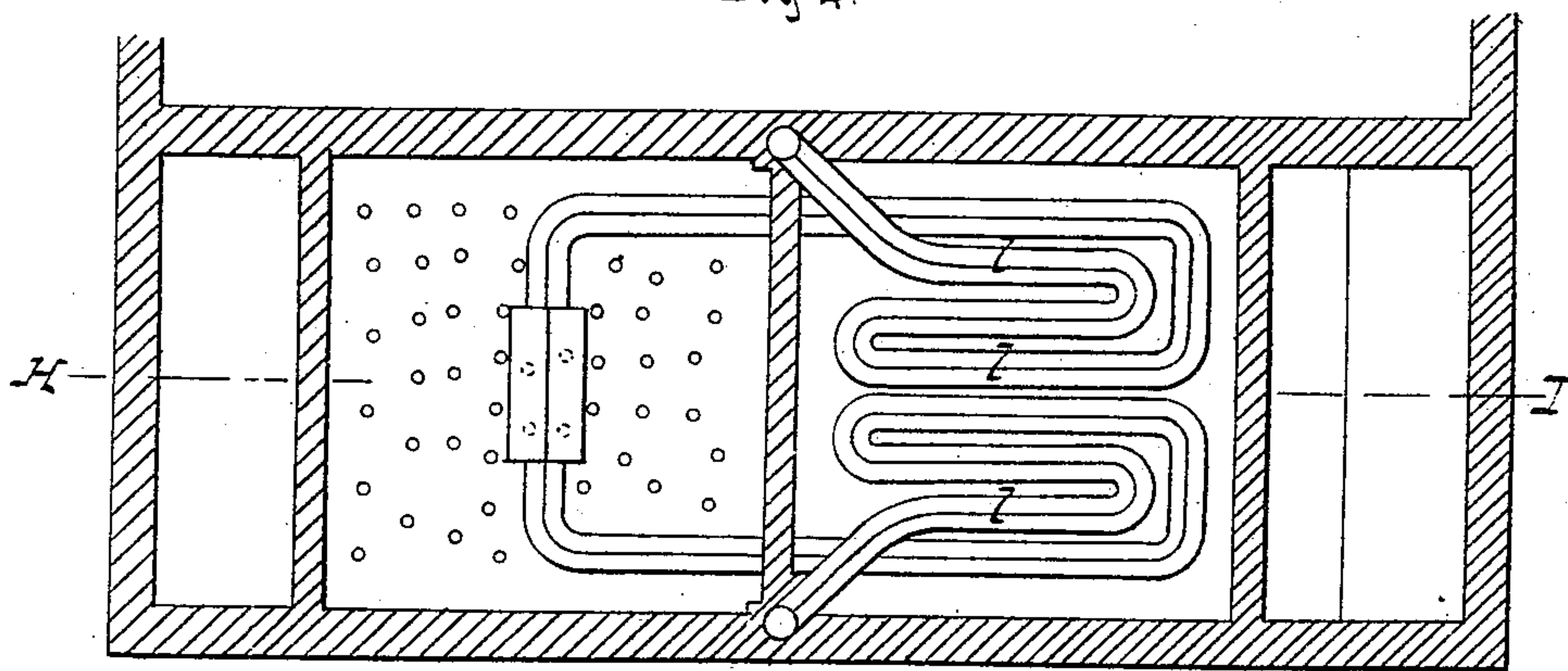
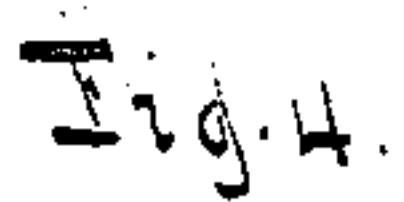


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No. 271,551.

Patented Jan. 30, 1883.



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CONTINUOUS MALT KILN.

