

(No Model.)

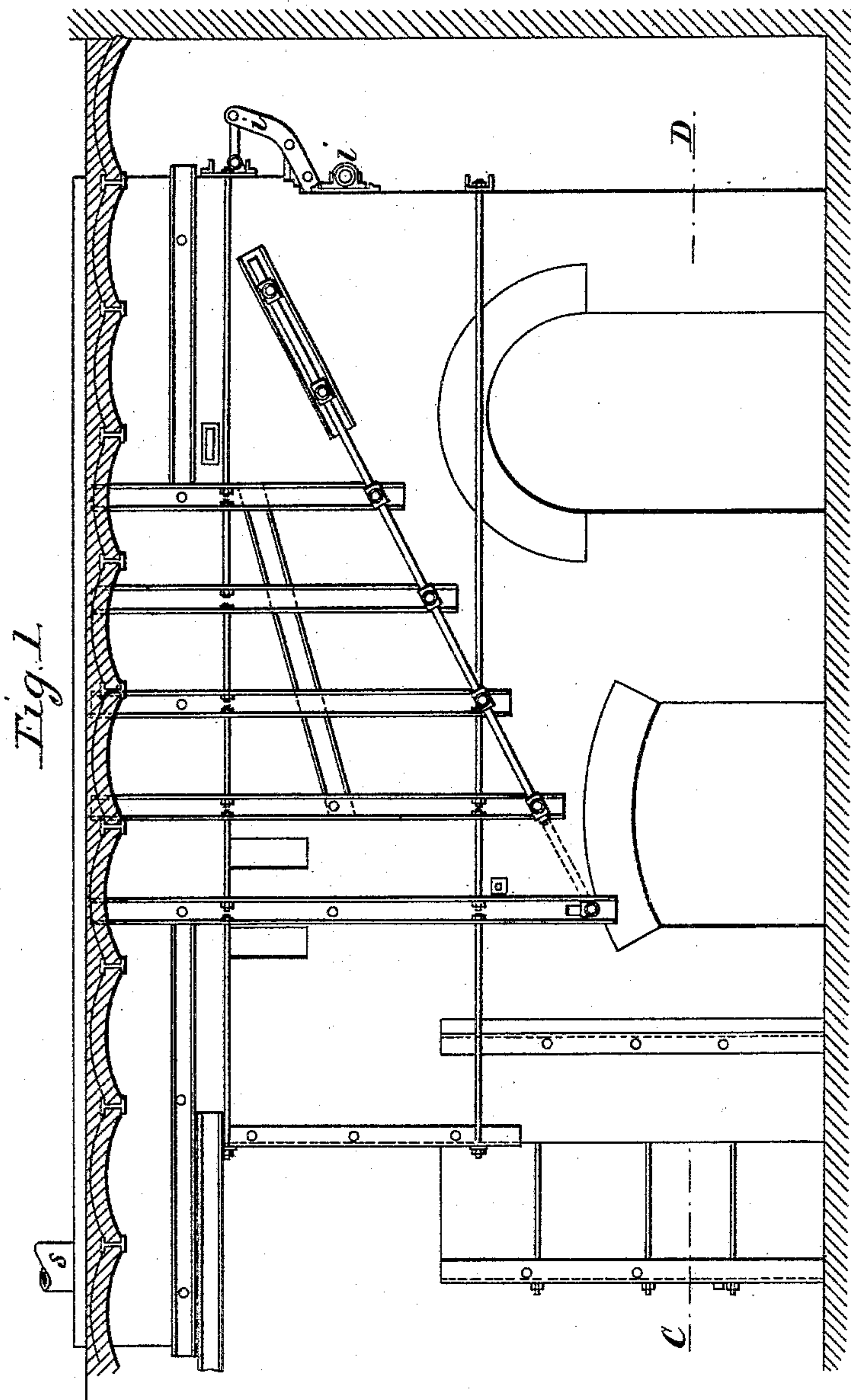
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E. LANGEN.

FURNACE FOR ROASTING OR OTHERWISE TREATING GRANULAR OR
PULVERULENT MATERIALS.

No. 414,552.

Patented Nov. 5, 1889.



Witnesses:

Percy B. Hills.

Robert Garrett.

Inventor:

Eugen Langen

By

James L. Norris

Atty.

(No Model.)

