

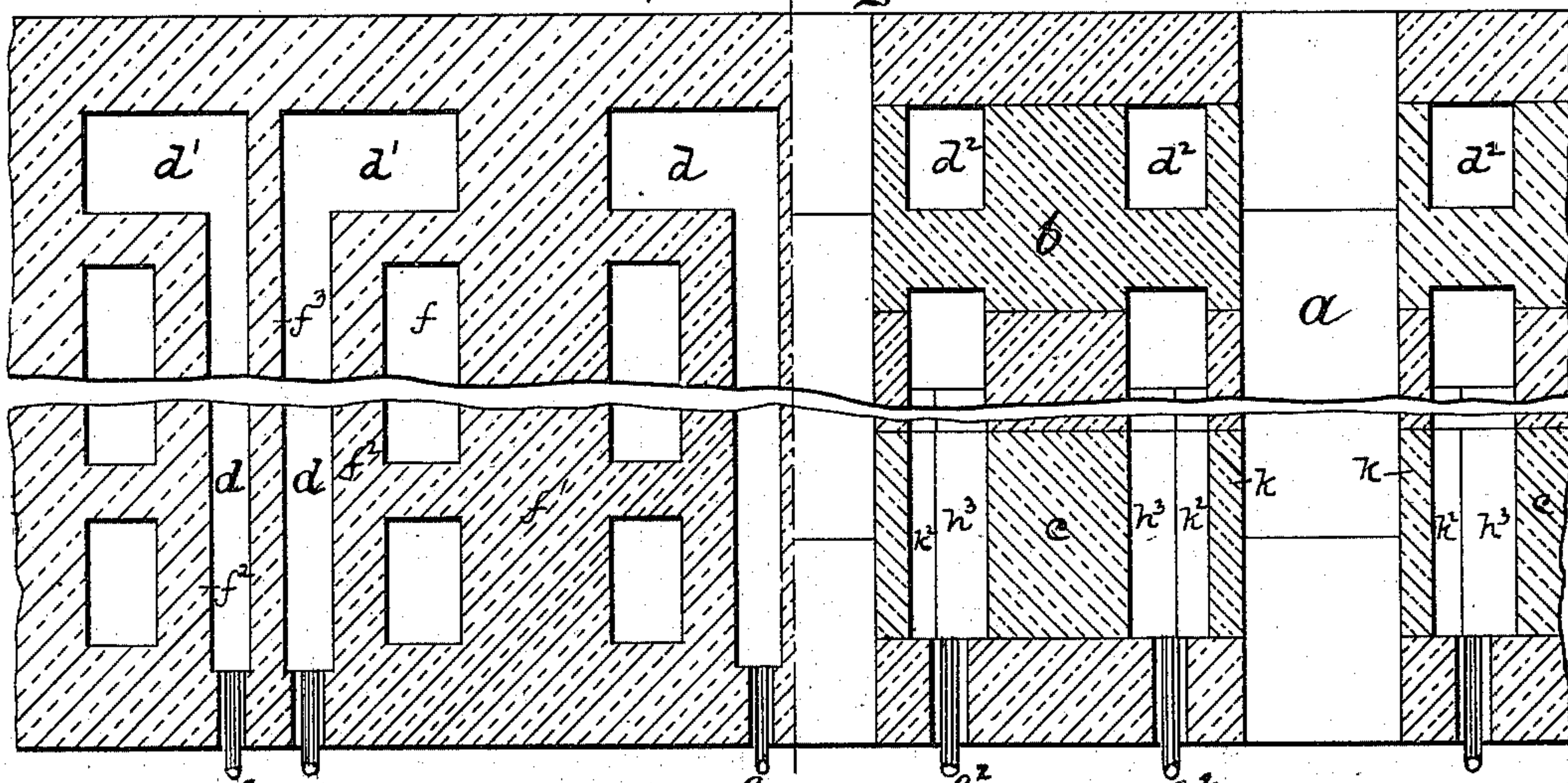