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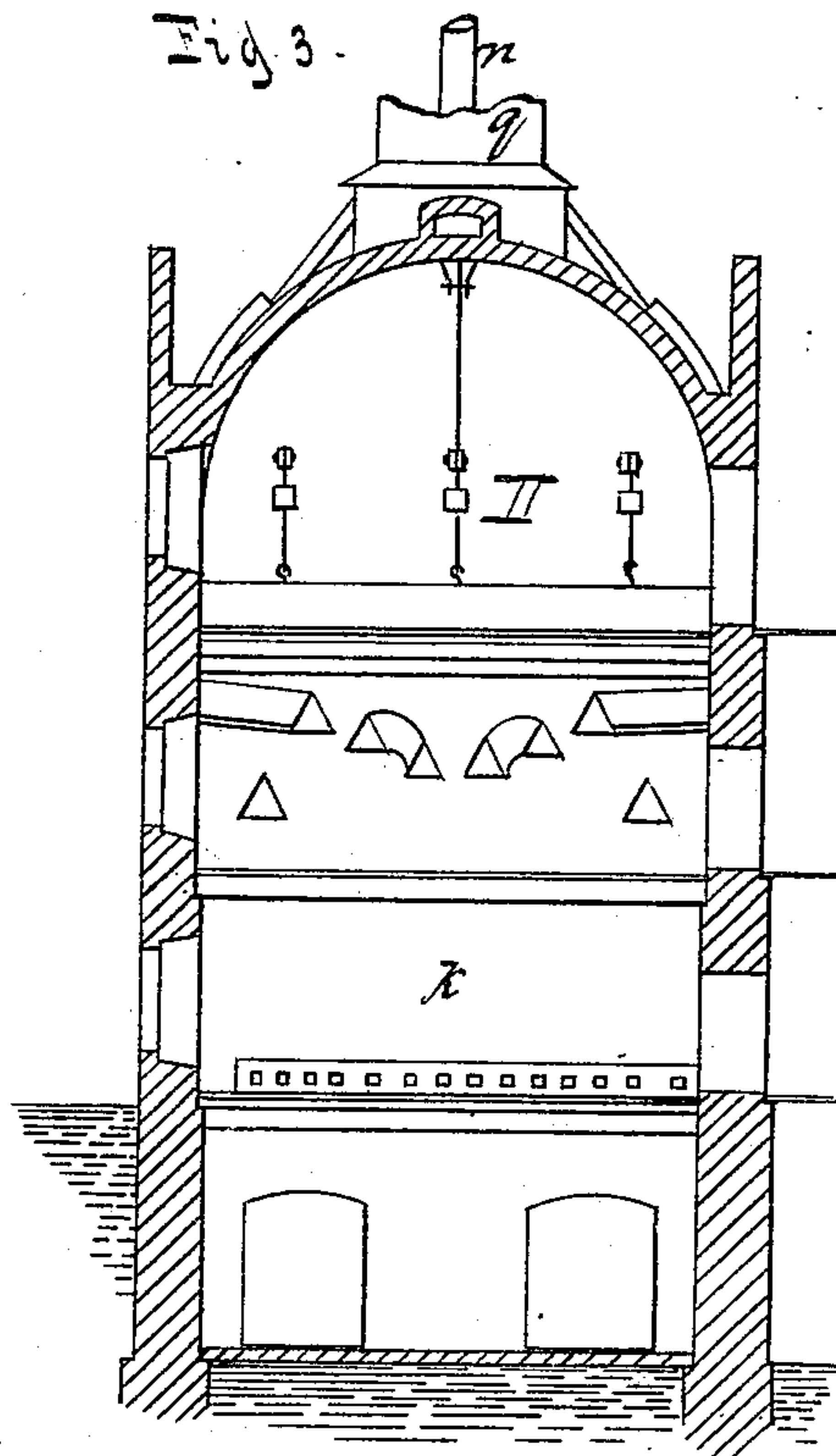
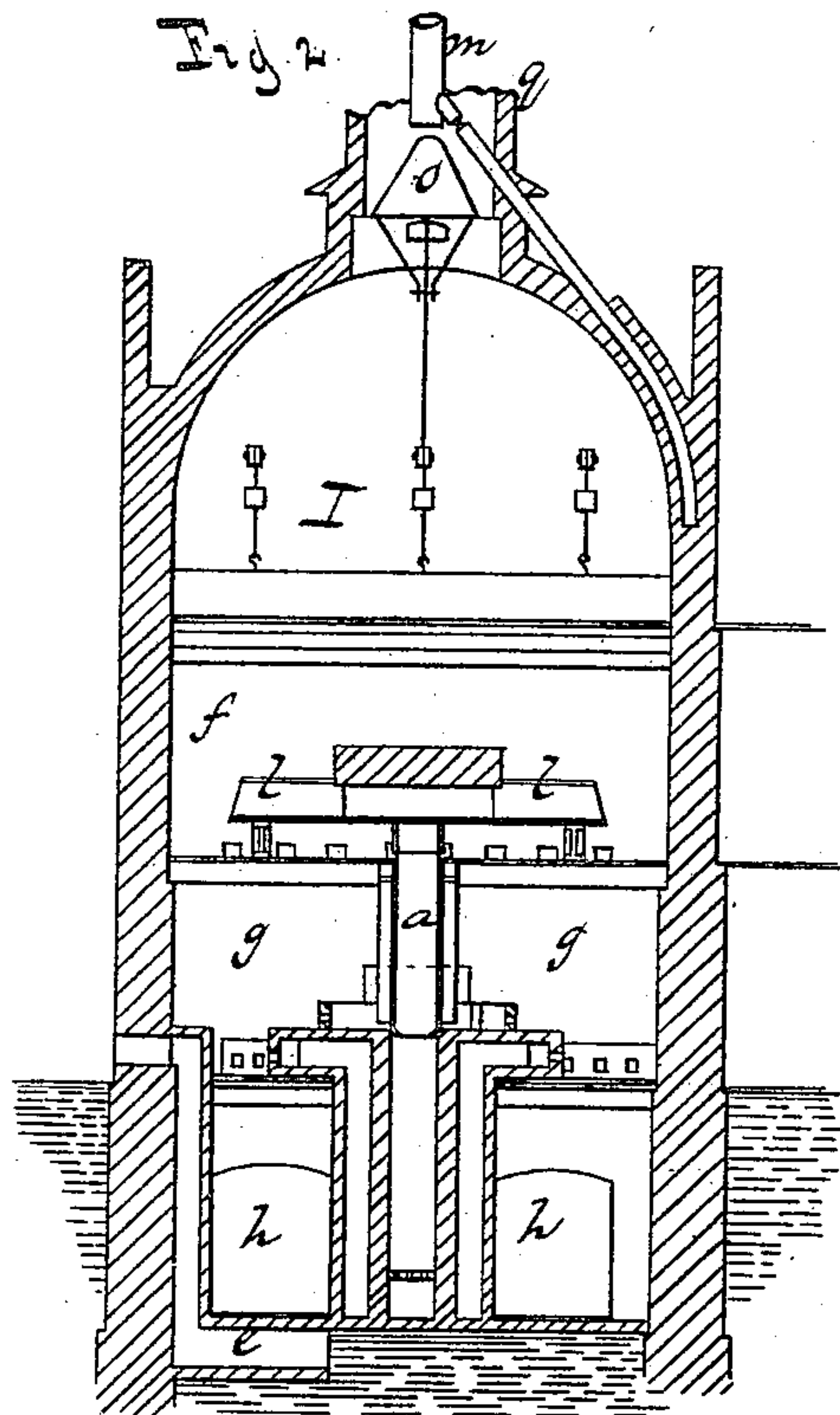
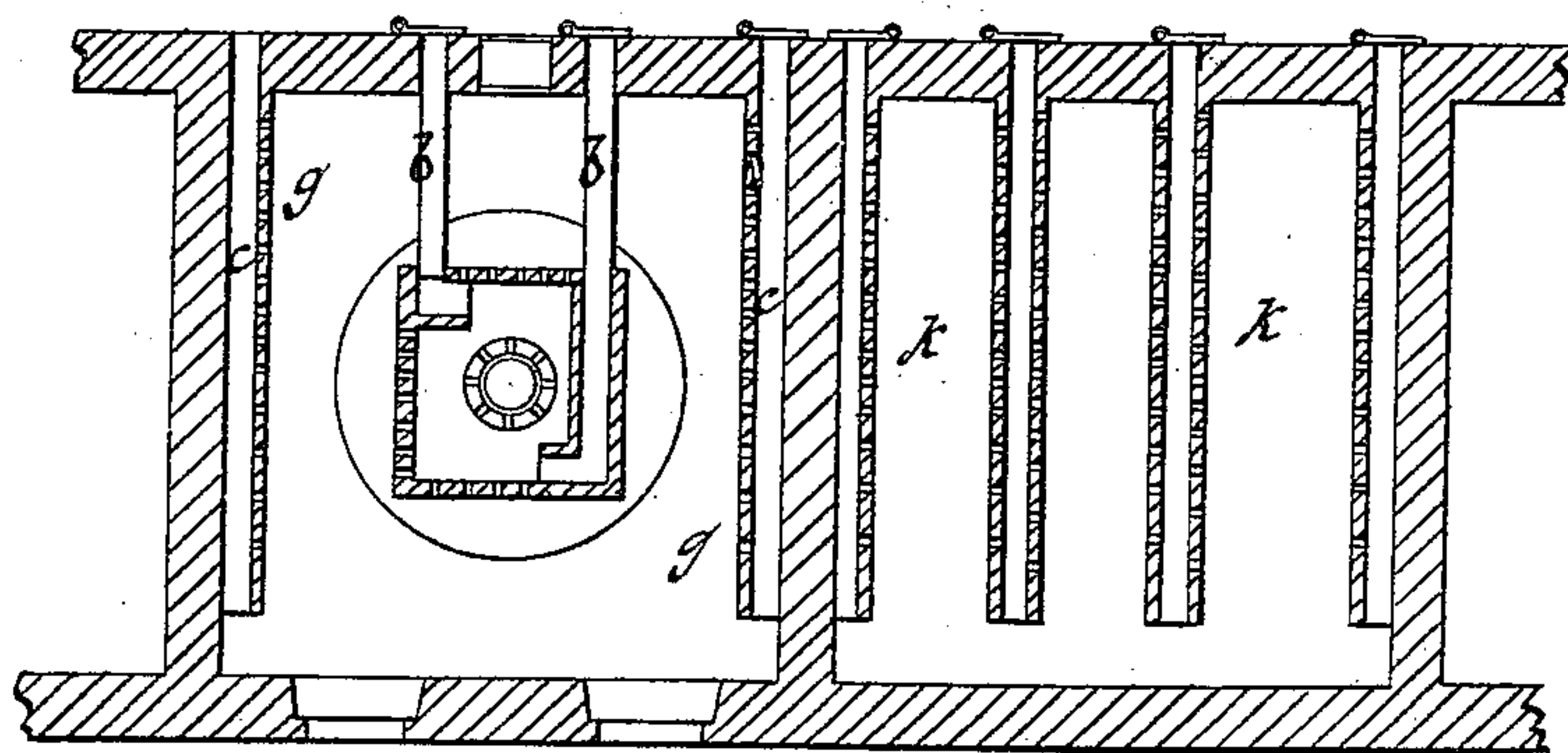


