

(No Model.)

2 Sheets—Sheet 1.

E. THEISEN.
DRIER.

No. 550,852.

Patented Dec. 3, 1895.

Fig. 2.

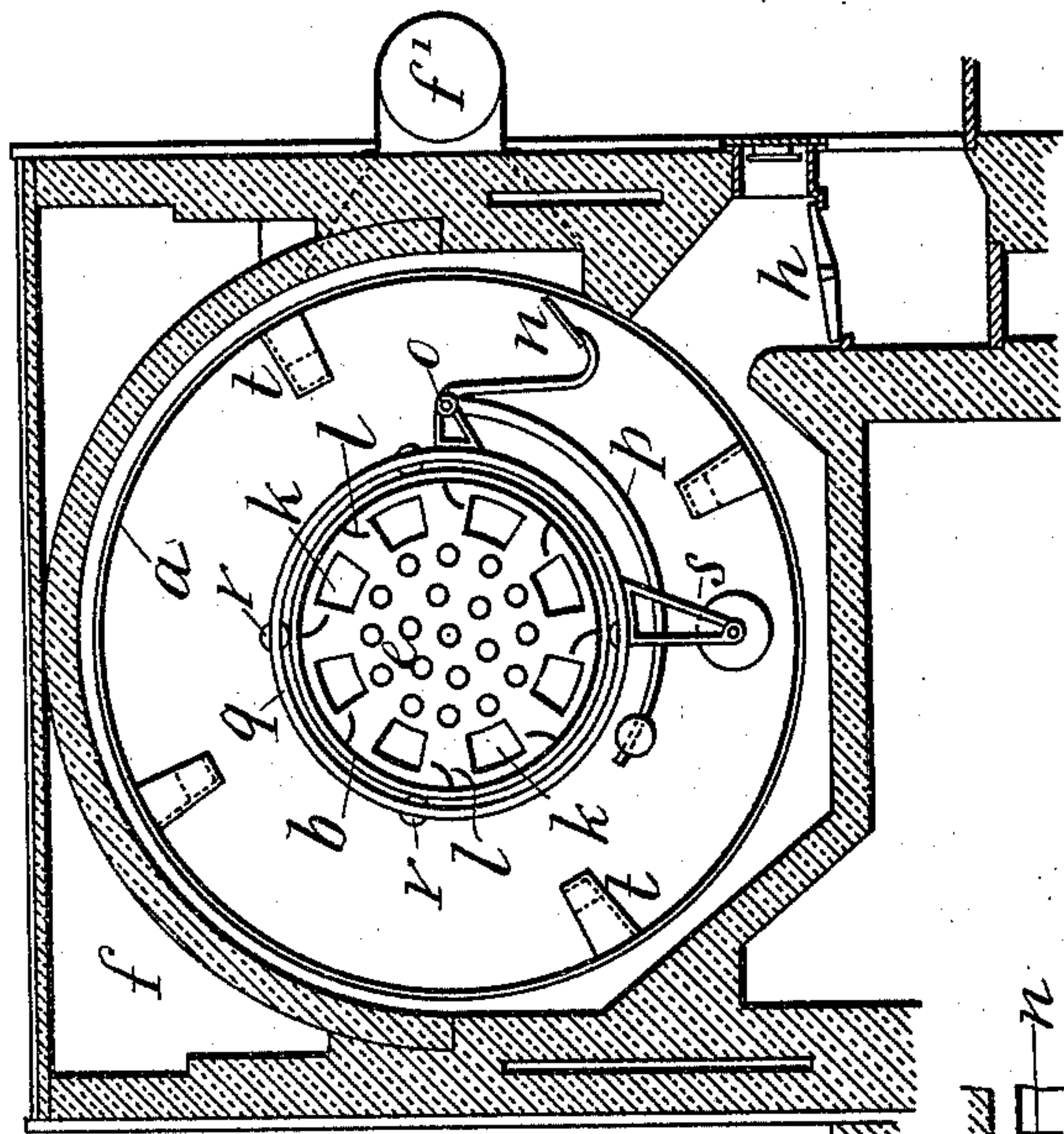
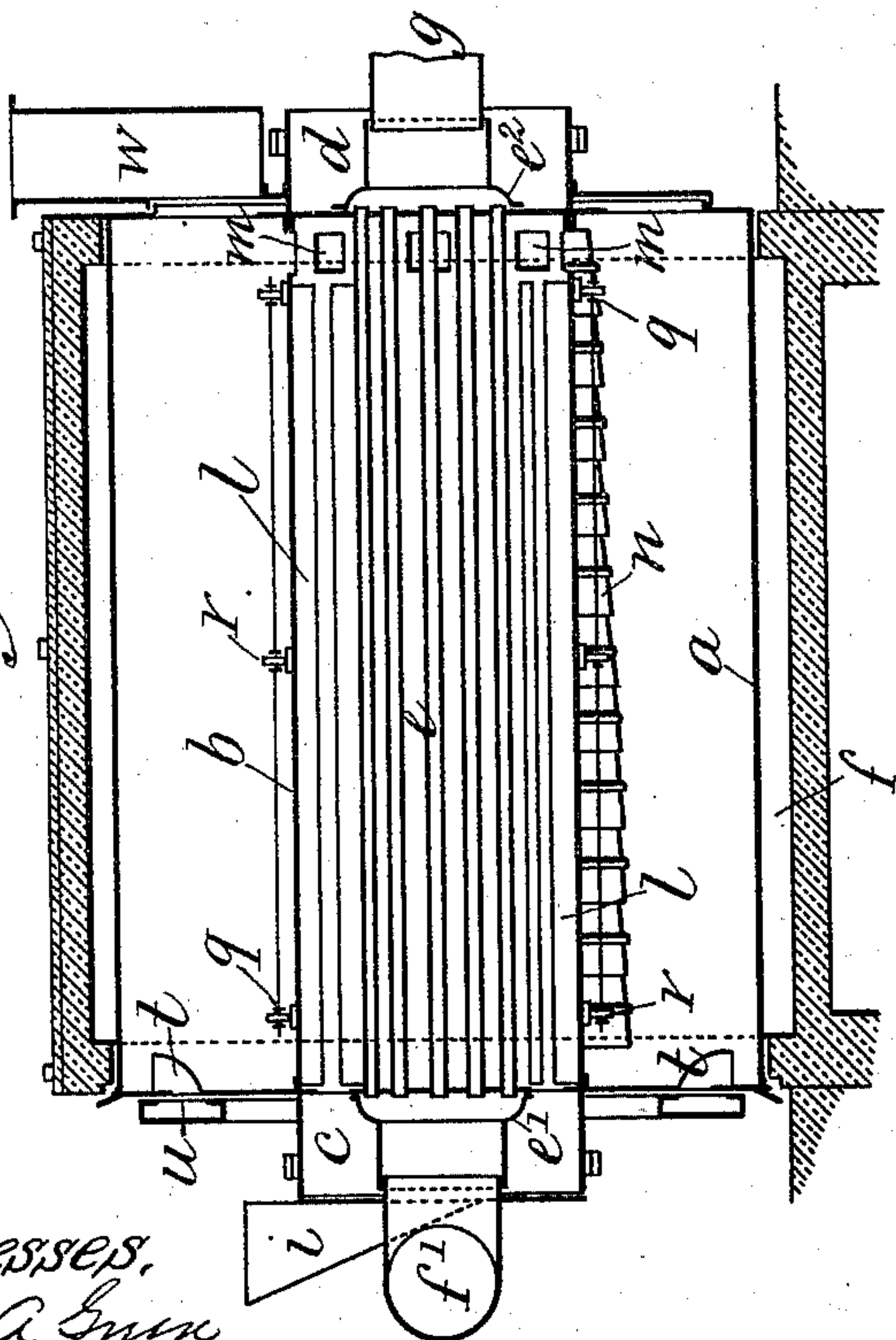