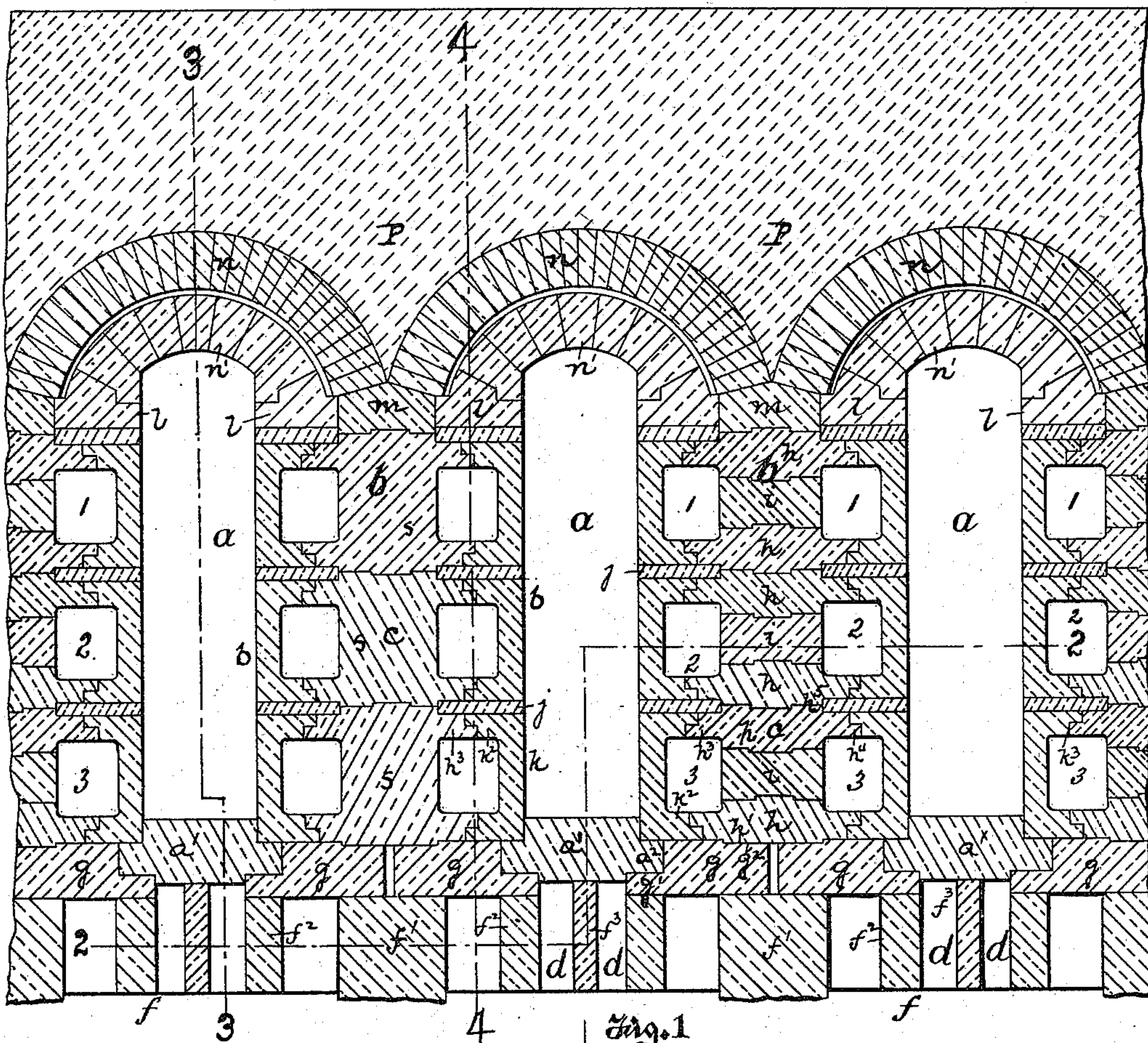
(No Model.)