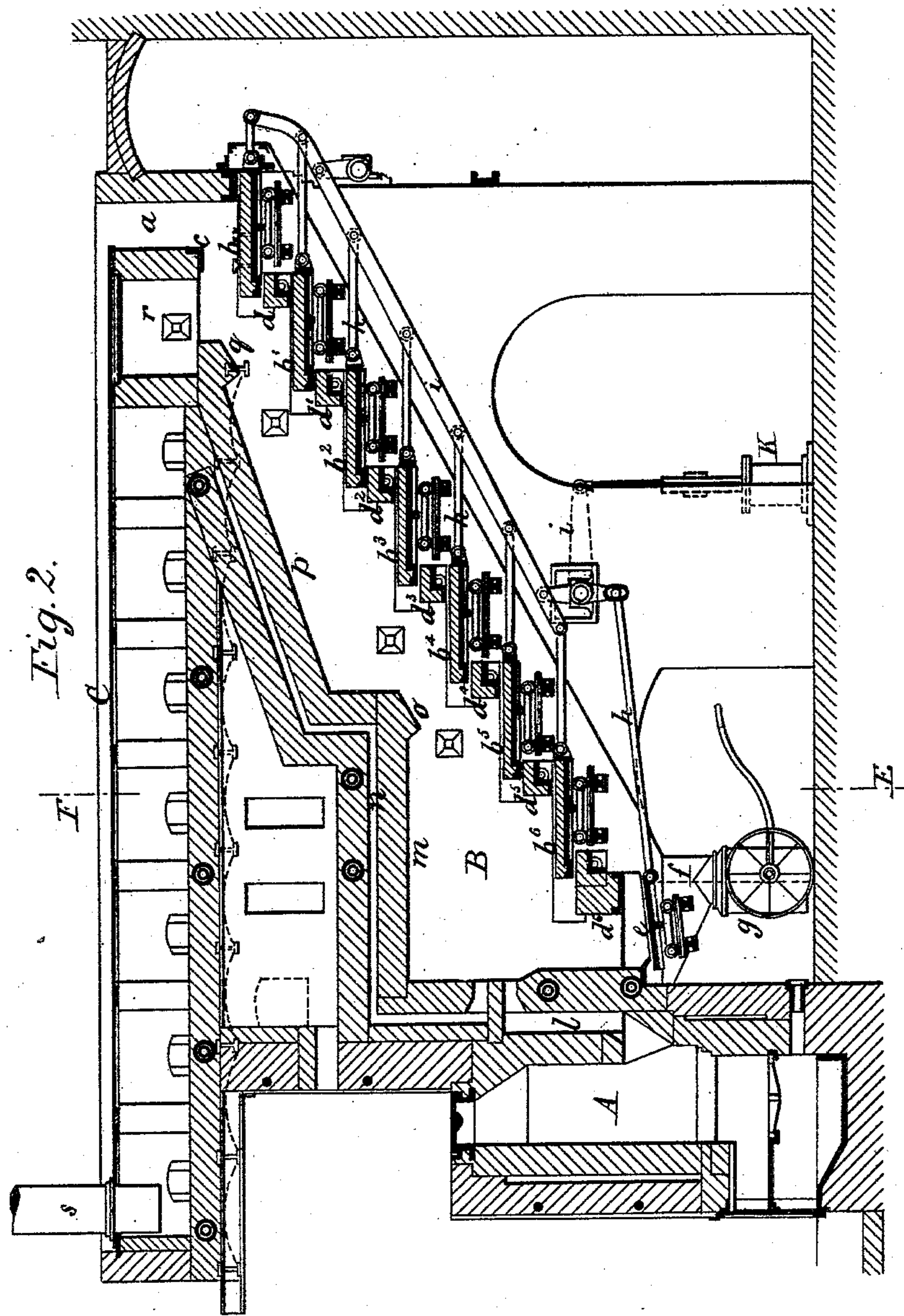
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E. LANGEN.

FURNACE FOR ROASTING OR OTHERWISE TREATING GRANULAR OR
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No. 414,552.

Patented Nov. 5, 1889.



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Fig. 3.

