

(No Model.)

3 Sheets—Sheet 1.

E. C. HEGELER.

FURNACE FOR ROASTING ZINC AND OTHER ORES.

No. 303,571.

Patented Aug. 12, 1884.

Fig.1.

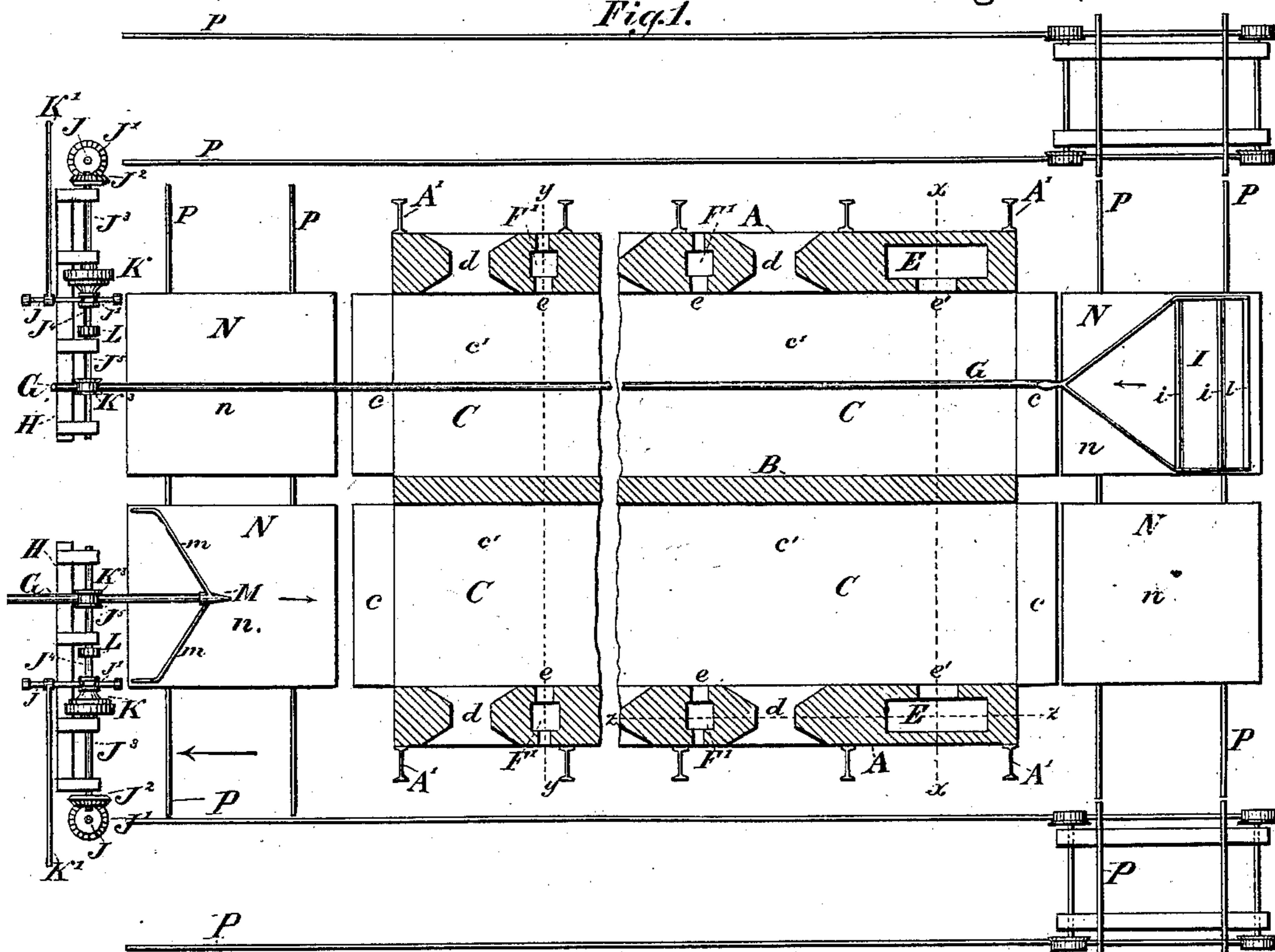
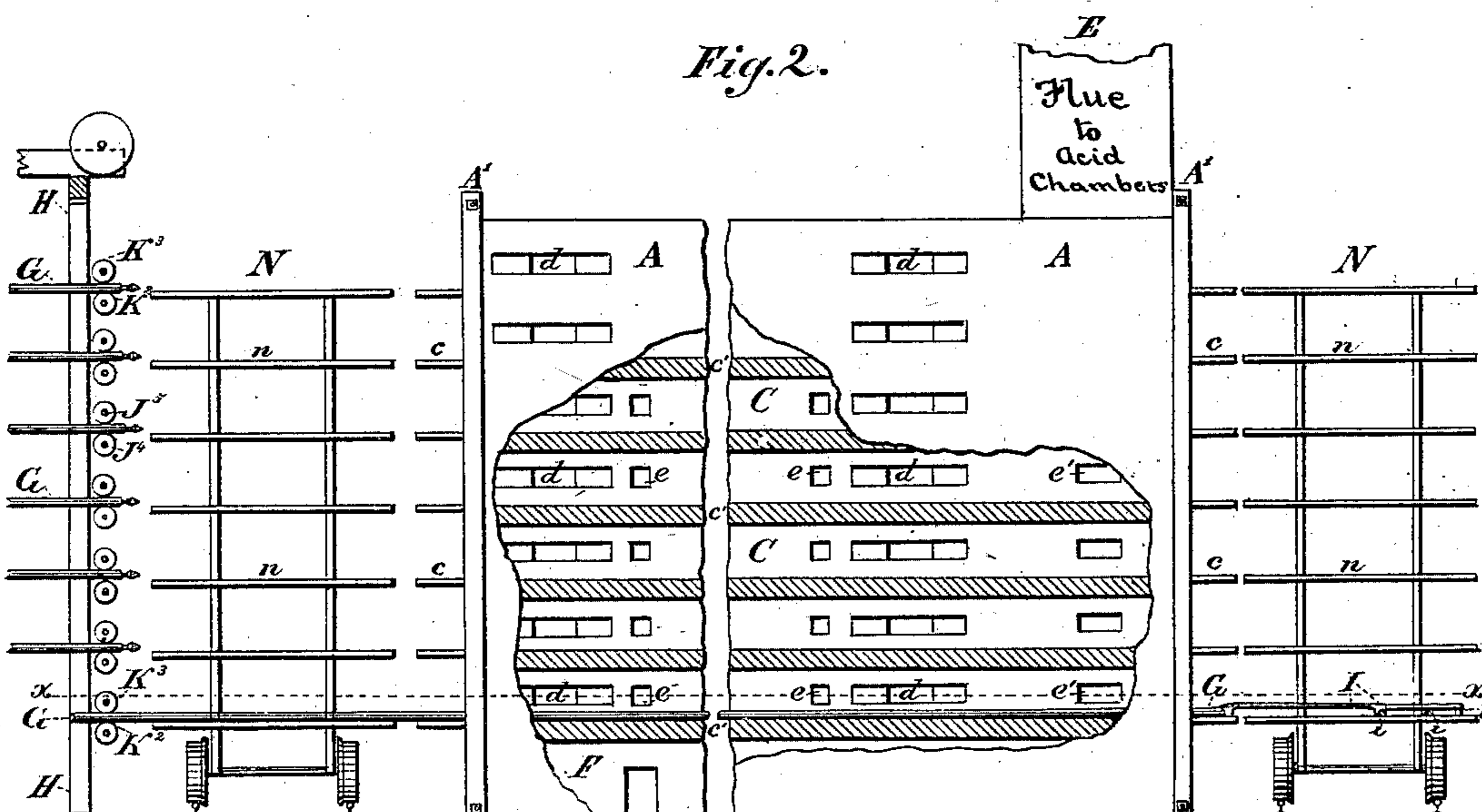