Fig. 5.



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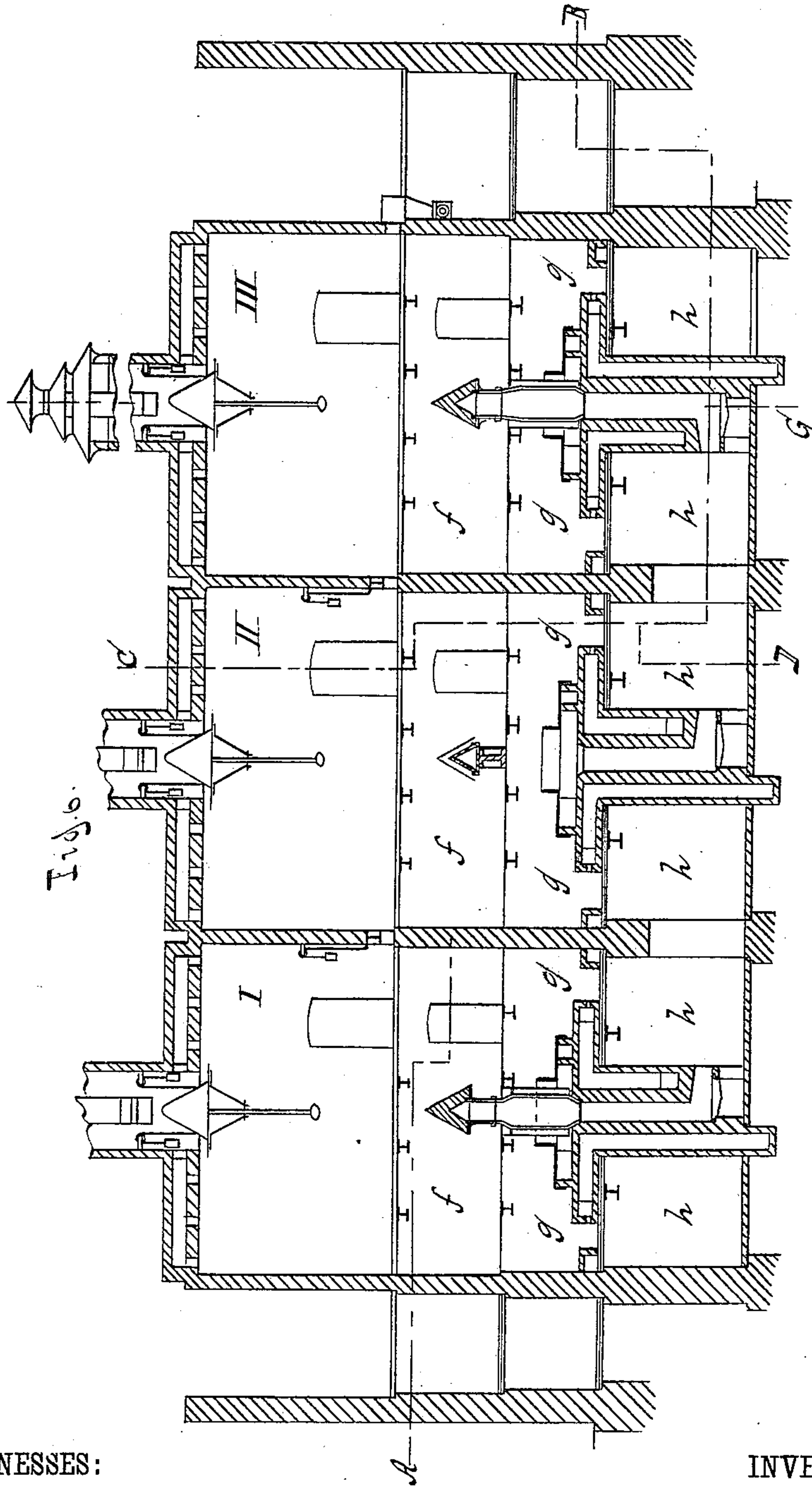
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