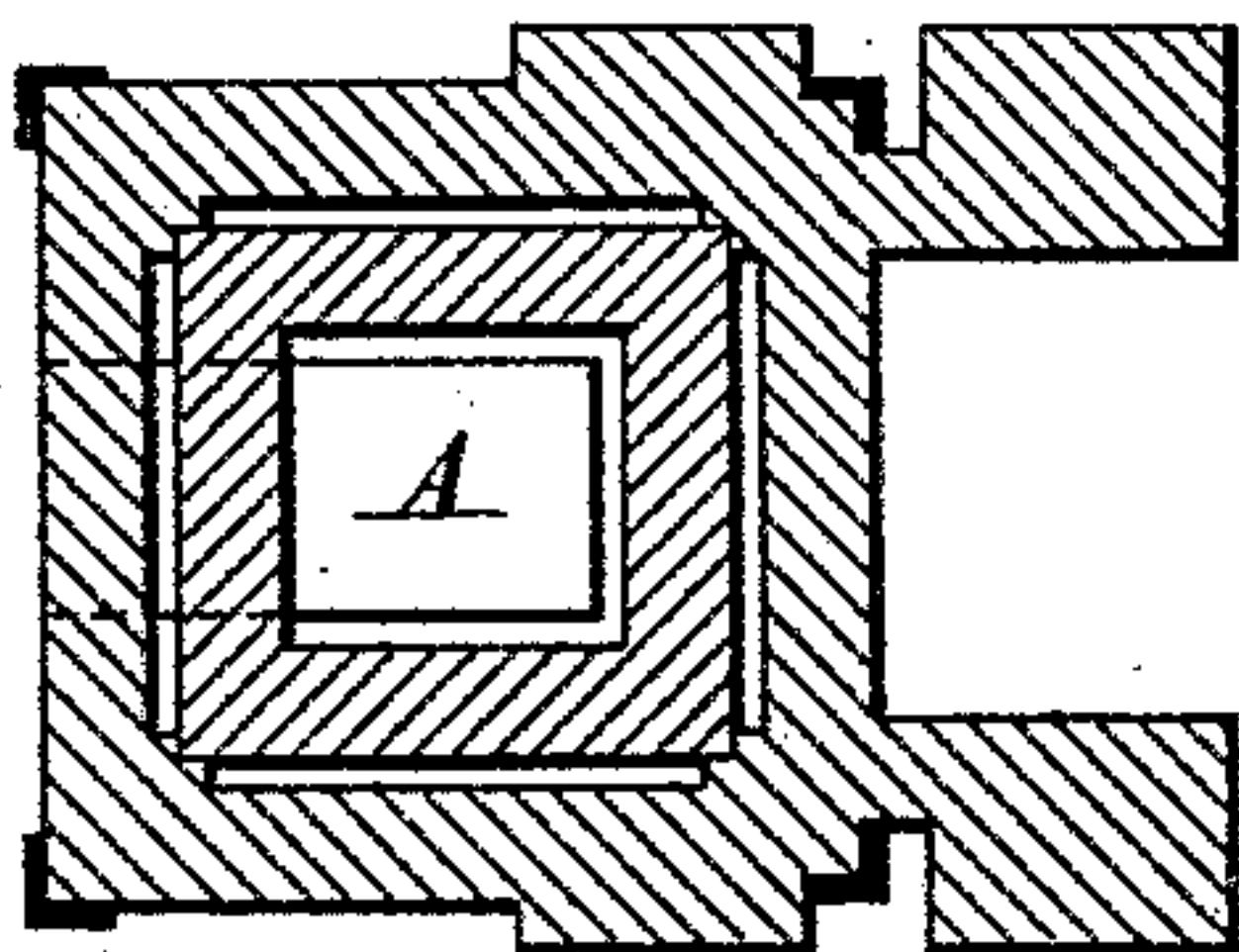
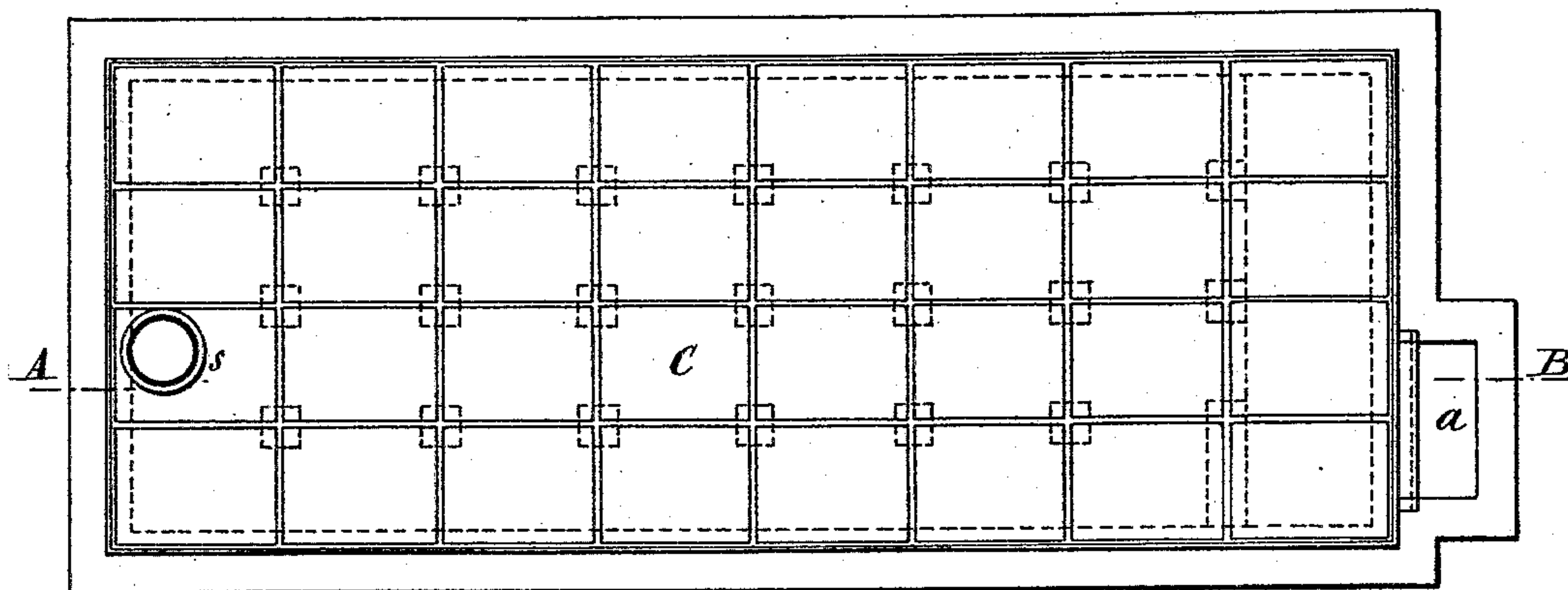