Fig. 2.



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Fig. 3.

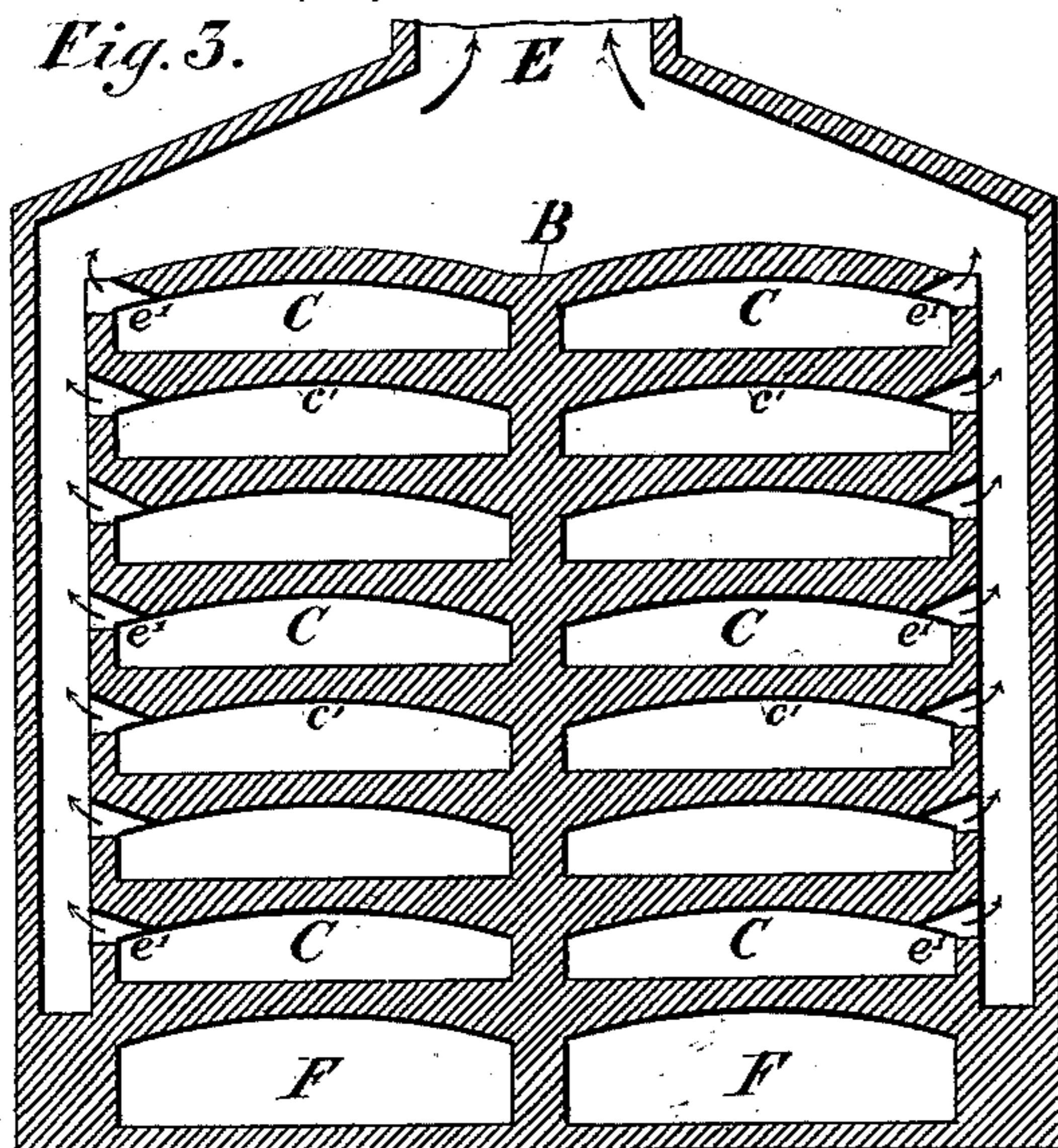


Fig. 4.

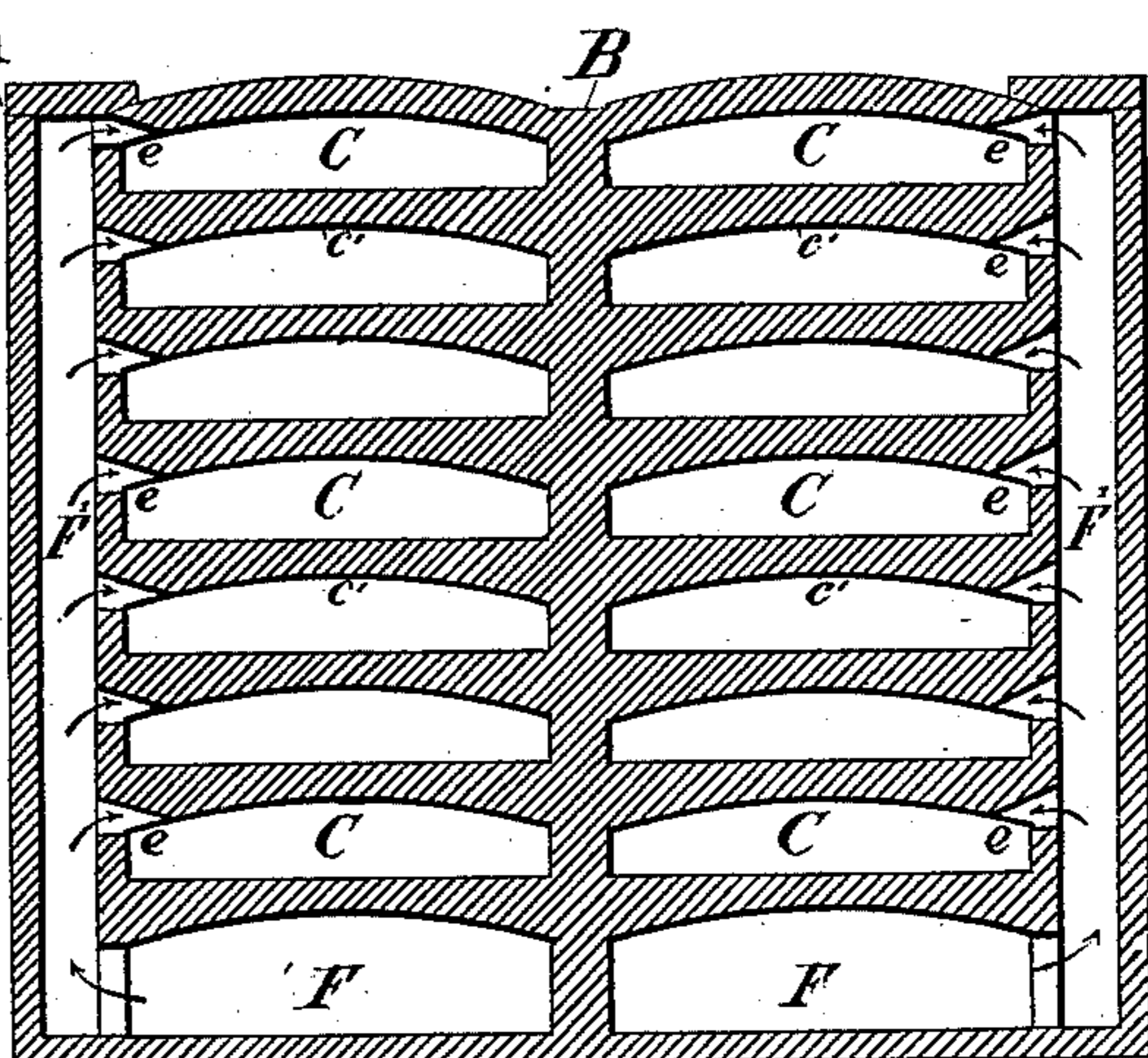


Fig. 6.