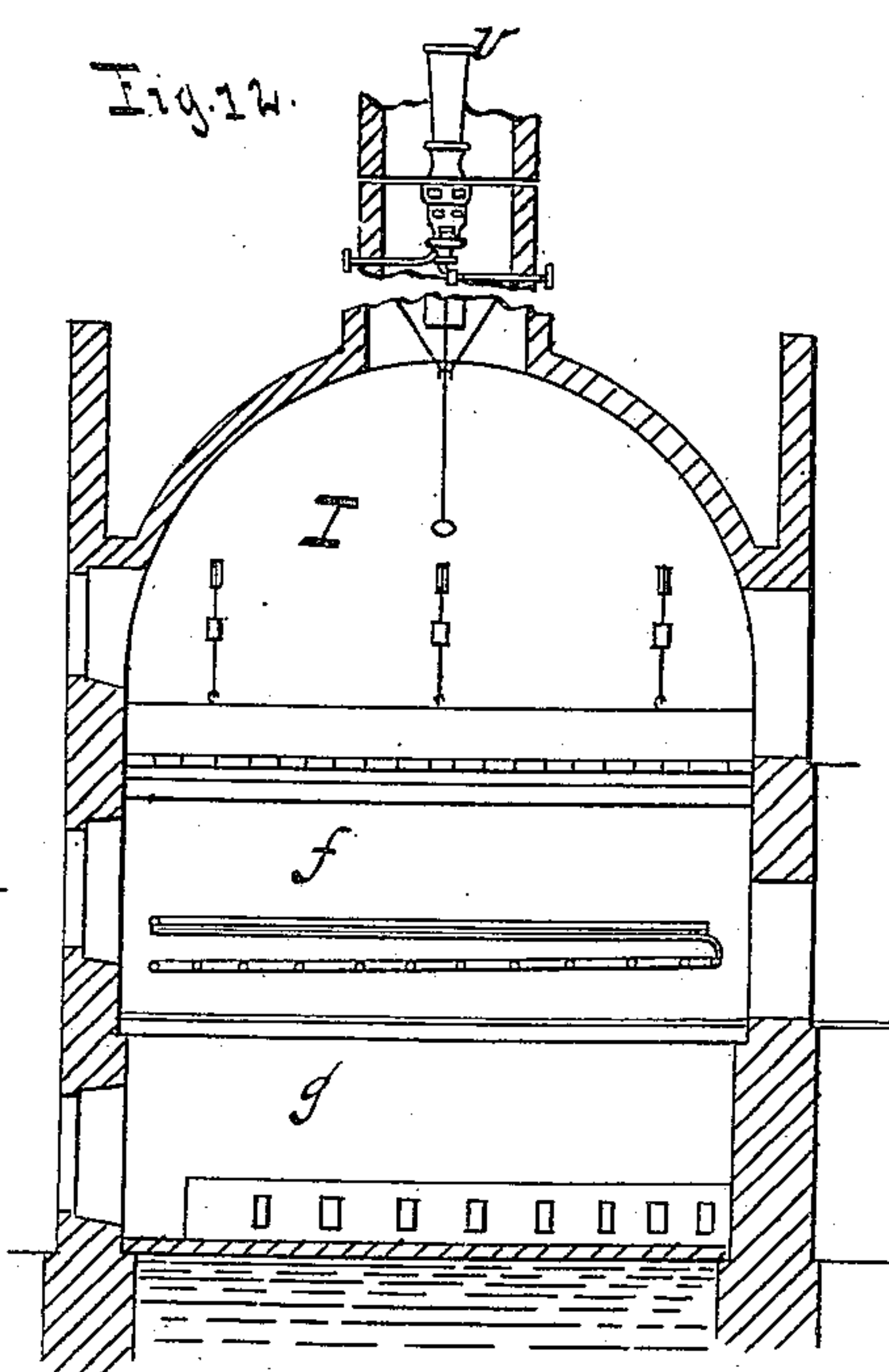
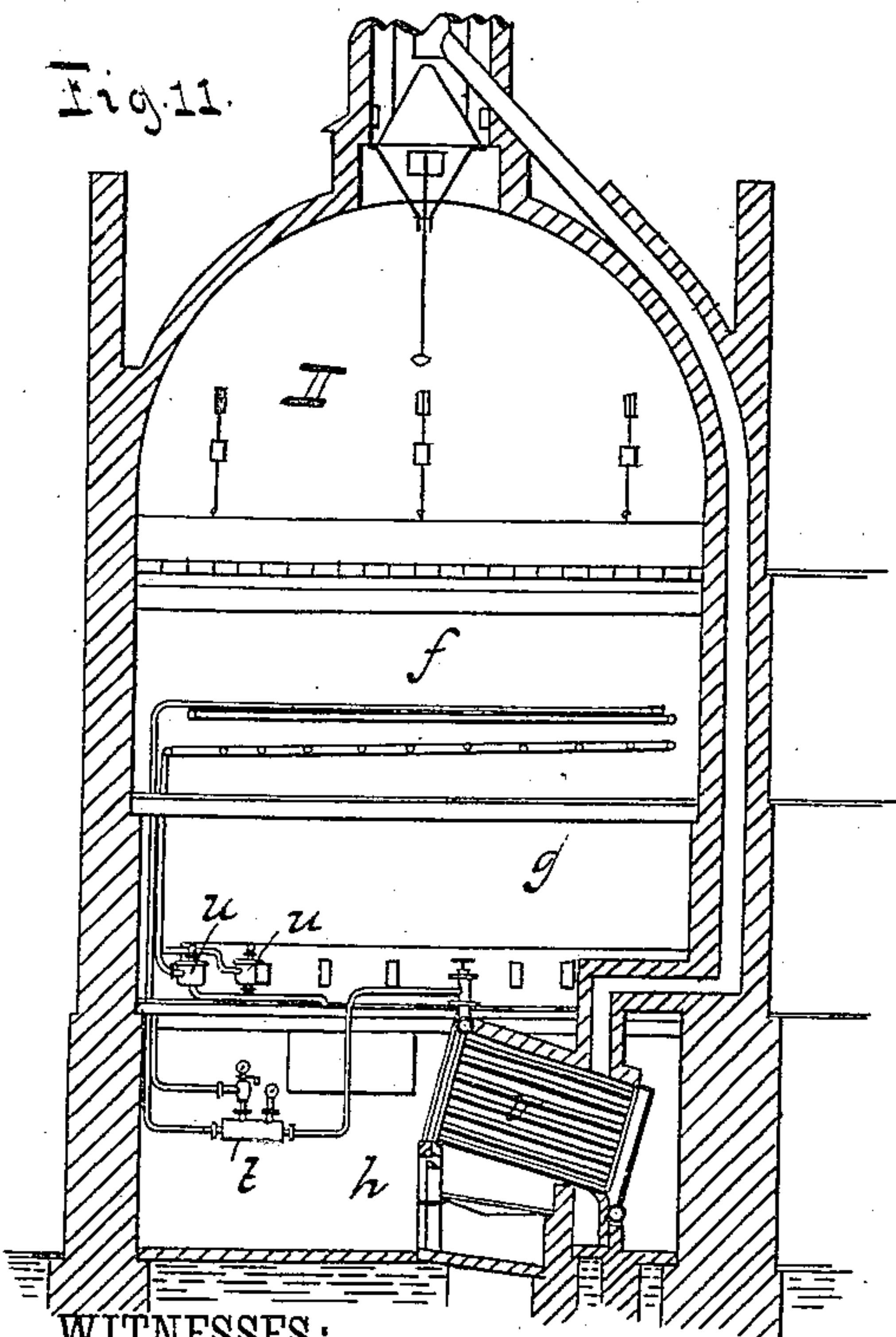
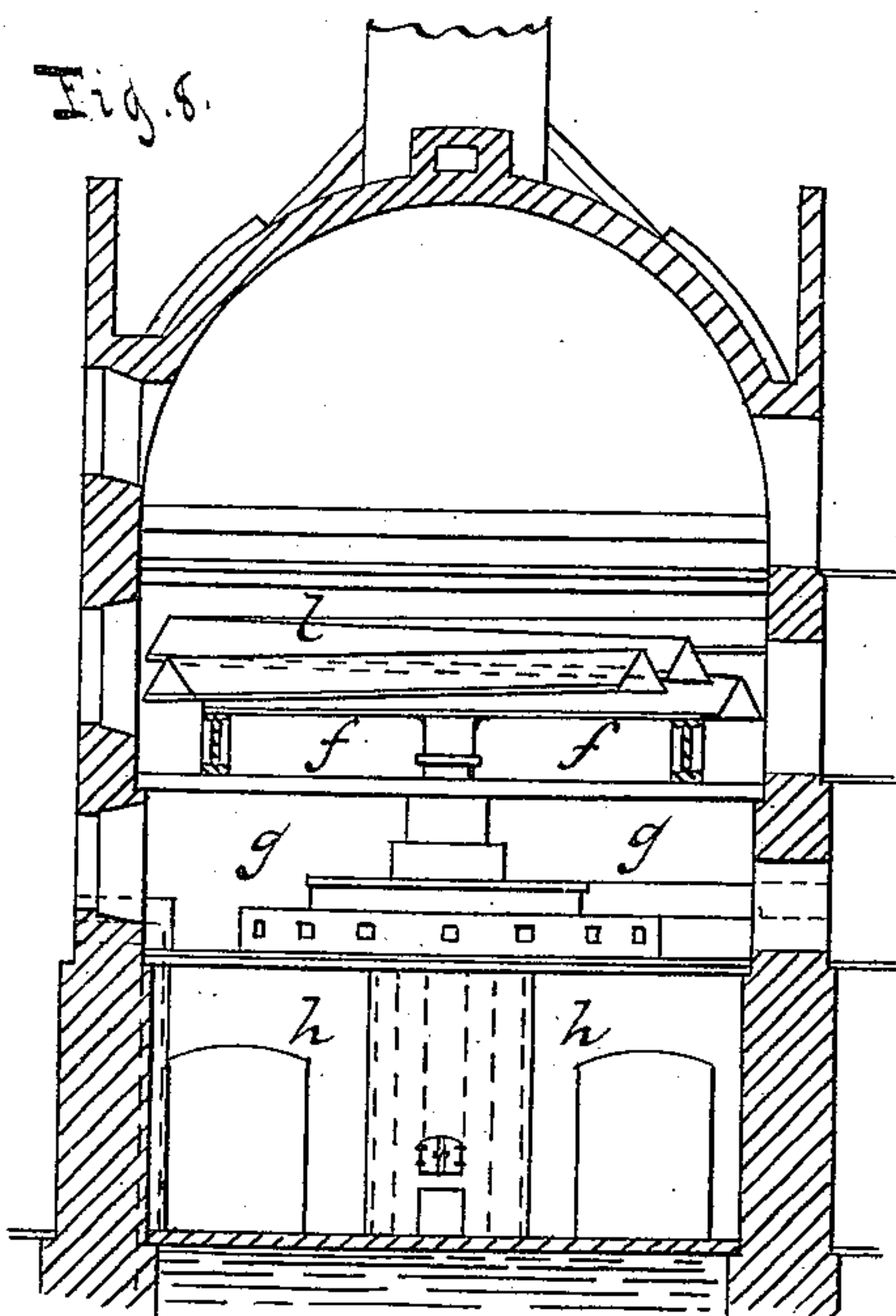
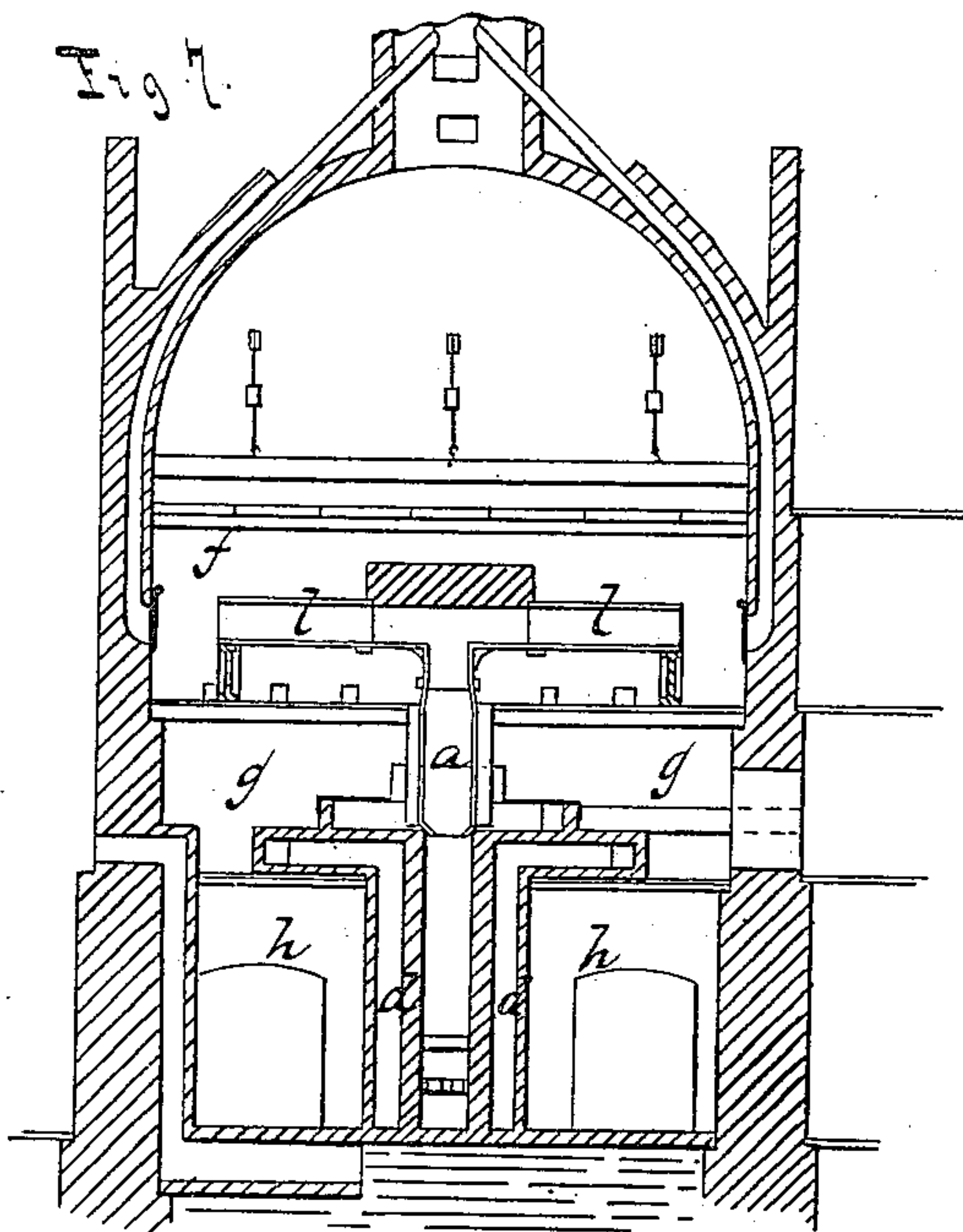