4 Sheets—Sheet 1.

F. L. SLOCUM.  
COKE OVEN.

No. 568,074.

Patented Sept. 22, 1896.



Witnesses  
Chas. J. Tamar.  
L. A. Griggith

Inventor  
Frank L. Slocum  
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Attorneys



(No Model.)

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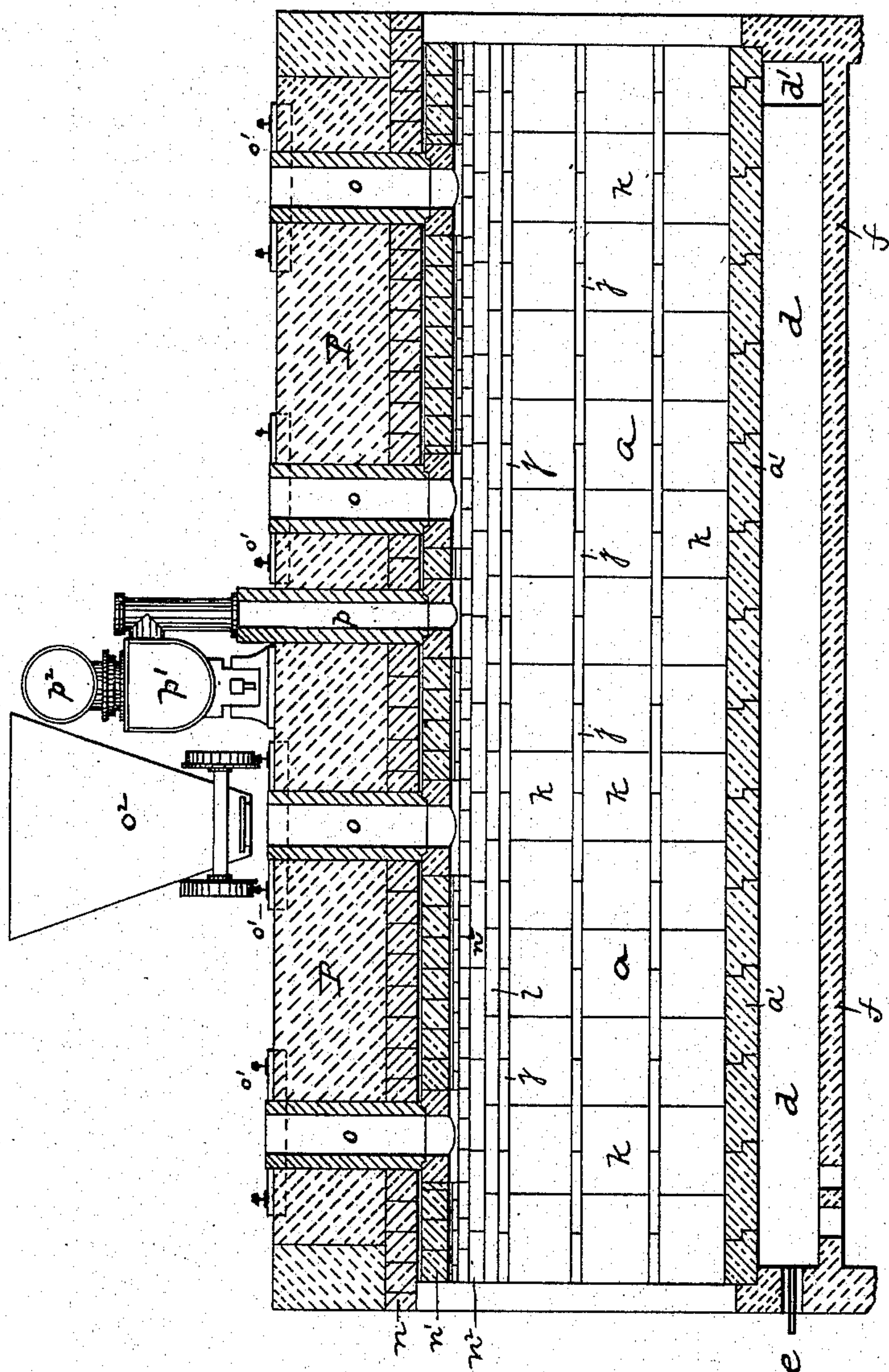


Fig. 3

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(No Model.)

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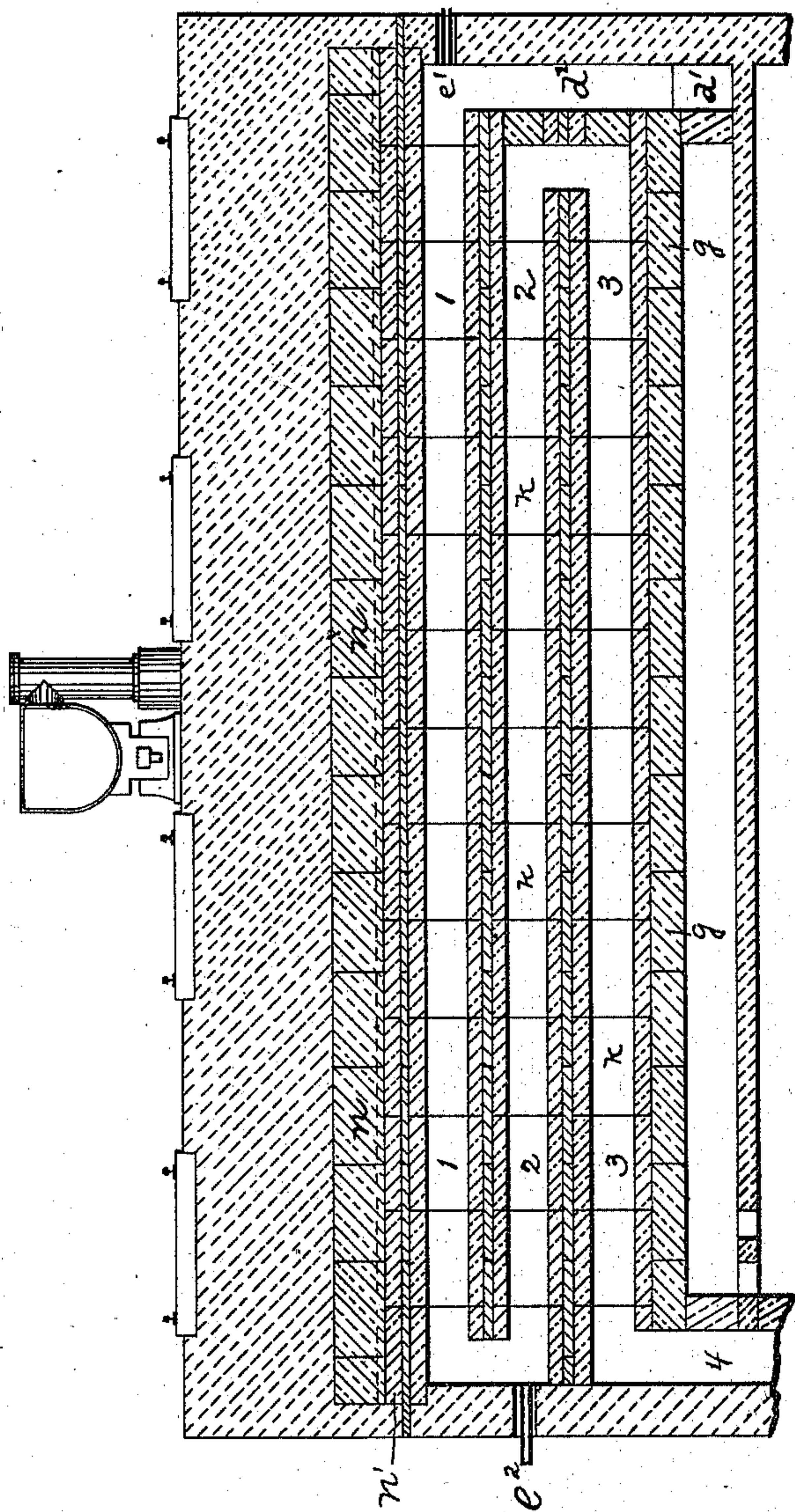