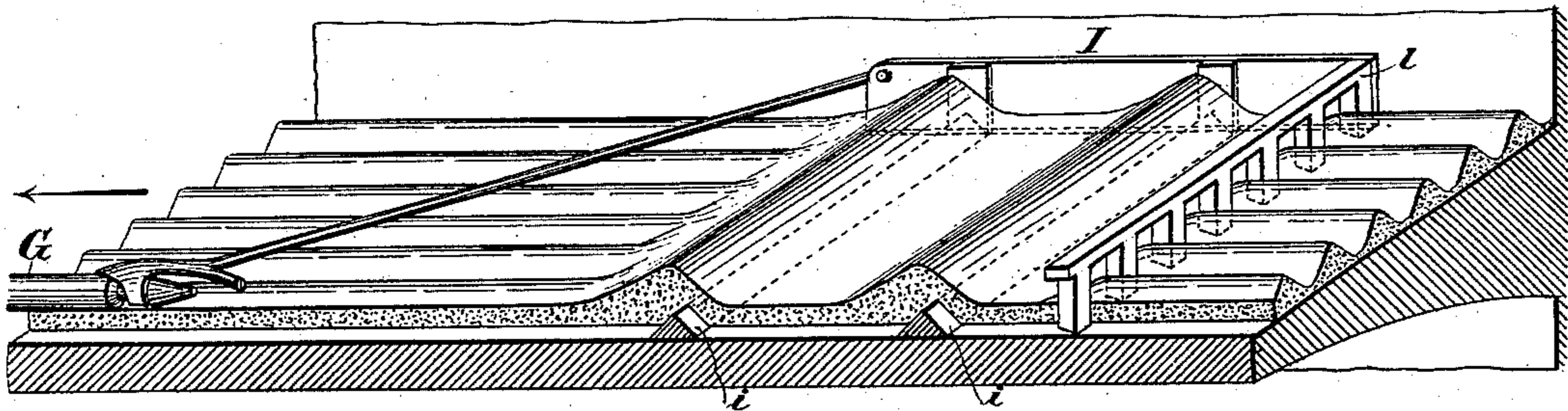


Fig. 5.

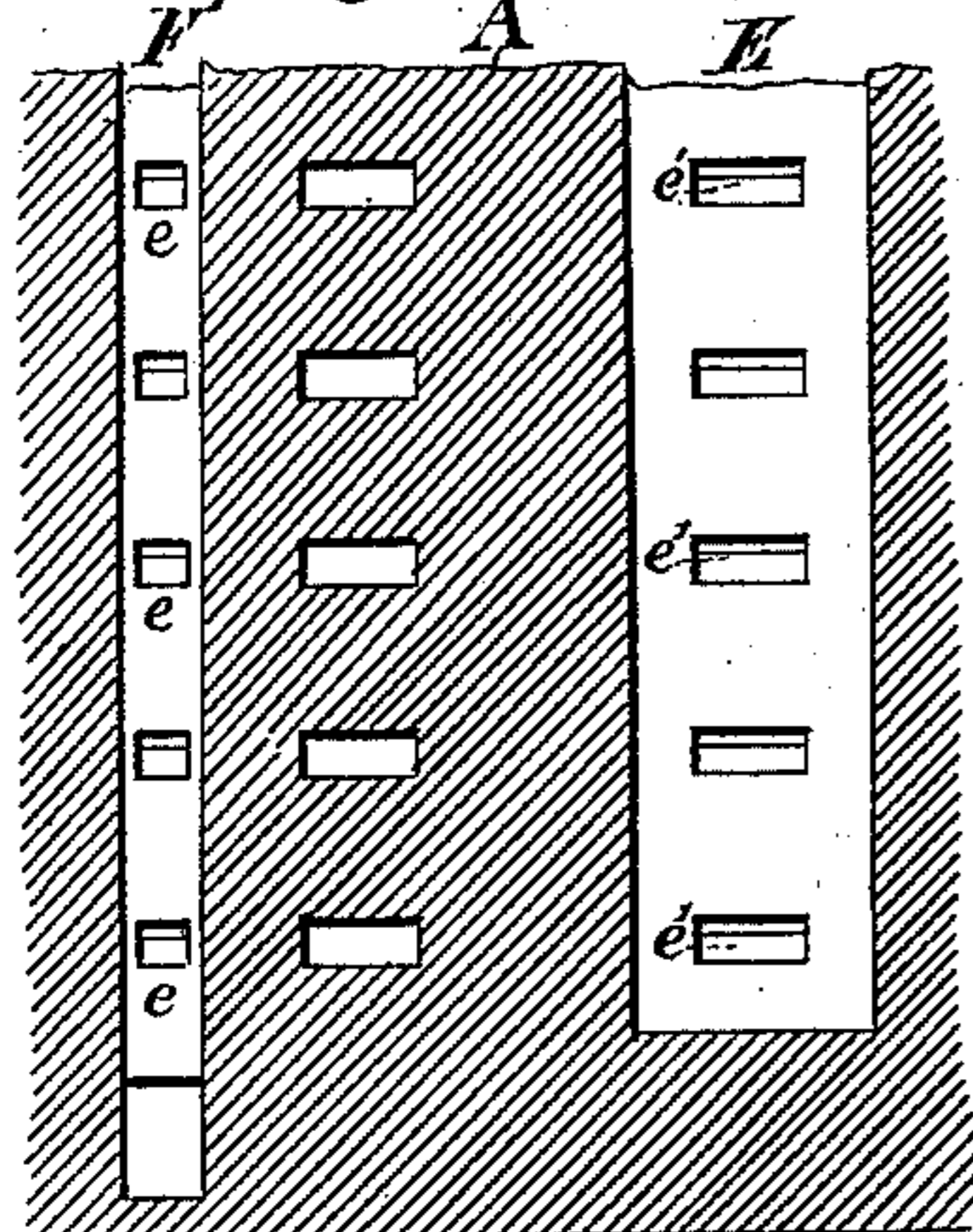


Fig. 7.