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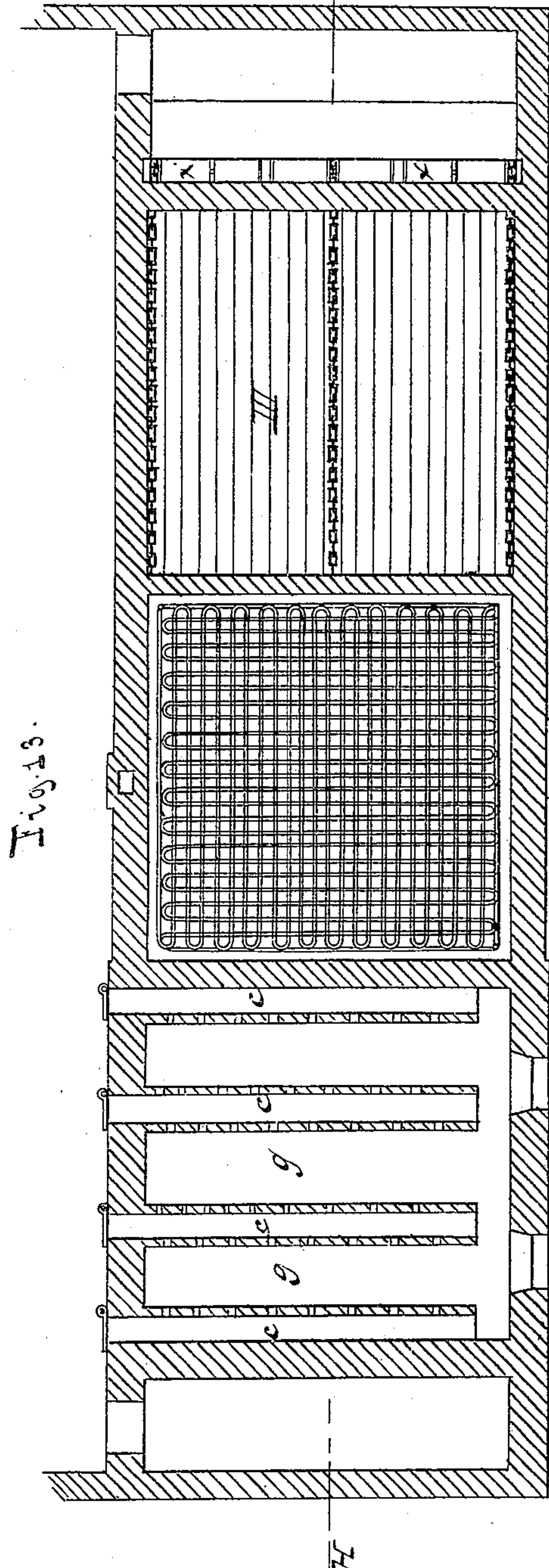
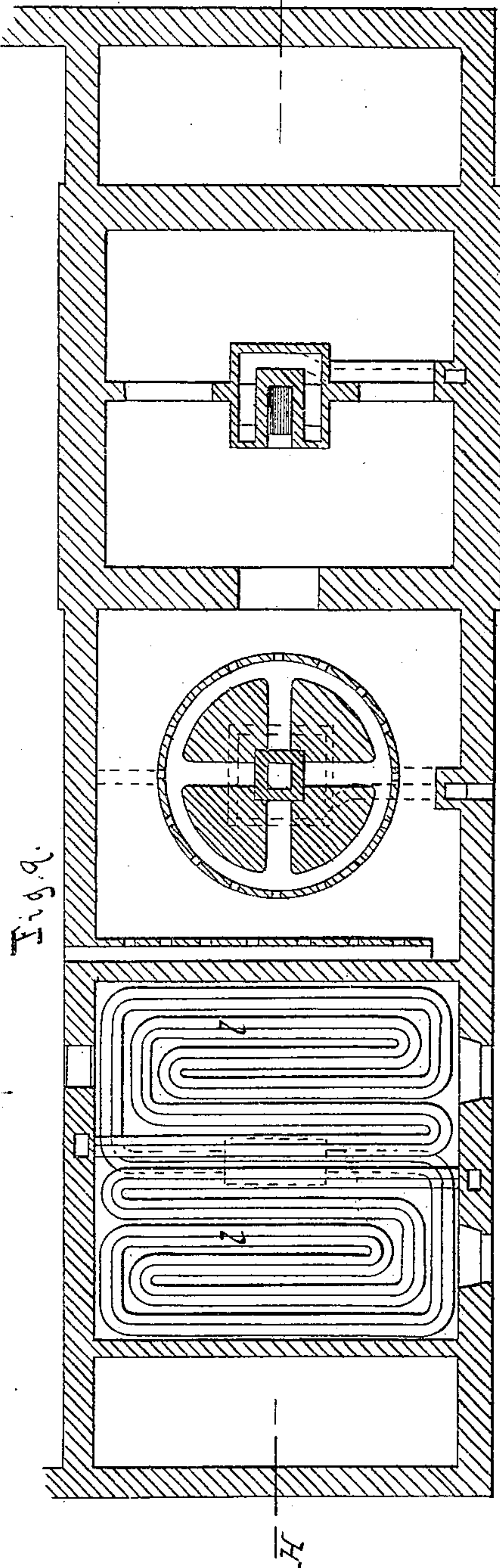