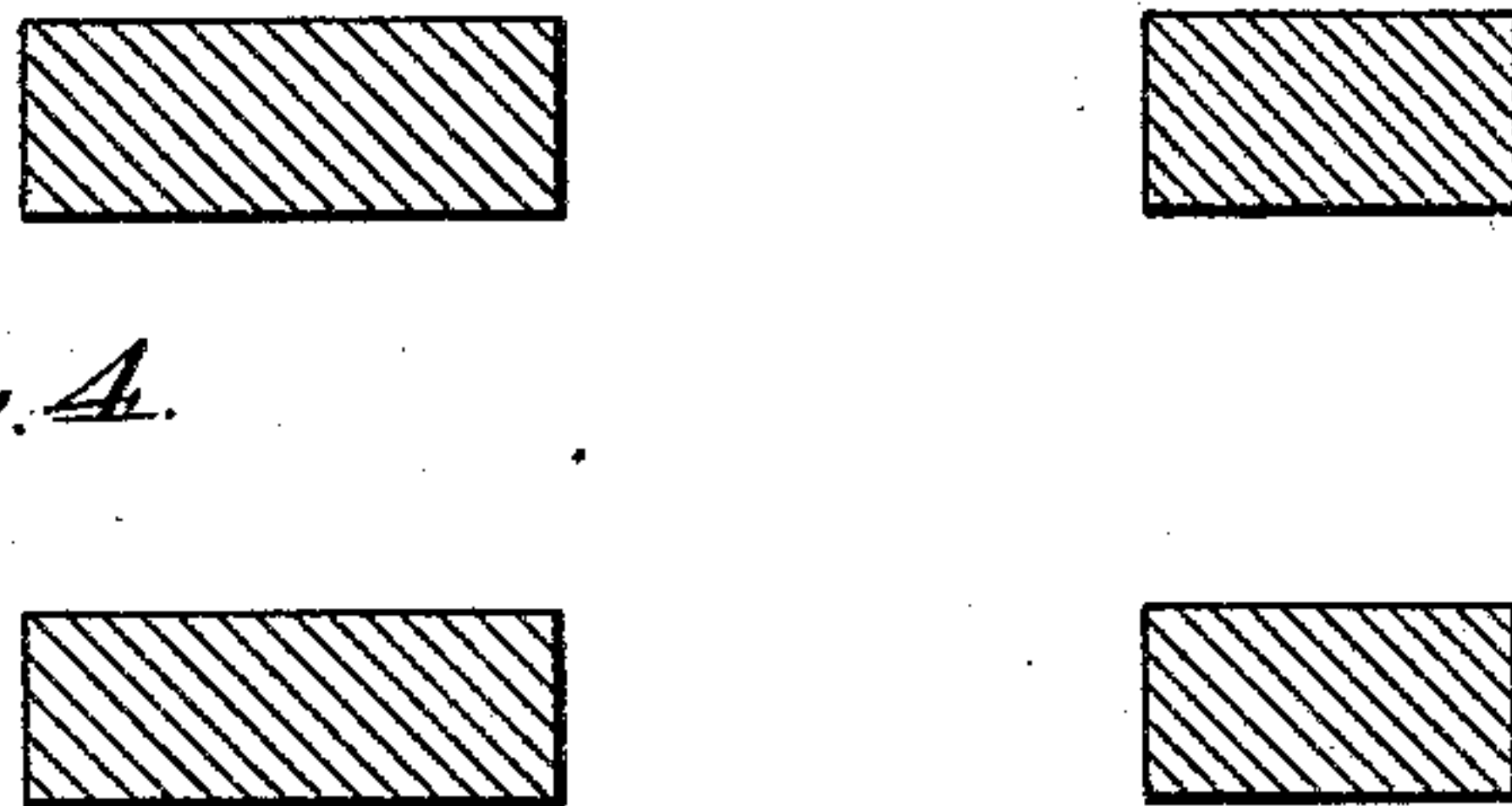