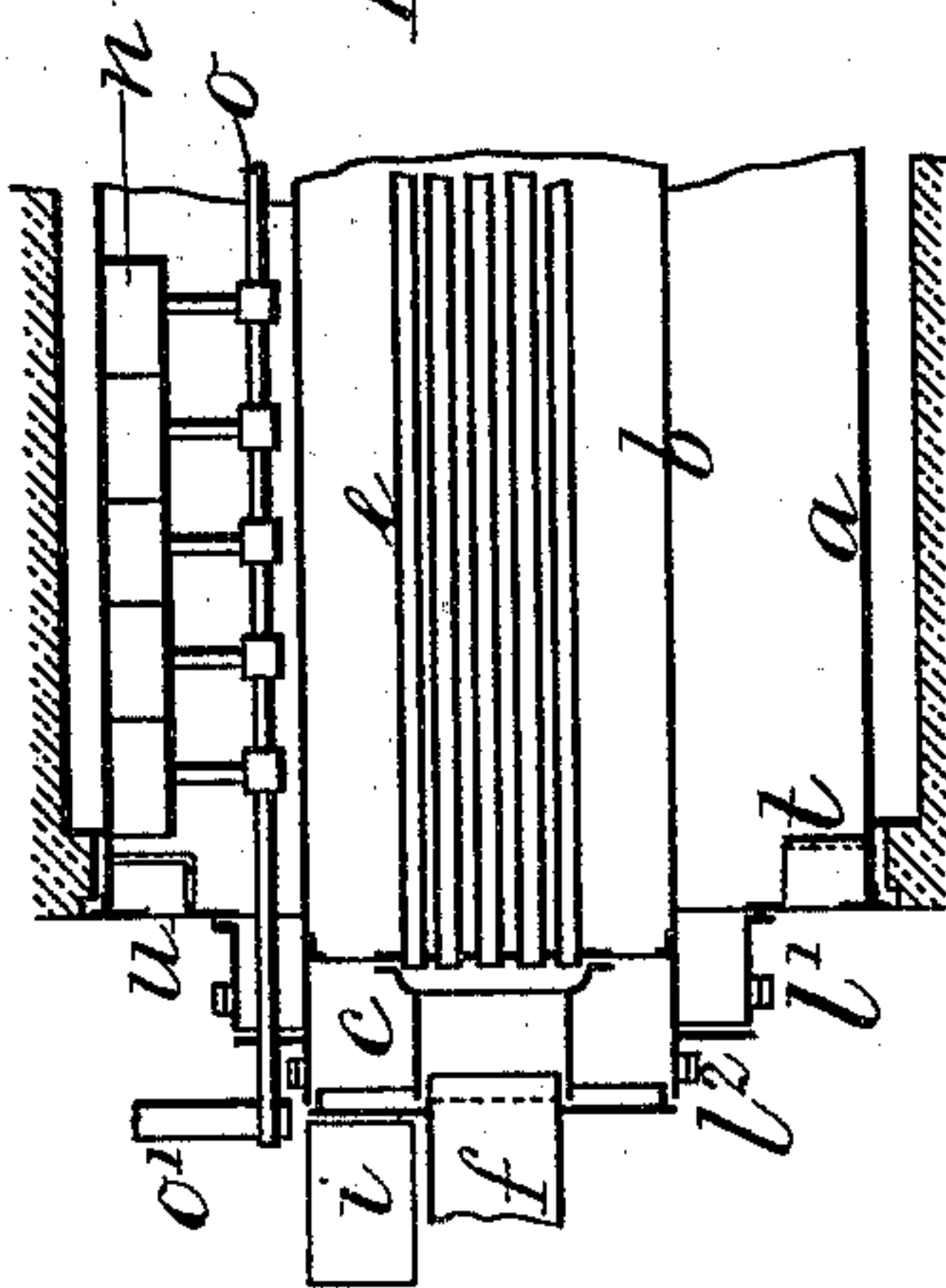
Fig. 1.