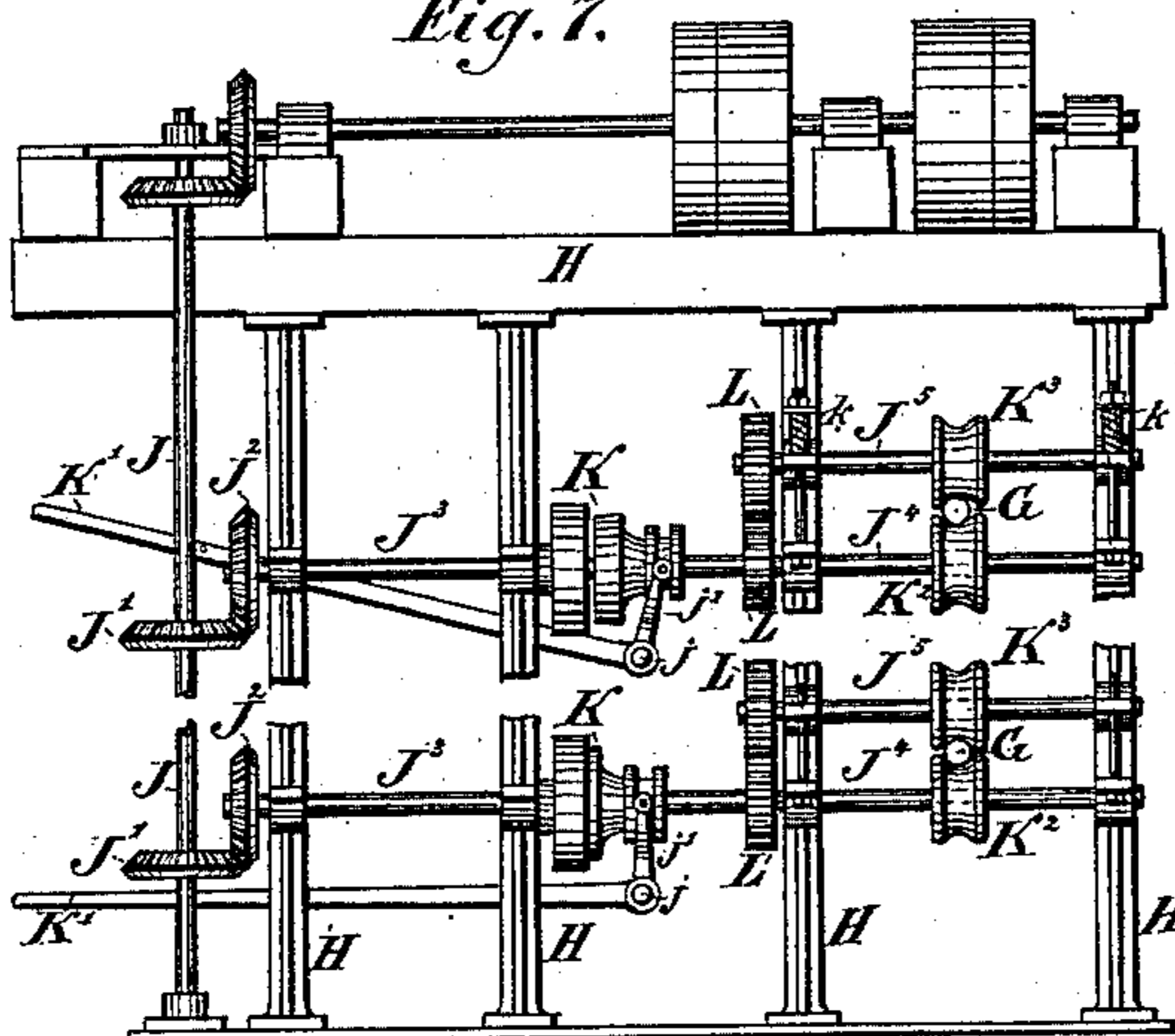
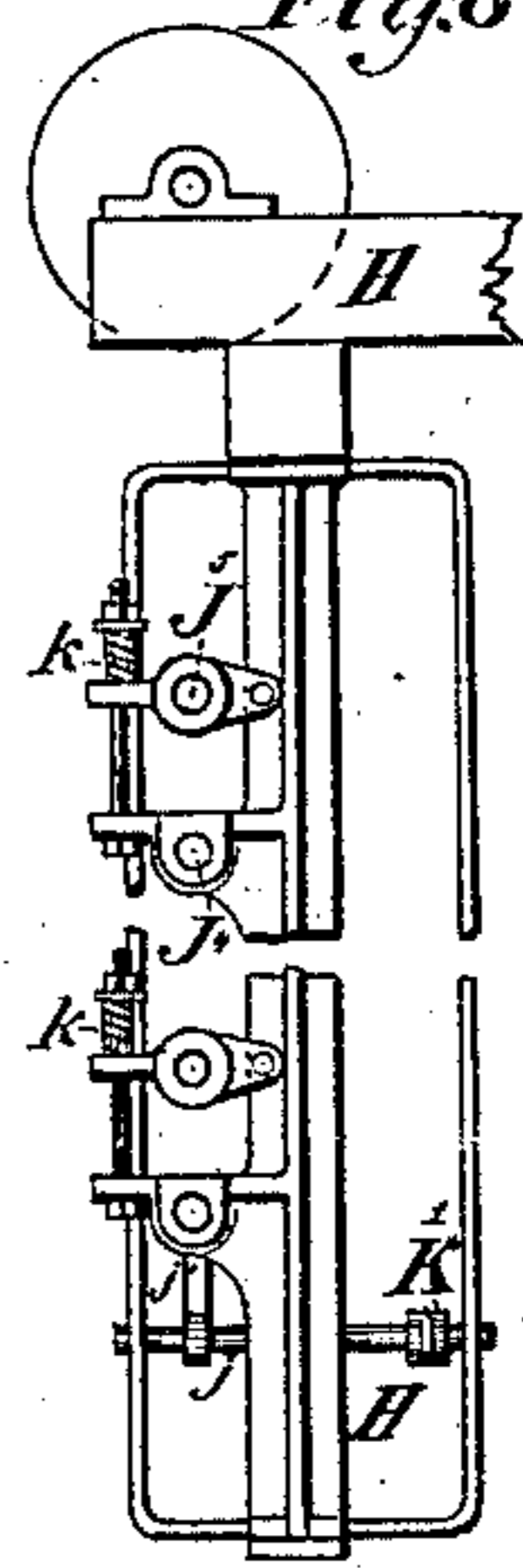