Fig. 4.



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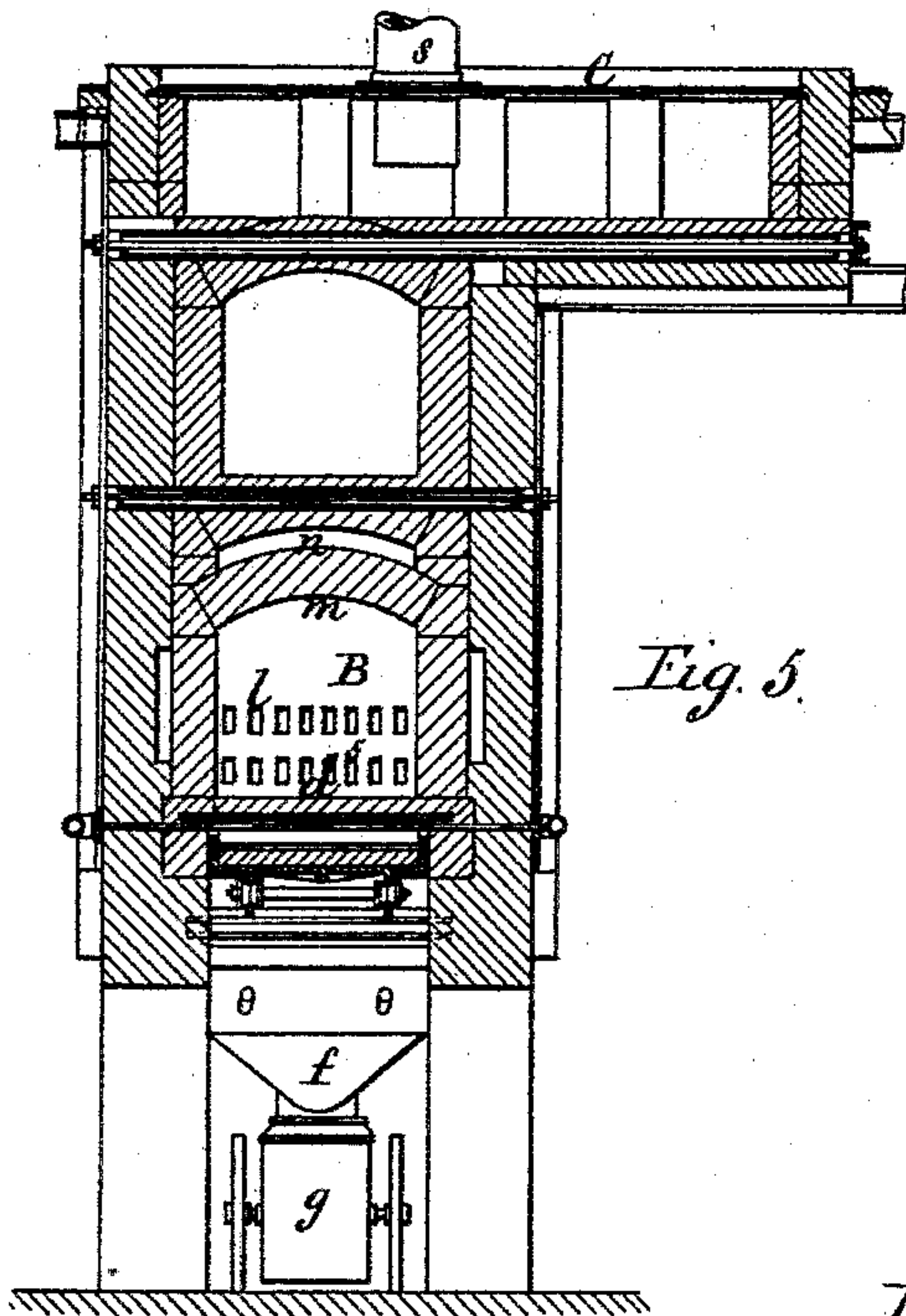


Fig. 5.