Witnesses,
Thos. A. Green

Robert Everett

Fig. 3.



Inventor,
Edward Theisen.

By
James L. Norris,
Atty

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2 Sheets—Sheet 2.

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Fig. 5.

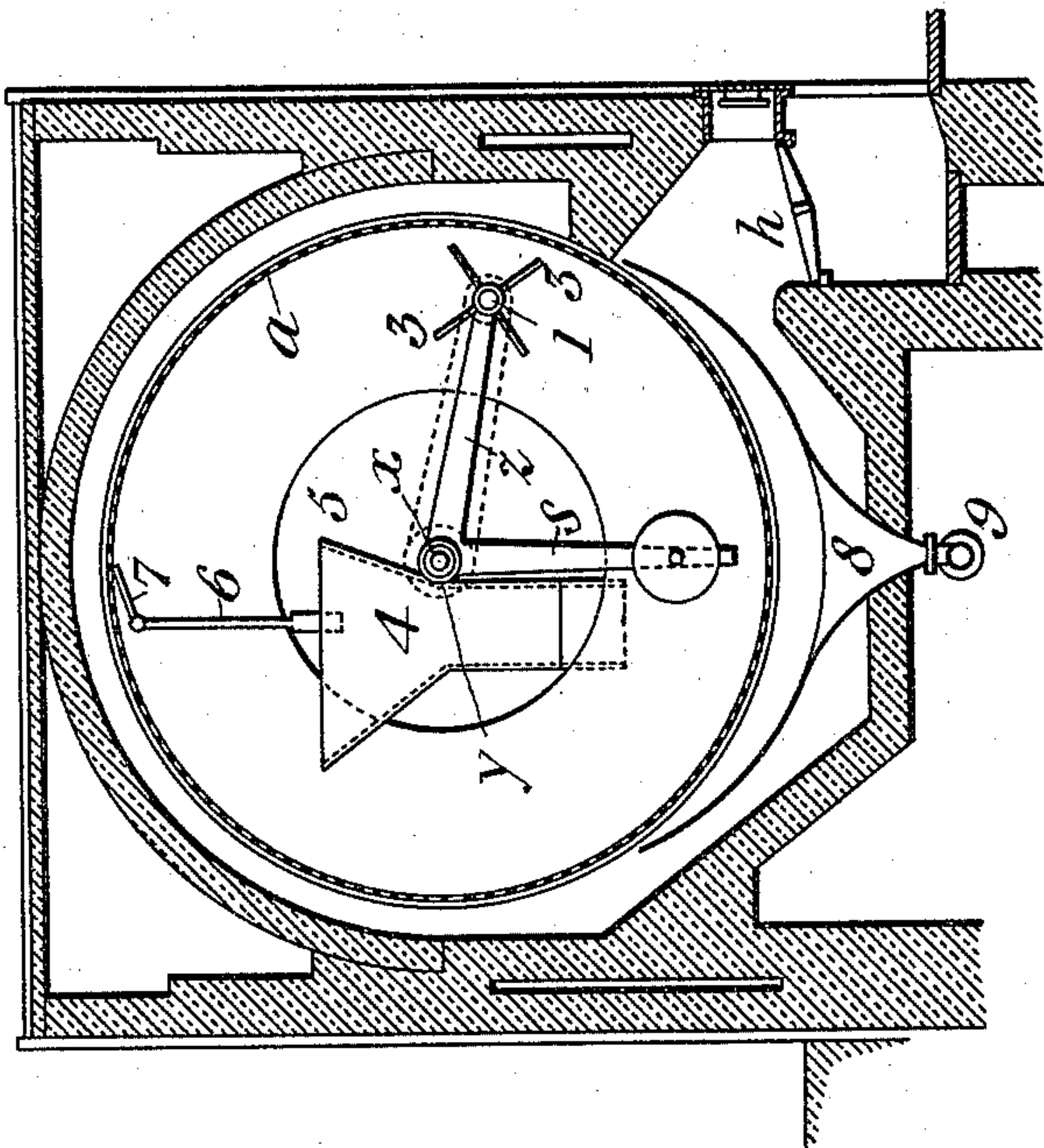
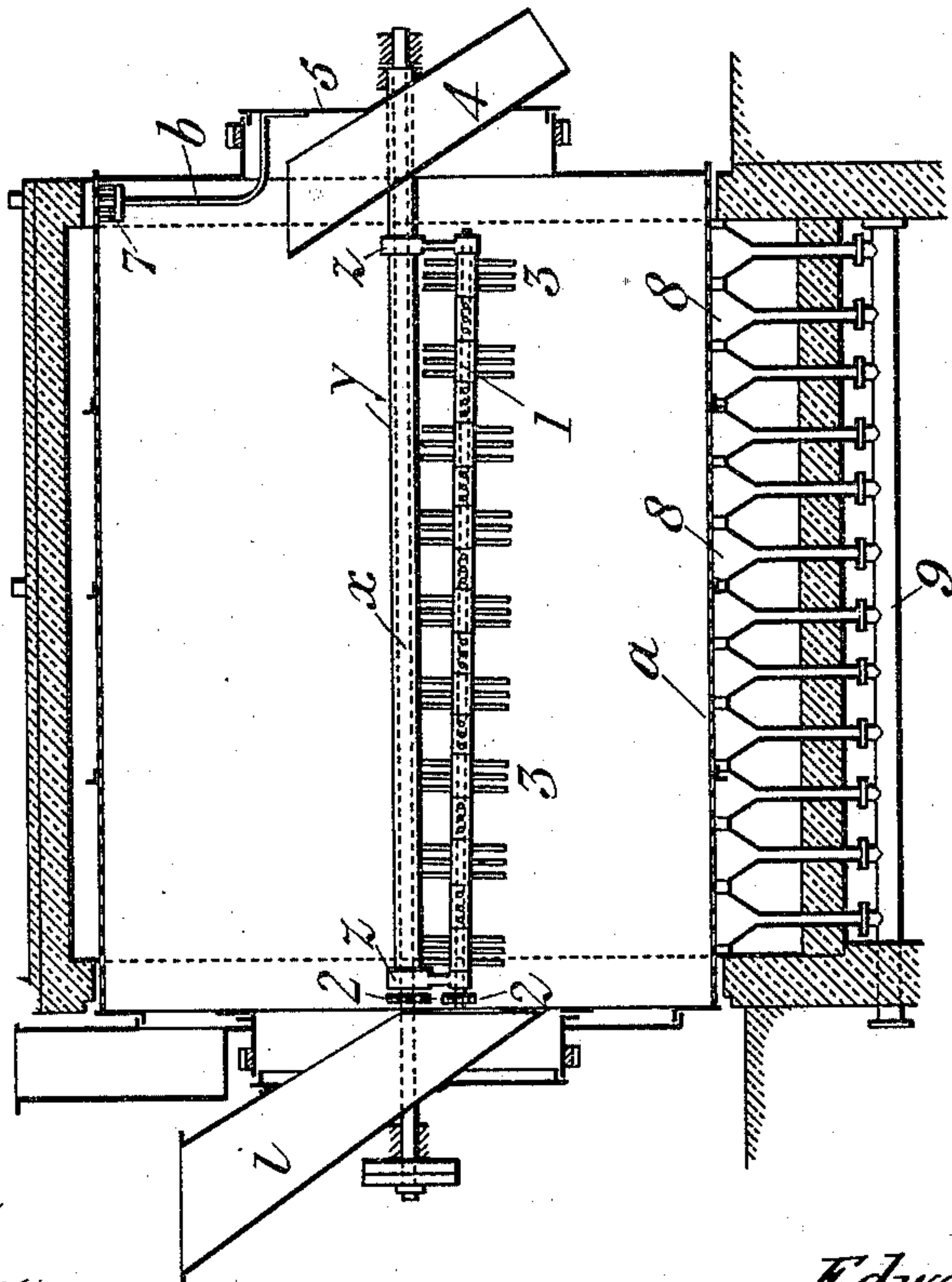