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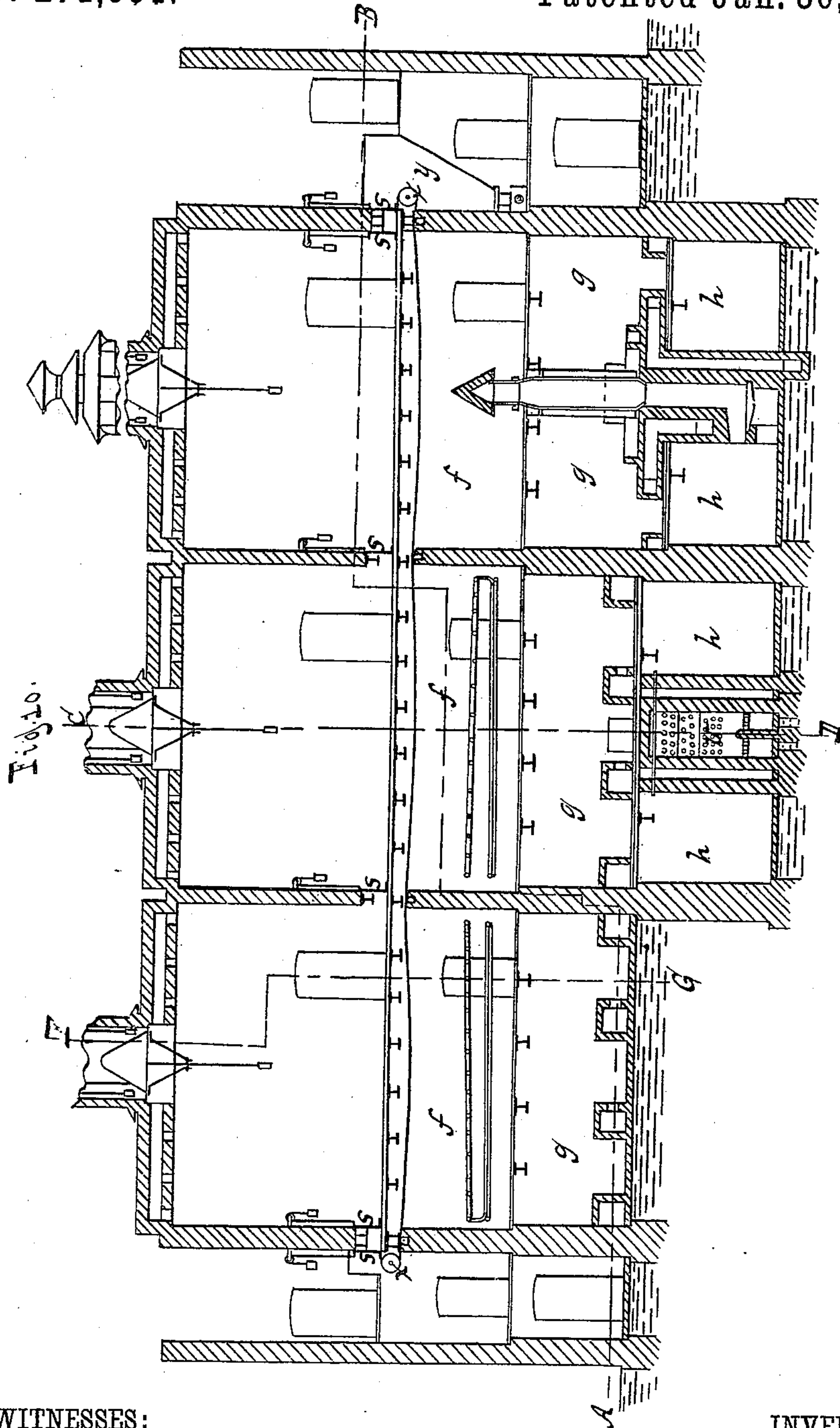
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UNITED STATES PATENT OFFICE.