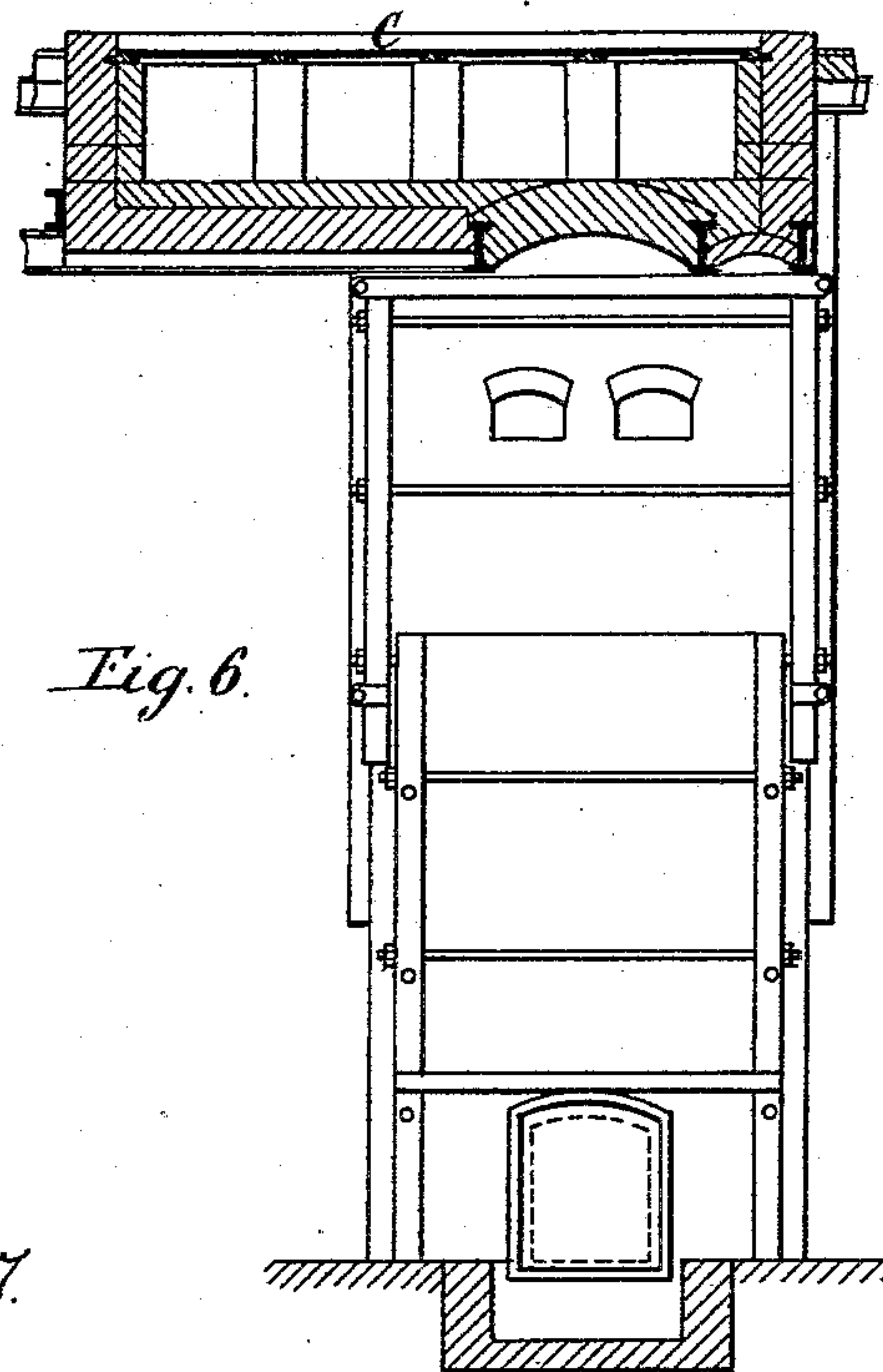
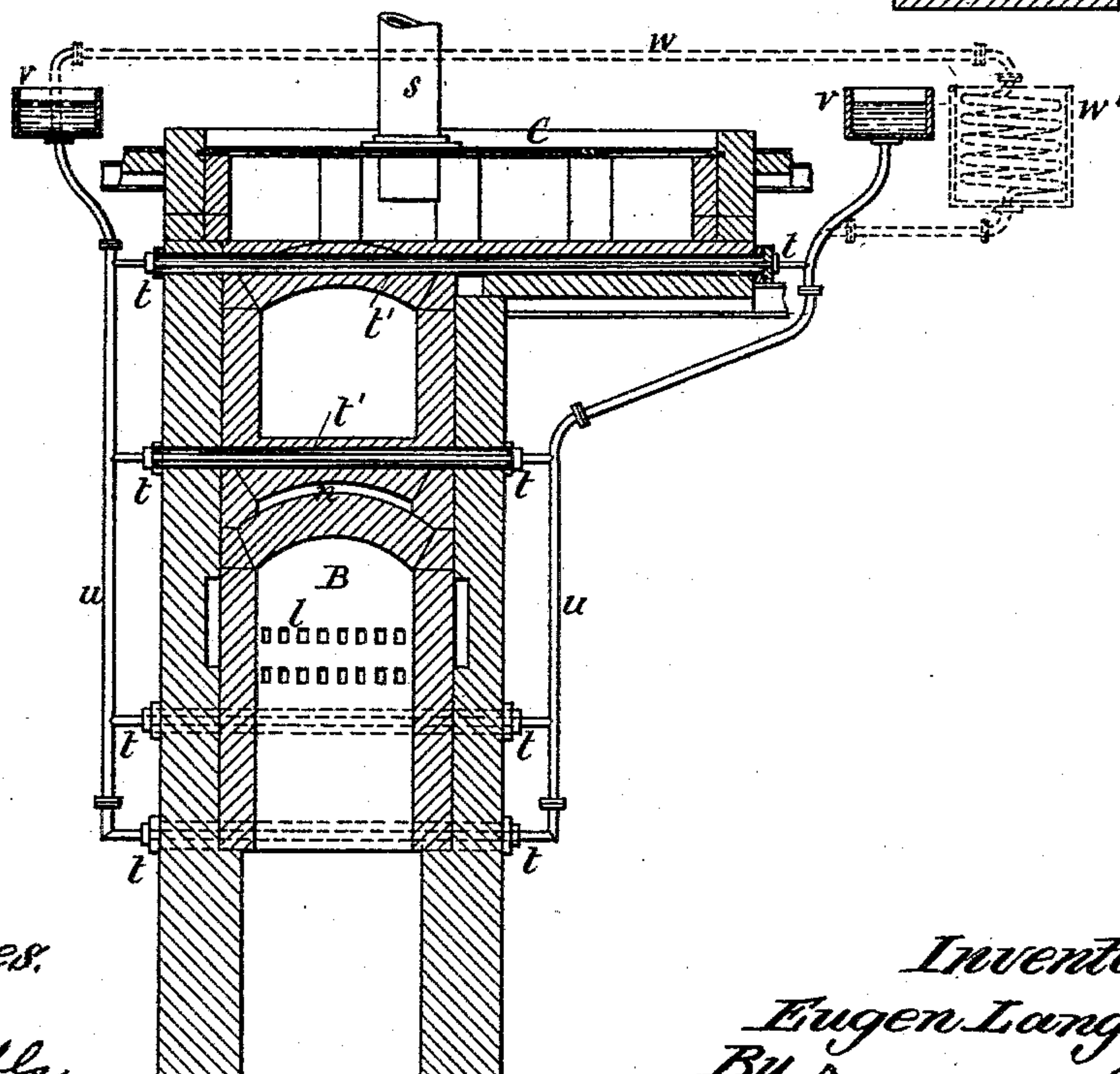