Fig. 8.



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(No Model.)

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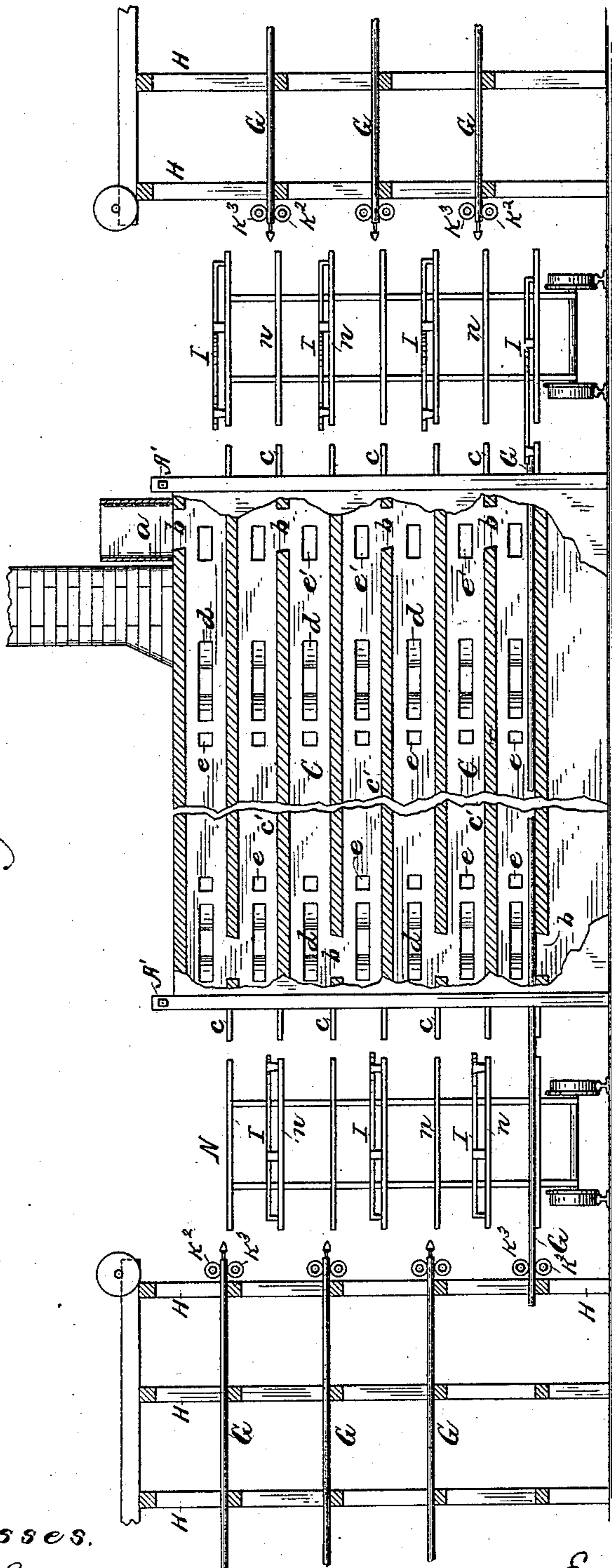
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Fig. 9.



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UNITED STATES PATENT OFFICE.

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FURNACE FOR ROASTING ZINC AND OTHER ORES.

SPECIFICATION forming part of Letters Patent No. 303,571, dated August 12, 1884.

Application filed March 16, 1882. (No model.)

To all whom it may concern:

Be it known that I, EDWARD C. HEGELER, of La Salle, Illinois, have invented certain new and useful Improvements in Furnaces for Roasting Zinc and other Ores, and Machinery for Operating the Same, of which the following is a specification.

The invention consists of the furnace and appliances hereinafter described and claimed. The accompanying drawings illustrate the same.