Fig. 4.



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UNITED STATES PATENT OFFICE.

EDUARD THEISEN, OF BADEN, GERMANY.

DRIER.

SPECIFICATION forming part of Letters Patent No. 550,852, dated December 3, 1895.

Application filed August 19, 1895. Serial No. 559,840. (No model.)

To all whom it may concern:

Be it known that I, EDUARD THEISEN, a citizen of the United States of America, residing at 15 Werderstrasse, Baden, Germany, have invented certain new and useful Apparatus for Drying Pulverulent, Granular, or Fibrous Materials, of which the following is a specification.

In many industries—as, for example, in chemical works, breweries, distilleries, sugar manufactories, &c.—there exist a number of waste or by products of comparatively low value when in wet condition, the drying of which to increase their value and facilitate their transport has hitherto entailed considerable expense in the erection of extensive drying apparatus taking up a large amount of valuable space and in the expenditure of a large amount of fuel.

My present invention has for its object the construction of improved apparatus whereby the drying of such products can be effected in a comparatively inexpensive manner, and which, while giving a large output, is of a very compact nature, so as to occupy only a comparatively small space.

It consists mainly in the employment of a revolving drum the outer surface of which is heated in any suitable manner, while the material to be treated is fed onto its interior surface in such a manner as to be spread by centrifugal action in a uniform thin layer over the same, a series of scrapers or stirrers being provided within the drum by means of which such layer of material is detached from the drum at certain points, so as to be stirred up and delivered onto another part of the drum. By this means the material, while being subjected to the heat transmitted through the drum, so as to be effectually dried thereby, owing to the thinness of the layer, is at the same time made to travel from the one end of the drum to the other, where it is discharged. The said apparatus may be constructed in various ways for carrying out this mode of operating. In the accompanying drawings are shown two such constructions.

Figure 1 shows a longitudinal section, and Fig. 2 a cross-section, of one construction. Fig. 3 shows a partly-sectional plan of a modification. Figs. 4 and 5 show, respectively, a

longitudinal section and cross-section of the second construction.

In the arrangement at Figs. 1 and 2, *a* is a revolving cylinder, containing centrally a second cylinder *b*, which is extended beyond *a* at each end, the extension *c* being closed, while *d* is open, which extension serves as the means of support and rotation for the combined cylinders, being provided with a toothed ring or other means for receiving motion from a motor. Through the central drum *b* passes a group of pipes *e*, the ends of which are inclosed by caps *e'* *e''*, of which *e'* communicates with a flue-pipe *f'*, leading from the flues of the heating-chamber *f*, surrounding the drum *a*, so that the hot combustion-gases from the furnace *h* are made to pass through the pipe *f'*, cap *e'*, and pipes *e* and escape through cap *e''* and flue-pipe *g* to the chimney. In the examples illustrated in the drawings the material to be dried is introduced into the extension *c* through a hopper *i* and passes thence through openings *k* into the cylinder *b*, where it is seized by projecting blades or scoops *l*, of such a form as to be thrown thereby onto the group of tubes *e* and at the same time to be propelled forward in falling through the interstices between the tubes. Arrived at the other end of the cylinder *b* the material falls through lateral openings *m* into the drum *a*, the speed of which is such as to carry the material right around with it by centrifugal action. As it travels around it is brought in contact with a series of slightly-inclined scrapers *n*, which detach the material from the surface of the drum and cause it in falling to advance in the direction from the openings *m* toward the other end of the drum, while at the same time it is effectually stirred up, so that all particles of the material are repeatedly brought in contact with the heated drum-surface and the disengagement of the vapor generated by the evaporation of the moisture is greatly facilitated. The scrapers *n* are held in a yielding manner against the drum-surface, so as to avoid concussions and unnecessary wear by the following arrangement: They are attached to arms loosely pivoted on a shaft *o* and provided with a weighted tail *p*, which keeps the scraper against the drum.

The shaft *o* is carried by a series of rings

5 *q*, surrounding the cylinder *b* and having rollers *r* resting thereon, so that the ring can turn around the cylinder; but the rings and scrapers are maintained in the position shown
 10 by a weighted arm *s*, so that if the scrapers should be subject to undue frictional resistance by the layer of material they will be depressed thereby and will regain their original position on such resistance passing away, so
 15 that no jamming or crushing of the material can occur.

When the dried material arrives at the left-hand end of the drum, it is taken up by scoops *t*, which in revolving discharge it
 20 through openings *u* into an annular collecting-channel, from one point of which it is discharged into a shed.

The aqueous vapor disengaged from the material in the drum is drawn off by an exhaust-fan communicating with the exhaust-
 25 passage *w*.

If desired, the tube group *e*, instead of revolving with the drum, can be made to revolve independently in the contrary direction in
 30 order to increase the movement of the material entering the drum. For this purpose the arrangement shown at Fig. 3 may be employed, in which the drum *a* is rotated by a toothed ring *l'*, and the cylinder *b*, with the
 35 tube group *e*, is rotated in the contrary direction by means of a toothed ring *l''*, the cylinder *b* being in this case separate from the drum. The shaft *o*, carrying the scrapers *n*, is in this case extended through the end of
 40 the drum *a* and carried by an external support *o'*, the annular plate *a'*, which closes the end of *a*, being, of course, separate from the latter and held stationary.