Fig. 6.

Fig. 7.



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UNITED STATES PATENT OFFICE.

EUGEN LANGEN, OF COLOGNE, GERMANY.

FURNACE FOR ROASTING OR OTHERWISE TREATING GRANULAR OR PULVERULENT MATERIALS.

SPECIFICATION forming part of Letters Patent No. 414,552, dated November 5, 1889.

Application filed December 6, 1888. Serial No. 292,791. (No model.) Patented in England May 14, 1888, No. 7,168, and in France May 14, 1888, No. 190,587.

To all whom it may concern:

Be it known that I, EUGEN LANGEN, a citizen of Prussia, residing at Cologne, in the Empire of Germany, have invented a new and useful Furnace for Roasting, Calcining, Burning, Drying, or otherwise Subjecting Materials to Heat, (for which I have obtained a patent in Great Britain, dated May 14, 1888, No. 7,168, and in France, dated May 14, 1888, No. 190,587,) of which the following is a specification.

My invention relates to an improved construction of furnace for roasting or otherwise treating granular or pulverulent materials, the essential feature of which furnace consists in the arrangement of a set of horizontal slides of a stepped form having a to-and-fro motion imparted to them and operating in combination with a series of fixed steps in such manner that as the granular or pulverulent material is fed onto the uppermost slide a portion thereof is caused by the backward motion of the slide to fall upon the step below it, while on the forward motion of the slide this pushes the material that has fallen onto the step onto the next slide below and so on. By this means the material will be made to pass downward in thin cascades from step to step to the bottom of the furnace while the flame or hot gases are passing in an upward direction in close contact therewith, the described action of the slides being to cause the particles of the material to fall over and over each other, and thus in continually presenting fresh particles to the action of the flame to subject the whole body of material in a very uniform manner to the required treatment.

The accompanying drawings show the arrangement of furnace which I prefer to employ in carrying out my invention.

Figure 1 shows a side view of the furnace; Fig. 2, a longitudinal section on line A B, Fig. 3. Fig. 3 shows a plan; Fig. 4, a horizontal section on line C D, Fig. 1; Fig. 5, a cross-section on line E F of Fig. 2; Fig. 6, an end view, and Fig. 7 also a cross-section showing the manner of circulating water through the tubular tie-rods.

The furnace consists of a gas-producer A for generating the requisite carbonic-oxide

gas for combustion in the furnace B, above which is arranged a preliminary drying-floor C.