Fig. 4

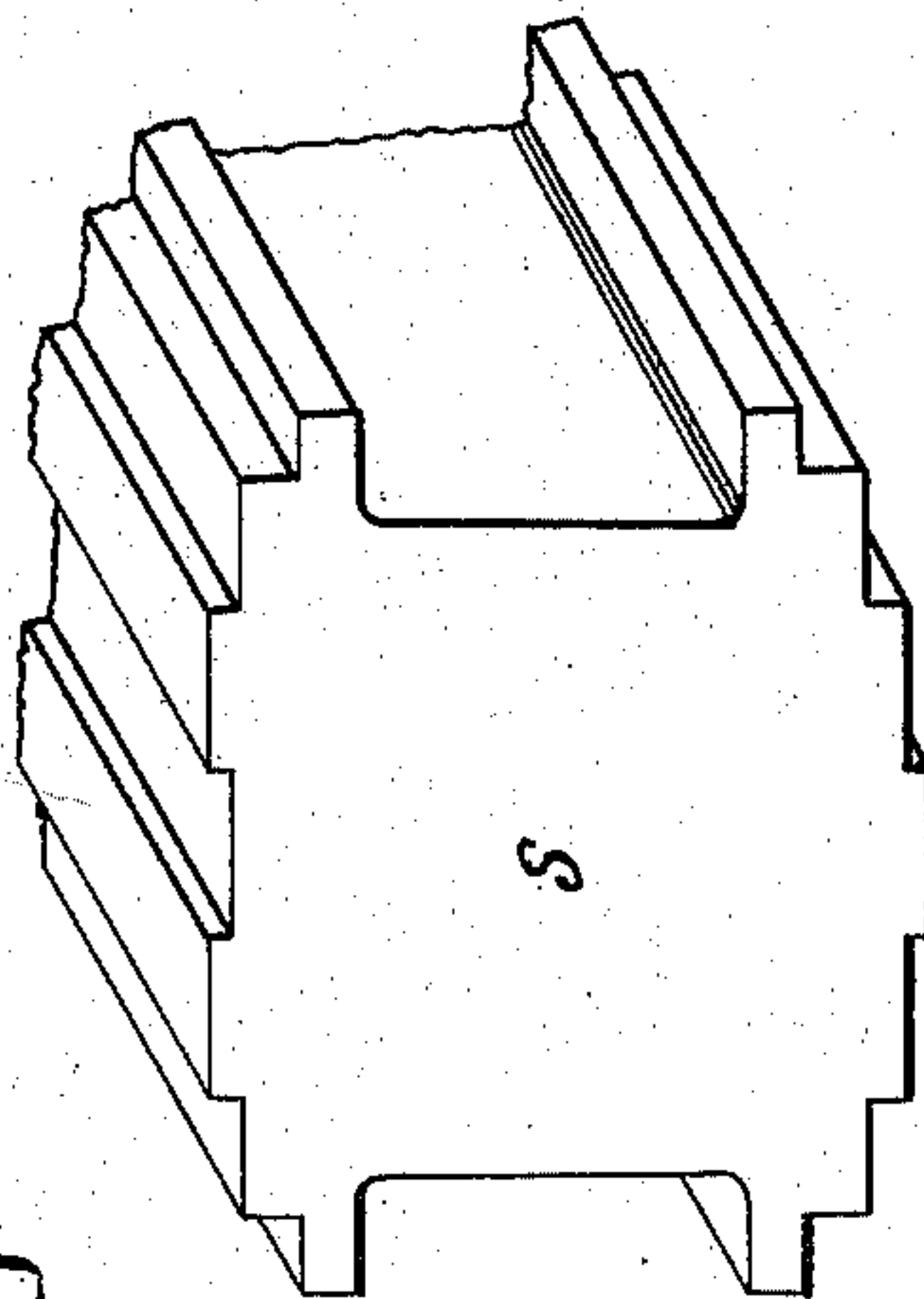


Fig. 15

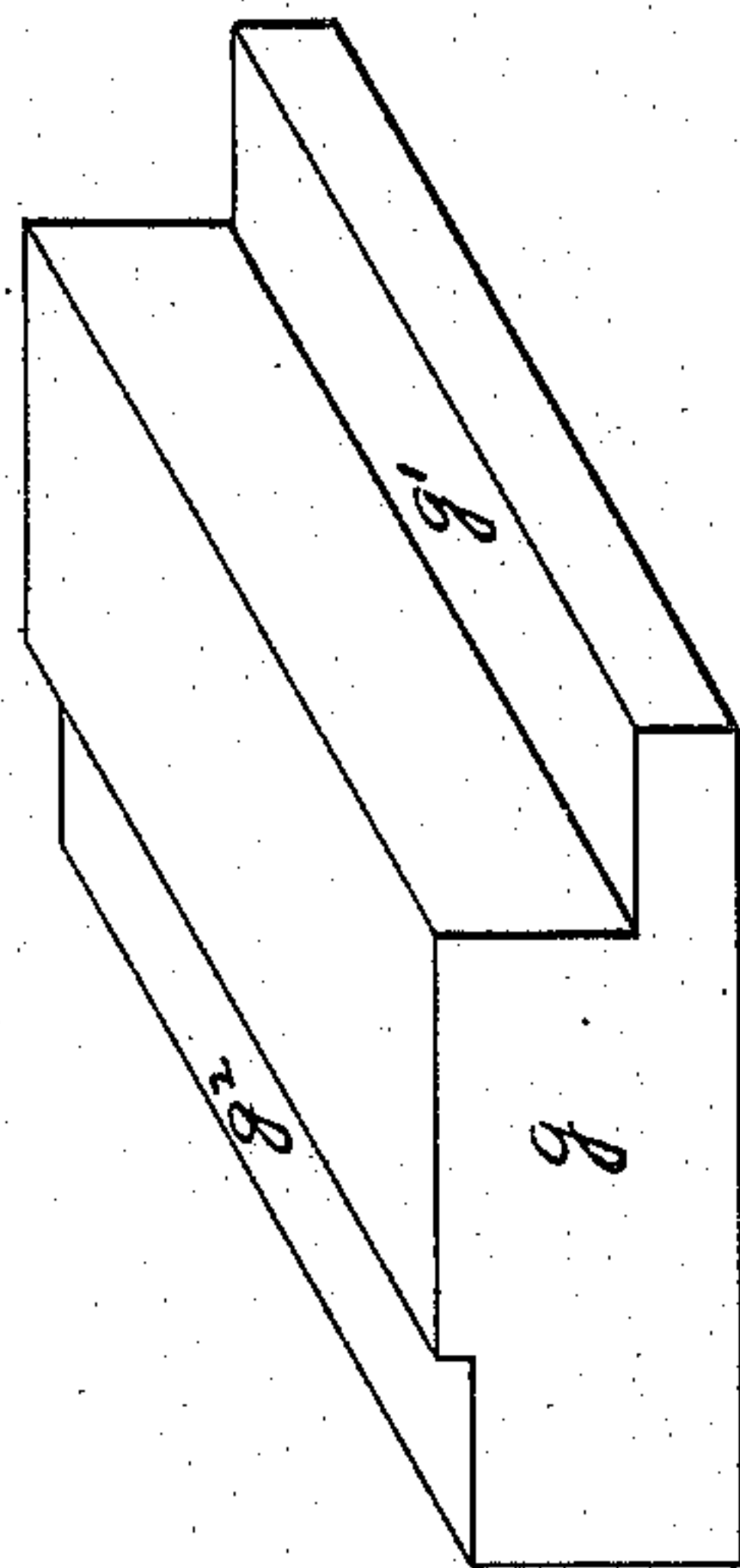


Fig. 5

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(No Model.)