Figure 1 is a sectional plan view taken on line *xx* of Fig. 2. Fig. 2 is a side elevation, having a portion of the outer wall of the furnace removed. Fig. 3 is a vertical cross-section on line *xx* of Fig. 1. Fig. 4 is a like section on line *yy* of Fig. 1. Fig. 5 is a vertical longitudinal section on line *zz* of Fig. 1. Fig. 6 is a perspective view showing a portion of the oven-bottom covered with ore, with the rake in the operation of being drawn over the oven-bottom through the ore. Fig. 7 is a front elevation of machinery used in the operation of the furnace. Fig. 8 is a side elevation of such machinery. Fig. 9 shows the furnace in modified form, and having the machinery for operating it placed at opposite ends.

A designates the side walls of the furnace, which is bound together by anchors A'. B is a central wall, C the roasting-ovens, and E a chimney or flue, into which the fumes escape from the ovens and are carried off. The furnace is about fifty feet long by twelve feet wide, and the ovens on each side of the central wall extend clear through, and have platforms *c* at each end, made of iron. The ovens are formed in arches *c'*, to give strength, and are made of fire-clay brick about four and a half inches thick, supported against the outside and central walls. They are about seven and a half inches deep by four and a half feet wide, and level, or nearly so, lengthwise of the furnace, and their floors may be level or remain in the arched form. Working-openings *d* are made at regular intervals through the side walls into the ovens, so that all parts of them can be seen and reached with tools from the outside, and these openings are ordinarily closed, so as to be easily opened and closed

again, as use requires during the working. They also serve, by keeping one or more of them partly open, to admit cold air into the ovens when the temperature is too high, and the ore thereby becomes sticky. Each of the ovens also has an opening, *e'*, into the chimney, from which the fumes escape. The ovens are closed at the ends by doors arranged to hang down over them, or by an accumulation of ore on the platforms *c*. Flues F under the furnace connect with a hot-air blast, and through several vertical side flues or branches, F', having an opening, *e*, into each of the ovens, convey hot air into the ovens for heating them. One or more of these branch flues F' are used in the roasting process, as by experience is found best, depending on the nature of the ore to be roasted and other attending circumstances, the others being stopped off. The supply of hot air to each of the ovens is regulated by enlarging or contracting the openings *e* as desired, and to enable this to be done small openings through the outer wall into the branch flues F', opposite to openings *e*, are provided, but kept closed ordinarily. The assemblage of ovens affords economy of heat, the cold air coming in contact with the outer walls only.

The ovens may be made of great length, so that each oven will be a roasting-furnace of itself, in which the ore can be sufficiently roasted by being passed through gradually from one end to the other in the stirring process. In such case the operating machinery hereinafter described should be placed at one end of the furnace; but a succession of ovens, arranged one above the other, may be used, in which the ore is to be moved back and forth successively, being discharged from one to the other through openings *b*, as seen in Fig. 9. In such case the machinery should be placed at opposite ends. A frame, H, is placed before the ovens, and at a sufficient distance therefrom to allow space for a car, N, to pass between the frame and the furnace. This frame has a series of supports corresponding with the ovens, and a series of rods or gas-pipes, G, resting on such supports in line with the ovens, in position to be thrust through them lengthwise. The frame also has mech-

anism for thrusting the rods respectively into the ovens and drawing them out again, of which the following is a description: A shaft, J, is geared to shafting overhead in the usual manner, to be operated in both directions, and provided with miter-gears J', with which gears J² on shafts J³ are connected. Shafts J³ are connected to shafts J⁴ by friction-couplings K, so as to be disconnected and reconnected by a lever, K', operating a rock-shaft, j, having an arm, j', which engages the sliding collar of the couplings, keyed on the shaft J⁴, so as to slide thereon. To shafts J⁴ grooved pulleys K² are attached, and above shafts J⁴ are shorter shafts J⁵, which have grooved pulleys K³. The rod G is held fast between the pulleys K² K³ by springs k, arranged to press the shaft of pulley K³ toward the other and bring the pulleys together, and the shafts of said grooved pulleys are connected by gears L, so that when the coupling K is connected the motion of shaft J³ is communicated to shafts J⁴ J⁵, and the pulleys can be operated in one direction to thrust the rod G into the oven, and in the other to draw it out. A set of the pulleys K² K³ is employed in connection with each of the rods G and arranged to be operated separately. Cars N, having a series of platforms, n, corresponding in number and height with the ovens, are used for the purpose of holding and transporting the rakes I, which are used for stirring the ore and moving it gradually in the oven toward the point of discharge. Any of the common forms of rake-head, when adapted to be temporarily attached to the rod G, may be used; but the rake provided with one or more heads, *i i*, made of a flat bar beveled from the top side down to a sharp edge at the bottom in front, and either square behind or beveled so as to form a triangular bar, is preferable to the ordinary rake. The beveled heads are attached to the part I or secured and braced together in the rake in any manner, and provided with suitable means, as a bail, link, or short piece of chain, for attaching them to the rod G, so as to be thereby drawn through the oven. The sides of the rake are made of flat iron at the forward end, arranged to scrape the sides of the oven and prevent the ore from packing at the sides. A separate rake for each two ovens on the same level is employed, and when the rakes are not in use in the ovens they are left on the platforms n of one of the cars to cool, and remain in proper position ready for use. Tracks or ways P are arranged, as shown in the drawings, for moving the cars from one end of the furnace to the other.