The floor of the furnace consists, first, of a series of fixed steps *d*, and, secondly, of horizontally-reciprocating slides *b*, alternating with the steps, which latter may, however, be replaced by a second set of slides, as above stated. The slides *b* to *b*⁶ have a to-and-fro motion imparted to them simultaneously from a water-pressure engine or other suitable motor K, through connecting-rods *h* and levers *i*, the motor-engine being arranged in any suitable known manner for varying the extent and speed of the motion imparted to the slides.

The material to be acted upon passes from the drying-floor C into the charging-throat *a*, at the bottom of which is situated the first slide *b*, so that as this moves forward into the furnace it conveys the portion of material lying immediately upon it through the opening between the wall *c* of the throat *a* and the step *d* into the furnace. On the backward motion of the slide the material lying upon it will be prevented from moving back with it by the back wall of the throat *a*, and consequently the front portion of the material will be pushed over the edge of the slide and will fall onto the step *d* below. On the slide *b* again advancing it pushes the material lying upon the step *d* down onto the next slide *b'*, and on this slide moving backward the same action will take place as described with reference to *b*, a portion of the material lying thereon being made to fall over onto the next step *d'*, and so on. The material is consequently made to travel gradually from the charging-throat *a* successively from slide *b* to step *d*, slide *b'*, step *d'*, and so on until it passes from the last step—such as *d*⁶—onto a plate *e*, which also moves to and fro, and from which it passes through the hopper *f* into the receptacle *g*. By the forward motion of the slides *b* *b'* *b*², &c., the material is pushed in thin layers from the steps *d'* *d*², &c., onto the following slides, while on the backward motion it is prevented by the edge of the steps from moving backward, and consequently a portion falls over the edge onto

the next step, so that by this means the material is continuously turned over and over, so as to present always a fresh extended surface to the action of the flame.

5 In order to prevent the material from passing down between the sides of the slides and the walls of the furnace, the former are made to extend into the grooves in the latter.

10 The slides b' b^2 , &c., consist of cast-iron plates covered with fire-clay slabs, and they have on their under sides guide-ribs, with which they rest on rollers that can roll upon fixed rails, so as to reduce frictional resistance. The steps d d' d^2 , &c., are made of fire-
15 clay resting upon cast-iron bearers. The gas-producer A, which is of any suitable known construction, supplies carbonic-oxide gas through the openings l into the furnace-chamber, where it mixes with the previously-
20 heated air and enters therewith into combustion, so as to produce the requisite heat for acting in the required manner upon the material to be treated. The flames first act with the greatest heat upon the material
25 lying upon the lowermost steps, whereby this is deprived of the last particles of moisture or gases to be driven off. The heating of the air-supply is effected in flues n , formed over the roof of the furnace. The horizon-
30 tal part m of the roof terminates in a tongue o , whereby the flames are directed downward onto the material on the steps. From the tongue o the roof p rises in an inclined direction to a second tongue q , which again di-
35 rects the flames downward onto the material before escaping through the passage r into the space below the drying-floor, from which it finally escapes through the chimney s .

40 In order to prevent the expansion through heat of the tie-rods that hold the side walls of the furnace, these are formed tubular, so as to have water circulated through them, and they are furthermore protected by being inclosed in outer tubes, as shown more clearly in the
45 cross-section at Fig. 7, where t t are the tubular tie-rods inclosed in the outer tubes t' and connected at their outer ends with circulating-pipes u , which either communicate at

their upper ends with open water-tanks v v , or they are connected at top by a pipe w and
50 worm w' , as indicated in dotted lines, the worm being contained in a cooling-tank.

Having thus described the nature of my invention and the best means I know for carrying the same into practical effect, I claim— 55

1. A furnace for drying, roasting, burning, or otherwise treating materials having a furnace-bed comprising a series of plates arranged in steps, in combination with means for giving each alternate plate a horizontal
60 reciprocating movement upon the plate below to push off the material being treated and situated thereupon, and a hopper for delivering the material to be treated upon the uppermost plate, substantially as described. 65

2. A furnace for drying, roasting, burning, or otherwise treating material having a furnace-bed comprising a series of steps and slides, the slides being situated alternately
70 between the steps, in combination with a main lever, rods connecting the slides with the lever, an oscillatory plate arranged beneath the lowermost step, means for actuating the lever to reciprocate the slides, and a hopper and a receptacle beneath the oscillatory
75 plate, substantially as described.

3. In a furnace for drying, roasting, burning, or otherwise treating material by heat, the combination of the furnace-chamber B, the drying-floor C, a furnace-bed composed
80 of alternate steps and slides communicating with the drying-floor through a throat a at the top of the furnace, an oscillatory plate e , located beneath the lowermost step of the furnace-bed, and levers and connecting-rods
85 for actuating the said plate and slides, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 16th day of No-
90 vember, A. D. 1888.

EUGEN LANGEN.

Witnesses:

C. FRANZEN,
H. THIELE.