4 Sheets—Sheet 4.

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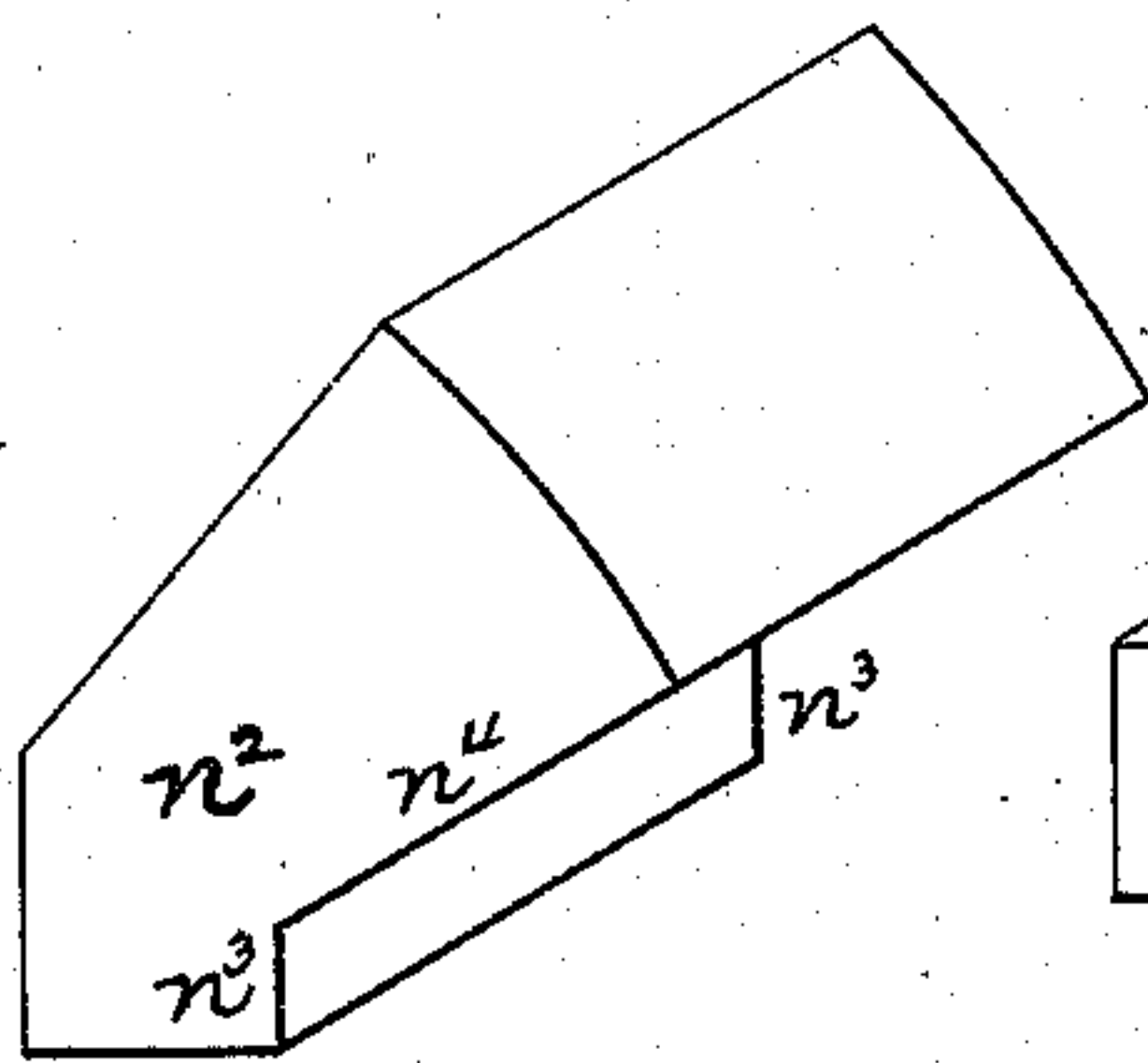


