by arrows in Fig. 1. On their way through the drying-chamber the
 15 gases take up the moisture from the wood and then leave the apparatus without coming in contact with other portions of the material.

The lower part of the drying-chamber *V* is formed as a hopper *u*, closed by the slide-door
 20 *v*, which is opened when the material has become sufficiently dried, thereby causing it to fall down into the port-chamber *Z*, the lower hopper-like part *w* of which is closed by the slide-door *x*.

25 In the lower part of the shaft *a*, forming the distilling or coking chamber *W*, heating-pipes *d*, of triangular shape, are arranged in horizontal rows above one another and communicate with the flues *r'* and *s s'*. The heating-
 30 gases are generated in the furnace *o*. The partition-walls *c* are employed for causing the heating-gases to pass through the distilling-chamber *W* in a zigzag course in order to most intensely profit by their heat. The gases pass
 35 from the lower part of the chamber *W* into the flue *r'*, thence through the upper part of the chamber *W* to the flue *s*, thence to the lower part of the drying-chamber *V*. Arranged below the heating-pipes *d* are the chan-
 40 nels *h*, open at their under sides. These channels are so arranged that their sides do not project beyond the heating-pipes *d*, and therefore do not afford any obstacle to the filling material. The channels *h* of each horizontal
 45 row communicate with a common collecting-pipe *i*, passing through the wall of the shafts *a* and *b*, and the collecting-pipes *i* are connected in groups with pipes *k*, leading to suitable cooling and condensing tanks, (not
 50 shown,) so that the products of distillation can be collected according to the temperature of generation in the manner of the fractional distillation.

In the lower part of the distilling-chamber
 55 *W* cooling-pipes *p* and *m* are arranged, the former communicating with the atmosphere and with the furnace, thereby cooling the charred wood and at the same time preheating the air for the furnace, and the latter
 60 pipes *m* communicating with each other and provided with an inlet *l* and an outlet *n* for cooling water.

The lower part of the distilling-chamber is substantially in the form of a hopper and
 65 has arranged therein one or more conveyers *g* for discharging the charred material.

The manner of operating is as follows:

After closing slide-door *v* the wood or the like is charged into the drying-chamber *V* through hopper *f* and passes down over the
 70 sides of the heating-flues *e*, thereby being dried. The slide-door *x* is then closed and slide-door *v* opened, thus allowing the dry material to enter the port-chamber *Z*, where-
 75 upon slide-door *v* is closed and slide-door *x* opened. Now the material passes down through the distilling-chamber *W*, over the heating-pipes *d*, and after being coked is cooled by means of the cooling-pipes *p* and
 80 *m* in the lower part of the chamber *W*. The charcoal is discharged by means of the conveyers *g*, while the heating-gases are carried away by the exhaust-fan or similar device *q*, and the gaseous products of distillation pass
 85 through pipes *k* to the condensing and collecting tanks.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

90 1. In an apparatus of the character described, an inner shaft, an outer shaft surrounding said inner shaft, a drying-chamber arranged in the upper portion of said inner shaft, a distilling-chamber arranged in the
 95 lower portion of said inner shaft, a port-chamber interposed between said drying and distilling chambers, means for establishing communication between said port-chamber and said drying-chamber, and means for estab- 100
 lishing communication between said distilling-chamber and said port-chamber, substantially as herein shown and described and for the purpose set forth.

105 2. In an apparatus of the character described, an outer shaft, an inner shaft arranged within said outer shaft, and of such size as to form on the two opposite sides thereof flues between the two shafts, parti- 110
 tions in the said flues, a drying-chamber in the upper portion of said inner flue, a distilling-chamber in the lower portion of said inner flue, and a port-chamber interposed be-
 115 tween said drying and distilling chamber.

120 3. In an apparatus of the character described, an outer shaft, an inner shaft arranged within said outer shaft, and of such size as to form on the two opposite sides thereof flues between the two shafts, parti- 125
 tions in the said flues, a drying-chamber in the upper portion of said inner flue, a distilling-chamber in the lower portion of said inner flue, a port-chamber interposed be-
 130 tween said drying and distilling chamber, means for establishing communication between said port-chamber and drying-chamber, and means for establishing communica-
 135 tion between said distilling-chamber and said port-chamber.

4. In an apparatus of the character de- 130
 scribed, an outer shaft, an inner shaft arranged within said outer shaft, and of such size as to form on the two opposite sides there-
 135 of flues between the two shafts, a drying-cham-

ber arranged in the upper portion of said inner shaft, a series of heating-flues in said drying-chamber and communicating with the flues at the opposite side of the inner shaft, a distilling-chamber in the lower portion of said inner shaft, a series of heating-pipes arranged in said distilling-chamber and communicating with the flues at the two opposite sides of said inner shaft, and an exhausting device in communication with said drying-chamber.