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CONTINUOUS MALT-KILN.

SPECIFICATION forming part of Letters Patent No. 271,551, dated January 30, 1883.

Application filed May 27, 1882. (No model.) Patented in Germany December 28, 1880, No. 14,904.

To all whom it may concern:

Be it known that I, JUSTUS ULRICH, a citizen of the German Empire, residing at Pfungstadt, Germany, have invented new and useful Improvements in Continuous Malt-Kilns, of which the following is a specification.

This invention relates to an improved malt-kiln, said kiln having a series of hurdles, each of said hurdles being provided with mechanism for regulating the temperature therein independently of the others, as hereinafter more fully set forth. An endless belt or conveying mechanism for transferring the malt from one hurdle to another is also provided. The hurdles communicate with one another, and are provided with mechanism for cutting off said communication.

This invention is illustrated in the accompanying drawings, in which Figure 1 is a vertical longitudinal section. Fig. 2 is a transverse section in the plane F G, Fig. 1. Fig. 3 is a transverse section in the plane C D, Fig. 1. Fig. 4 is a horizontal section in the plane A B, Fig. 1. Fig. 5 is a horizontal section in the plane K M, Fig. 1. Fig. 6 is a vertical longitudinal section of a continuous kiln, showing three hurdles and an independent heater for each. Fig. 7 is a transverse section on the line F G of Fig. 6. Fig. 8 is a similar section on the line C D of Fig. 6. Fig. 9 is a horizontal transverse section on the line A B of Fig. 6. Fig. 10 is a vertical longitudinal section of a kiln embodying another modification of my invention. Fig. 11 is a vertical transverse sectional view on the line C D of Fig. 10. Fig. 12 is a similar section on the line F G of Fig. 10, and Fig. 13 is a longitudinal transverse section on the line A B of Fig. 10.

Similar letters indicate corresponding parts.

The malt-kiln represented in Figs. 1 to 5 consists of two hurdles, I II, and a heating apparatus, a distinctive feature being that the two hurdles lie one alongside the other. The heating apparatus is arranged under the hurdle I, (see Fig. 1,) and the radiating heat from the cast iron part or cap *a* of the heater is principally utilized for the hurdle I. In the primary warming-chamber, *g*, are arranged drafts *b b*, Fig. 5, with regulating-slides to lead

the cold air to the cast-iron part or cap *a* of the heater, said air, when heated, passing out above. Surrounding the heater are drafts *d d*, communicating with the channel *e*, which leads the air in from the outside. The air entering here is warmed in the drafts *d d* and passes up into the primary warming-chamber, *g*, where it is distributed. In addition are also supplied the drafts *c c*, Fig. 5, also provided with regulating-slides, to allow fresh air to be supplied according to desire. By the setting of these various drafts the temperature and ventilation are always perfectly controlled. In order to have the warmed air distributed equally through the secondary warming-chamber, *f*, under hurdle I, the primary warming-chamber is covered with perforated plates, and when the drafts are properly set the temperature of hurdle I does not exceed 35° Reaumur.

The hurdle II, in which drying is effected, has a chamber, *k*, underneath the warming-chamber *i*, into which chamber *k* pass cold drafts, said chamber *k* also being covered with perforated plates. The air passes equally distributed through these holes in said plates, under the sheet-metal channels or pipes *l* for the escaping products of combustion, where it is heated, and then reaches the hurdle. The sheet-metal channels for the escaping products of combustion are arranged as shown in Fig. 4. The escaping products of combustion, on passing out from the cast-iron part or cap of the heater in the secondary warming-chamber, *f*, underneath the hurdle I, separate into two parts, each of which by itself, after it has delivered the greater part of its heat underneath hurdle II, passes one part to the escape-chimney *m* of hurdle I and the other part to the escape-chimney *n* of hurdle II. The chimneys *m* and *n* are of sheet metal, and serve to increase the ventilation. In order to have the ventilation at these places also under control, cone valves or drafts *o o* are suspended in the chimneys from counter-weights, as shown, whereby the regulation can easily be effected from the kiln.

The drying is effected as usual, green malt being laden into the hurdle I, the heater being gradually started up and the temperature

raised to 35° Reaumur, which process is to be accomplished most satisfactorily within eighteen hours. Within this time the malt is so far dried by the heat and strong ventilation that it can be brought to hurdle II, to be gradually dried and heated, according to necessity, up to 100° Reaumur, which also is most satisfactorily accomplished within eighteen hours.

The ventilation in hurdle II can be diminished without disadvantage, and the radiating heat from the channels *l* is very advantageous for the preparation of dark malt, in case such should be required. The hurdles are inclosed in a vault, on which rest the escape-chimneys with the smoke-stacks *q*. In the longitudinal direction over the vault is applied an escape-channel, *p*, which receives the ascending aqueous vapors and leads them to the smoke-stack.

This construction of kiln may be provided with mechanical working apparatus by applying a conveying mechanism, so that no special work on the kiln will be required from any workmen during the entire drying process.

The conveying mechanism shown consists of an endless belt of wire-netting extending across the entire breadth of the hurdles, which belt passes over two rollers, *x x*, serving to impart motion to the same. The rollers are turned either by hand or by machinery, and to prevent slipping and secure a movement of the endless band the inner side of the belt is provided with chains, which pass over chain-wheels. The rollers consist of parts, which are secured to a common axle, to which axle also are secured the chain-wheels. This axle is journaled at both ends, and, if desired, also in the middle.