Fig. 14

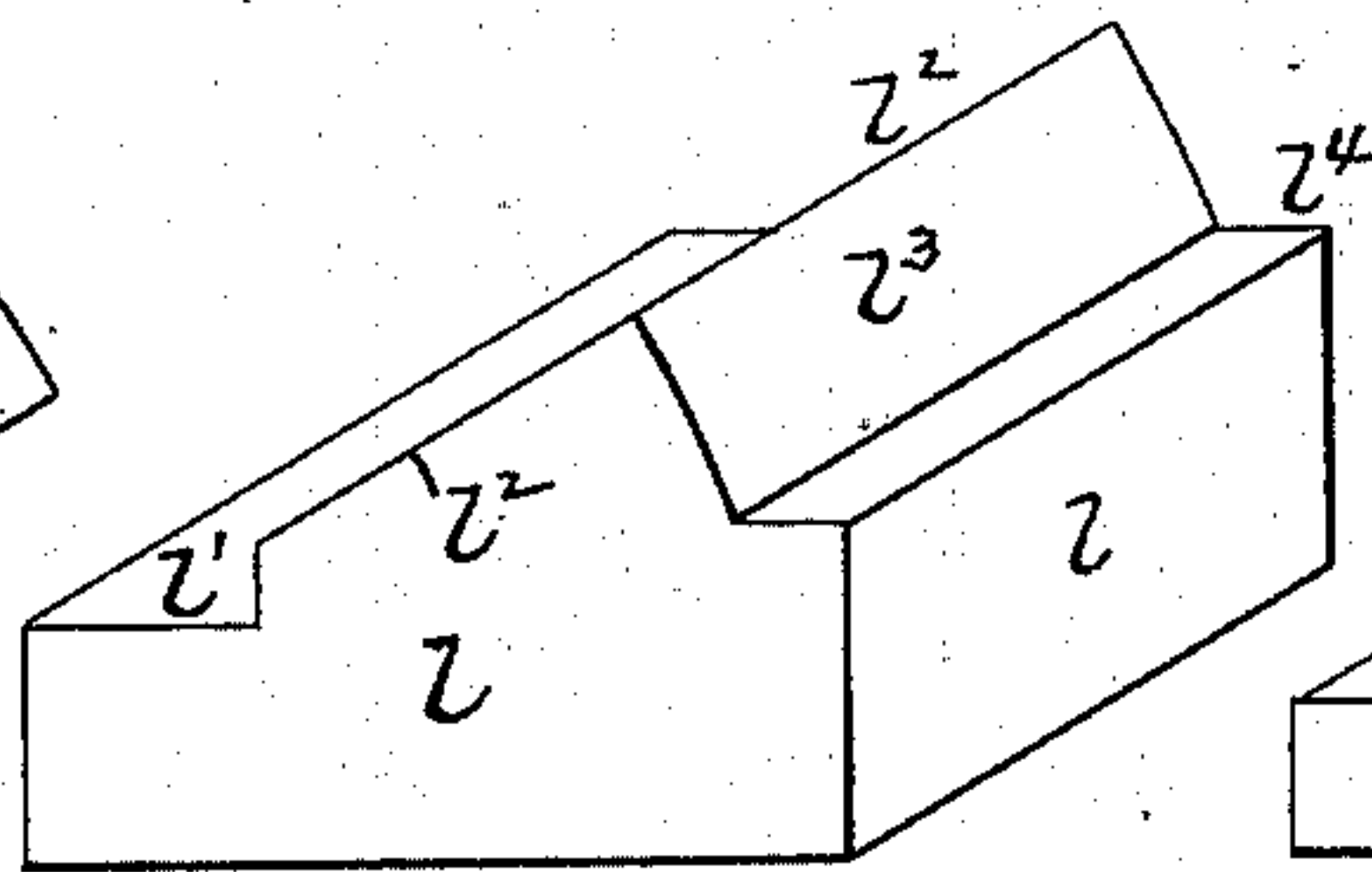


Fig. 13

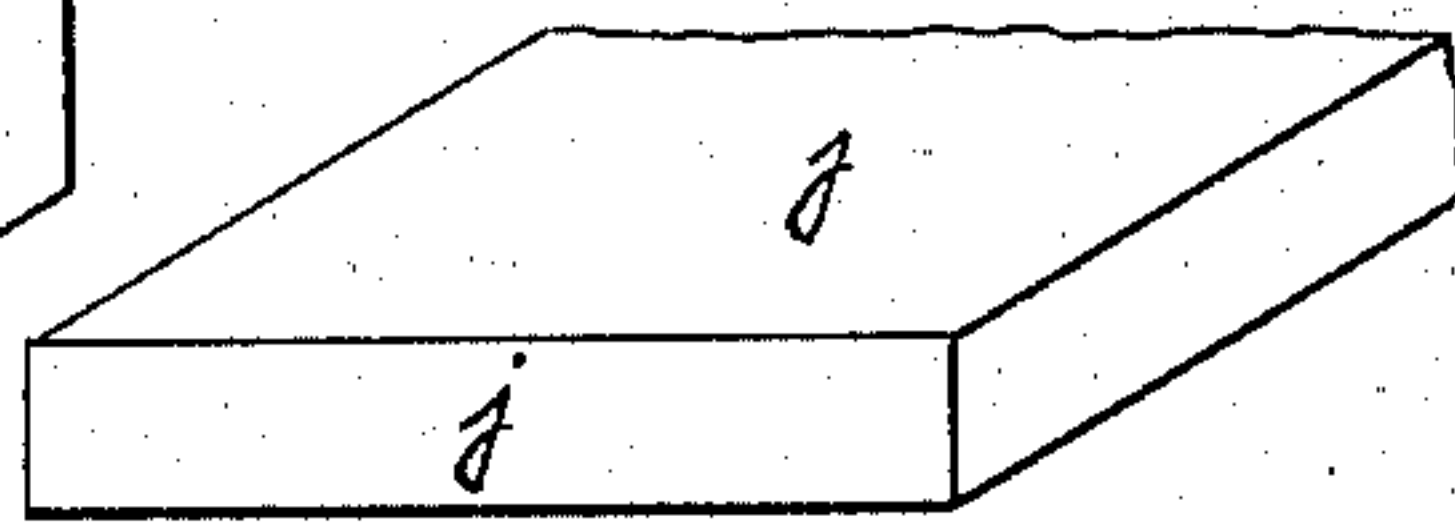