When the nature of the material to be
 45 treated is such that it will not be damaged by coming to a certain extent in direct contact with the combustion-gases from the fire, such as for drying grass, hay, &c., the above-described arrangement may be somewhat sim-
 50 plified by making the drum *a* of perforated metal or wire-gauze and dispensing with the heating-tubes *c* and cylinder *b*. This arrangement is shown at Figs. 4 and 5. The
 55 hay or other fibrous material is introduced through the hopper *i* directly into the drum *a*, which is of perforated metal, and which is mounted on an axis *X*, carried by external supports and driven by a pulley or chain-
 60 wheels and pitch-chain. Upon the axis *X* is mounted loose a hollow stationary shaft *y*, from which project arms *z*, carrying a shaft *l*, to which rotary motion is imparted in any
 65 suitable manner, such as by pitch wheels and chain 2, from the revolving shaft *x*. On the shaft *l* are fixed a series of radially-projecting prongs 3, which in revolving therewith pass in close contiguity to the inner surface of the drum *a*. The hollow shaft *y* also carries one or more weighted arms *s*, which tend
 to keep the shaft *l*, with its prongs 3, in the position shown, but allow of these being more

or less depressed when they meet with undue resistance from the material on the drum. By the above-described means the material revolving with the drum will be continually
 70 stirred up and loosened, and as the shaft *l* is arranged with a certain inclination, as shown at Fig. 4, the action of the prongs 3 will also cause the material to travel gradually from
 75 the inlet end of the drum to the discharge end. At the latter end is arranged a stationary discharge-chute 4, suitably held by a fixed plate 5, from which projects a bent arm 6, to
 80 the end of which is fixed a fork 7, situated at the periphery of the drum in such a position that as the material is carried round by the latter the fork detaches it and causes it to drop into the chute 4. Trough-like recepta-
 85 cles 8 are provided around the lower part of the drum, into which fall any small particles of the material that may fall through the perforations of the drum. These troughs com-
 90 municate with a pipe 9, the outer end of which is connected to an exhaust, by means of which all the said particles are drawn off.

In either of the above arrangements the drum *a* may be cylindrical, with horizontal or inclined axis, or it may be conical and its sur-
 face may be plain or corrugated.

Having thus described the nature of my
 95 said invention and the best means I know for carrying the same into practical effect, I claim—

1. In apparatus for drying granular pul-
 100 verulent or fibrous material, the combination of a revolving drum, means for heating the outer surface thereof, means for introducing the material to be treated into the drum at one end so as to be spread by centrifugal ac-
 105 tion in a thin layer over the same, in order to have its moisture evaporated therefrom, scraping or stirring devices within the drum, for removing the material from the surface thereof and causing it to be stirred up and to travel forward in the drum, and means for
 110 discharging the dried material at the discharge end of the drum, substantially as described.

2. In an apparatus for drying granular pul-
 115 verulent or fibrous material the combination of a revolving drum, means for heating the outer surface thereof, an inner revolving cylinder concentric with the drum and contain-
 120 ing internally heated pipes or equivalent heating devices, scrapers or equivalent means acting on the said inner surface for removing stirring and advancing the material, and means for discharging the dried material, sub-
 125 stantially as described.

3. In apparatus for drying granular pul-
 125 verulent or fibrous material the combination of a revolving drum, means for heating the outer surface thereof, means for supplying the material to be treated into the drum at one end so as to be spread by centrifugal
 130 action in a thin layer over the same and scrapers or equivalent devices within the

drum for removing the material from the surface thereof, said scrapers being held in a yielding manner by means of balance-weights, so as to yield to undue resistance offered by the material, substantially as described.

5 In testimony whereof I have signed my name to this specification, in the presence of

two subscribing witnesses, this 1st day of August, A. D. 1895.

EDUARD THEISEN.

Witnesses:

KARL HÄHNLEIN,
ERNEST THERION.