Within the kiln, and on its two outer sides, sliding doors *s*, of sheet metal, are suspended from counter-weights, to close the intermediate walls during the drying process. When the drying process is ended in the separate hurdles in the above-named time, the slides *s* are raised and the rollers *x* are set in motion until the supply of hurdle I has passed into hurdle II. At the same time the finished malt of hurdle II falls into the funnel *y* of a transporting worm-tube, which carries it to the degerminating apparatus. The slides *s* are then closed and the hurdle I freshly charged, which can be accomplished automatically, by applying to the exterior of the hurdle I along its whole width a funnel, in which there is the fresh quantum of malt. Before setting the conveying mechanism in motion the outer slide is lifted as high as it is intended to charge the hurdle, so that the fresh malt will distribute itself equally over conveyer as soon as the wire belt is set in motion. In this manner the operation can be carried on continuously and mechanically.

Figs. 6 to 9 show a continuously-working malt-kiln of three hurdles, lying one alongside the other, and each hurdle is either provided with a stove, or the hurdle I and II may be

heated by steam and hurdle III may be heated by a stove. In the former case, where every hurdle by itself is provided with a stove, the temperature is in a certain sense dependent upon the heater; but the size of the oven may be so chosen and the supply of air through the drafts may be so arranged that the heater has only to sustain at all times a uniformly strong fire, without the temperature being materially changed. The several hurdle-spaces consist of a furnace-room, *h*, a primary warming-chamber, *g*, and a secondary warming-chamber, *f*, and the hurdle. From each stove the products of combustion pass through the cast body *a*, which already gives off heat in the primary warming-chamber, *g*, and then separate into two parts, each of which by itself passes through the channels *l*, Fig. 9, to the side chimneys, which lie in the side walls and lead off over the vault and unite in the inside of the escape-chimney, Fig. 7. In the second case, where the hurdles I and II are also heated by steam and the hurdle III by a stove, it is almost entirely unnecessary to depend upon the stove, and this construction is the most advantageous.

Underneath hurdle II is arranged a boiler, Figs. 10 and 11, which can sustain a pressure of ten atmospheres, and which furnishes the requisite steam for heating the air. In each of the secondary warming-chambers, *ff*, underneath hurdles I and II, is a system of pipes, Fig. 13, in which is contained steam under a pressure proportionate to the temperature of the respective hurdle. As steam of different tension has also a different temperature, and as hurdle I requires a lower degree of temperature than hurdle II, the pipe system of hurdle I is under a less degree of pressure, which is regulated by means of a reducing-valve at the valve-joint *t*. When the required pressure is once determined it is noted on the respective manometer, which is arranged in the vicinity of the boiler, and the attendant has only to observe the manometer in order to secure the required temperature in the respective hurdle. In order to carry off the water of condensation within the two systems of pipes, each of the systems is brought into communication with a conveyer, *u*, for carrying off said water of condensation, which conveys said water into a reservoir for feeding the boiler.

The hurdle III is heated by a stove in the manner described above. In order to secure a strong ventilation of hurdle I, which possesses no chimney for conveying the products of combustion, the ventilating-chimney is provided with a steam-jet, *v*, Fig. 12, which can easily be regulated as desired. The supply of air, temperature, and ventilation in both cases is, as already set forth, under exact control by means of the various slides, and each hurdle may be regulated by itself. The drying is accomplished by placing the green malt into hurdle I, exposing it there to a temperature of from 25° to 30° Reaumur within twelve hours,

transferring it to hurdle II where it receives within twelve hours a temperature up to 45°. When the malt is thus far prepared in hurdle II it may be subjected to a higher temperature, and is then exposed in hurdle III to a temperature up to 100° Reaumur, according to desire, and dried. It is thus always under control to give each hurdle independently of the others any desired temperature, and consequently in drying nothing is to be apprehended.

Figs. 10 to 13 represent a continuous kiln of three hurdles with mechanical conveying apparatus, which is constructed as already described, but with this exception, that the malt remains in each hurdle but twelve hours, so that the slides *s* have to be drawn every twelve hours, and the axles *x* have then to be revolved until one section of the carrying-belt has passed into the next hurdle. In this way, within every twelve hours one hurdle is emptied and the contents carried off through the transporting worm-tube communicating with funnel *y*. By reason of this mechanical construction no particular work remains to be done by workmen in the kiln.

Some of the advantages of this construction of kiln are: first, the construction of the kiln, Figs. 1 to 5, makes the brewer or maltster independent of the temperature, moisture, and pressure of the outer atmosphere, as the ventilation through one hurdle is much stronger and more regular than it is possible to accomplish by a double or triple hurdle kiln; second, the production of a uniform and good malt, especially in its chemical composition, can be accomplished with slight expenditure of fuel; third, in this kiln malt can be produced as well for light beers as for dark beers; fourth, time is saved, as by this construction discharging may take place at the furthest, every eighteen hours, so that the malt is prepared in thirty-six hours, while at present, to obtain good malt with a double kiln, the malt has to lie in each hurdle twenty-four hours; fifth, by arranging the mechanical working or conveying apparatus saving of labor and a healthier condition of the workmen are attained, as the latter no longer have to work in the hot drying-rooms. The construction with three hurdles has the further advantage of saving labor and time, as here the discharging may take place every twelve hours.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a malt-kiln, the combination of a series of independent hurdles adapted to communicate with each other through a passage-way in the lower portion of their dividing-wall, and arranged horizontally side by side, and each

provided with an escape-chimney, means, such as described, for heating all the hurdles and producing different temperatures in the same, respectively, a door or slide for opening and closing the passage-way between the lower portions of the hurdles, and horizontally-traveling mechanism for conveying the material to be dried from one hurdle to the other consecutively through the aforesaid passage-way, substantially as set forth.

2. In a malt-kiln, the combination of a series of hurdles, arranged side by side, and each provided with an independent escape-chimney controlled by a valve, said hurdles having a lateral passage-way in the lower portion of their dividing-wall, a movable door or slide for opening and closing the passage-way, a traveling conveyer, forming a bottom to the hurdles, for delivering the malt from one hurdle to the other through the said passage-way, and means for supplying all the hurdles with heat, substantially as described.

3. In a malt-kiln, the combination of a series of hurdles communicating at their lower portions by a lateral passage-way in their dividing-wall, and each hurdle provided with an independent ventilating-chimney controlled by a valve, a slide or door for opening and closing said passage-way, and means for heating all of said hurdles, substantially as described.

4. In a malt-kiln, the combination of a series of hurdles, arranged side by side, and provided with devices for opening and closing communication between the same, traveling mechanism for conveying the malt from one hurdle to the other consecutively, a series of secondary warming-chambers arranged directly below the traveling conveying mechanism, a series of primary warming-chambers beneath the said secondary chambers, and means for heating the latter, substantially as described.

5. In a malt-kiln, the combination of a series of hurdles, arranged side by side, and each provided with an independent escape-chimney controlled by a valve, a movable door or slide for opening and closing communication between the hurdles, a traveling conveyer, forming a bottom to the hurdles, for delivering the malt from one hurdle to the other consecutively, and means, such as described, for independently supplying all the hurdles with heated air, substantially as described.

In testimony whereof I have hereunto set my hand and seal in the presence of two subscribing witnesses.

JUSTUS ULRICH. [L. S.]

Witnesses:

WILHELM HILDEBRANDT,
FYNUR BLÜMLEIN.