5. In an apparatus of the character described, an outer shaft, an inner shaft arranged within said outer shaft, and of such size as to form on the two opposite sides thereof flues between the two shafts, a drying-chamber arranged in the upper portion of said inner shaft, a series of heating-flues in said drying-chamber and communicating with the flues at the opposite side of the inner shaft, a distilling-chamber in the lower portion of said inner shaft, a series of heating-pipes arranged in said distilling-chamber and communicating with the flues at the two opposite sides of said inner shaft, an exhausting device in communication with said drying-chamber, a port-chamber interposed between said drying and distilling chambers, means for establishing communication between said port-chamber and said drying-chamber, and means for establishing communication between said port-chamber and said distilling-chamber.

6. In an apparatus of the class described, an inner and outer shaft arranged to form flues at two opposite sides of said inner shaft, a drying-chamber arranged in the upper portion of said inner shaft, a distilling-chamber in the lower portion of said inner shaft, a port-chamber interposed between the said drying and distilling chambers, separate means for establishing communication between said port-chamber and said drying and distilling chambers, a series of triangular-shaped heating-flues extending through said drying-chamber and communicating with the flues at two opposite sides of said inner shaft, a series of heating-pipes arranged in said distilling-chamber and communicating with said flues at two opposite sides of said inner shaft, channels arranged below said heating-pipes, and a collecting-pipe in communication with the said channels.

7. In an apparatus for continuously drying and distilling wood, sawdust, peat and the like, an outer and inner shaft arranged to form flues at two opposite sides of said inner shaft, a drying-chamber arranged in the upper portion of said inner shaft and communicating with said flues, a distilling-chamber in the lower portion of said inner shaft, a series of heating-pipes arranged in said distilling-chamber, channels mounted below said heating-pipes, a collecting-pipe in suitable communication with said channels, a cooling means mounted in the lower portion of

said distilling-chamber, and means at the lower portion of said distilling-chamber for conveying the material therefrom.

8. In an apparatus for continuously drying and distilling wood, sawdust, peat and the like, the combination of a rectangular upright shaft constructed of masonry or the like, a metallic shaft arranged in said upright shaft and forming flues at two opposite sides thereof between the two shafts, a drying-chamber on the upper portion of said metallic shaft suitably communicating with said flues, a port-chamber below the said drying-chamber and adapted to communicate therewith, a distilling-chamber below the said port-chamber and adapted to communicate therewith, a series of heating-pipes in said distilling-chamber, means for cooling the treated material arranged within said distilling-chamber, and means for conveying the treated material from said distilling-chamber arranged at the lower portion of the latter.

9. In an apparatus for continuously drying and distilling wood, sawdust, peat and the like, a substantially rectangular upright shaft constructed of masonry or the like, an iron shaft arranged within said upright shaft and forming flues at two opposite sides thereof between the shafts, partitions suitably arranged in the said flues, a drying-chamber in the upper portion of said iron shaft, a distilling-chamber at the lower portion of said iron shaft, a port-chamber interposed between the said drying and distilling chambers, a distilling means for establishing communication between said port and said drying chambers, means for establishing communication between said port and distilling chambers, a series of triangular-shaped heating-flues arranged within said drying-chamber and communicating with the flues at two opposite sides of said iron shaft, a series of heating-pipes, mounted in said distilling-chamber and communicating with the flues at two opposite sides of said iron shaft, channels arranged below said heating-pipes, collecting-pipes suitably connected to said channels, means for cooling the material arranged in said distilling-chamber, means for conveying the material from said distilling-chamber, and exhausting means in communication with one of said flues at the side of the iron shaft.

10. In an apparatus for continuously drying and distilling wood, sawdust, peat and the like, the combination of an upright shaft B, a shaft A within said shaft B and forming flues at two opposite sides thereof between the said shafts, a heating-chamber in the upper portion of said shaft A and communicating with said flues, a distilling-chamber at the lower portion of said shaft A, heating-pipes extending through said distilling-chamber and communicating with said flues at two opposite sides of said shaft A, means arranged in the said distilling-chamber for collecting the products of distillation, means arranged

in said distilling-chamber for cooling the material treated, means for conveying the treated material from the said distilling-chamber, a port-chamber arranged between said drying
5 and distilling chamber, separate means for establishing communication between the said port-chamber and said drying and distilling chambers, and an exhausting device in com-

munication with one of the flues at the sides of the said shaft A. 10

In witness whereof I have hereunto set my hand in presence of two witnesses.

EDUARD LARSEN.

Witnesses:

J. C. JACOBSEN,

J. C. FREEMAN.