The modified form of furnace shown in Fig. 9 is the same as the first, excepting that the ore passes in through a hopper, a, and thence from the top oven through the openings b in the alternate ends of the ovens, so that the ore may be made to pass back and forth successively through each of the ovens from the top to the bottom and be discharged at the latter. Also, the gases pass up through openings b

from the bottom oven to the one next above, and so on up to the top one, from which they pass into the chimney E. In this case two frames H are employed and placed at opposite ends of the furnace, each being situated with reference to the furnace the same as before described, and the rods G are alternated in the respective frames from the top down, so as to correspond on each side with every other of the ovens on each side, as shown in Fig. 9, instead of with every oven at one end, as in the first instance. The rods G are provided with a barb, head, or hook on the end, corresponding with a suitable device in the rake, for attaching and detaching the rakes to and from the rods.

The operation is as follows: The ovens being heated and charged with ore to be roasted, one of the cars N, having a rake upon each of its platforms n, is drawn before the rear end of the furnace, and the other car N, without the rakes, is drawn between the frame H and the furnace. By means of coupling K connection is made between one set of the shafts J³ J⁴ corresponding to one of the ovens, shaft J being in operation in the proper direction, thereby giving motion to the corresponding set of the pulleys K² K³ in the proper direction to draw the corresponding rod, G, from the frame and thrust it through the oven, in line, to the car at the opposite end, where the rake is attached, and by reversing the motion of shaft J the rod, with the rake attached, is drawn back through the oven, so that the rake is rested on the car standing between the furnace and the frame and unhooked or detached from the rod. This operation is repeated as to each of the ovens, and the cars are then exchanged over the tracks P, and the rakes are thereby brought into position for another operation. When the ovens are of great length, it may be necessary to use a guide, M, with arms m, to make the rod G properly pass through the oven.

With the modified form the operation is the same, except that the ore in the top oven is stirred or moved first by drawing the rake in at the end opposite from the opening b, and then in the next below at the opposite end, and so on alternating down to the last. The best mode is to have the rake in any lower row of ovens pass in at the same time that the one in the row next above is coming out. This prevents the ore from accumulating in piles below openings b. As the rake passes into the oven it drags in a quantity of fresh ore, and in passing through scrapes the bottom of the oven and stirs and gradually moves the ore forward, and in passing out a quantity of roasted ore is discharged from the oven; or, if the modified form is used, the rake in passing openings b discharges a quantity of the ore through them into the oven next below.

The mode of operation of the bevel-edged rake-head is shown in Fig. 6. The flat bottom of the rake slides over the oven-bottom, and the front edge, being close down to the

oven-bottom, passes under and makes a wave of ore rise before the rake and pass over the top. Thus it thoroughly scrapes every part of the oven-bottom, and stirs the ore as well as moves it forward. By the use of this form of rake-head the top of the oven may be made low down, as I have shown it. If the ore is to be completely roasted in passing through one oven, it is caused to pass through slowly; but in the modification, where it passes through several ovens successively, it is moved forward more rapidly. This may be done by increasing the length of the rake and by using an increased number or larger size of the heads *i*, or otherwise modifying the rake to make it carry a greater quantity of the ore every time it passes through the oven.

I do not wish to be understood as including herein as my invention anything shown in patents to O'Harra, No. 207,890, of September 10, 1878; to Thomas, No. 249,690, of November 15, 1881; and to West, No. 160,490, of March 2, 1875; nor in English patents to Spence, No. 5,260 of 1878, and to Fisher, No. 12,456 of 1849. My stirring-rake is distinguished from that shown in said Spence patent and his United States patent of October 18, 1881, in having the bevel-edged stirring head or heads adapted to extend crosswise of the oven and lie horizontally with the flat bottom side on the oven-bottom, so that it may slide edge foremost thereon and operate in the manner before described.

What I claim is—

1. The combination, with an ore-roasting furnace having an oven open at both ends, of a frame, H, placed before one end of the oven, there being open space between the frame and furnace, and the frame supporting a rod, G, in line with the oven, and having machinery for thrusting the rod into or through the oven and drawing it out with a detachable rake, substantially as and for the purpose shown.

2. The combination, with an ore-roasting

furnace having a series of ovens placed one above the other and open at both ends, with an opening, *b*, through the bottom of each oven near one end, said openings alternating with each other at opposite ends of the furnace, of two frames, H H, placed at opposite ends of the furnace, there being space between the frames and furnace, and the frames supporting a rod, G, in line with each of the ovens, said rods alternating with each other at opposite ends of the furnace, and each rod having machinery in its supporting-frame for thrusting it into or through the oven and drawing it out, and a detachable rake, substantially as and for the purpose shown.

3. An ore-roasting furnace having a series of ovens arranged one above the other, in combination with a frame, H, placed before the ovens, having a rod, G, in line with each of the ovens, there being an intervening space between the frame and the furnace, and cars N N, with a series of platforms, *n*, corresponding with the ovens, all arranged substantially as and for the purpose shown.

4. The frame H, having a series of rods, G, and supports for maintaining each of them separately in horizontal position, and a set of pulleys, K² K³, for each of said rods, in combination with mechanism arranged for operating each set of said pulleys separately in both directions, substantially as and for the purpose specified.

5. The combination, with a rake, of a detachable rod, G, a frame, H, having mechanism for moving the rod forth and back endwise, and cars N N, substantially as and for the purpose shown.

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