Fig. 11

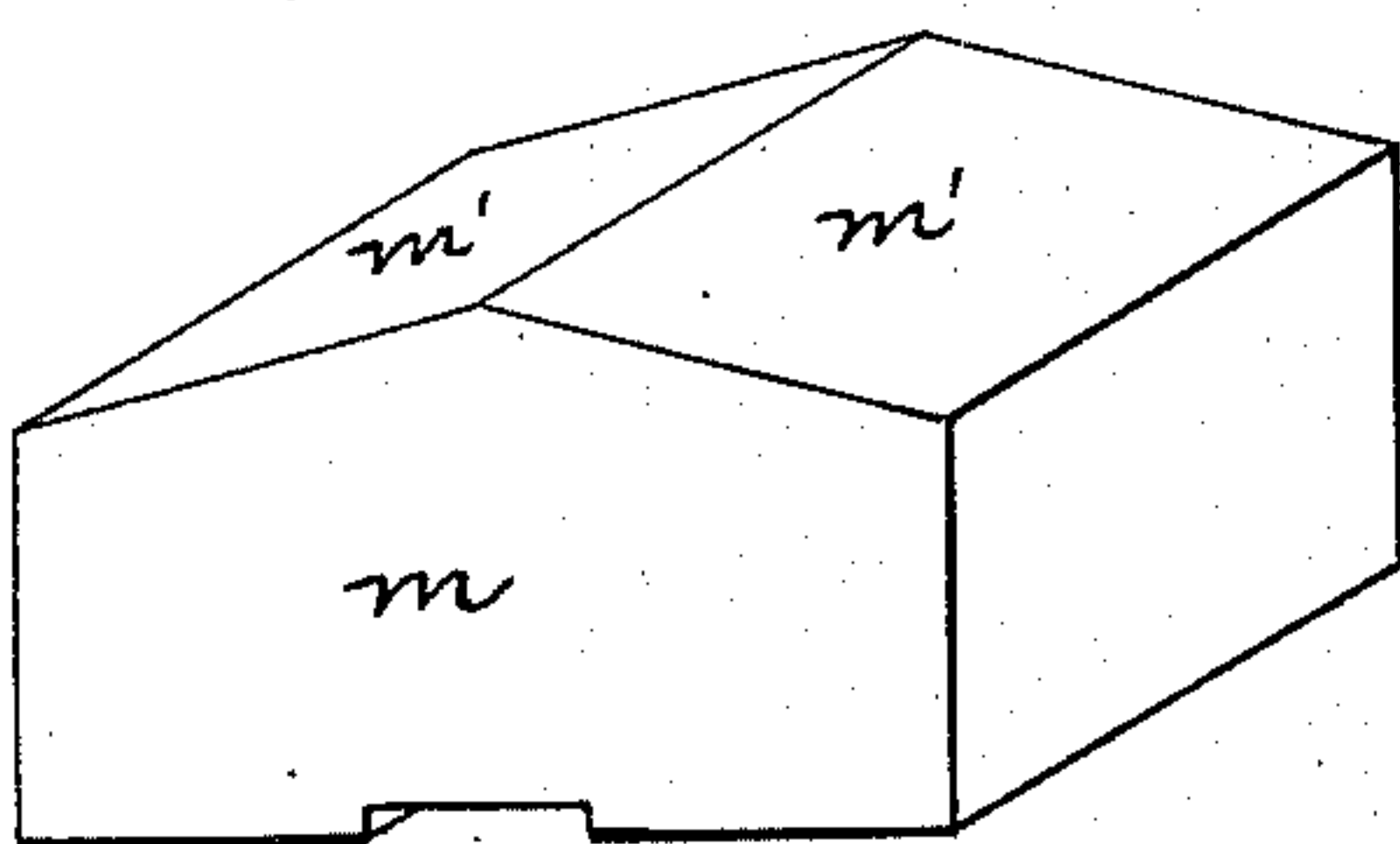


Fig. 12

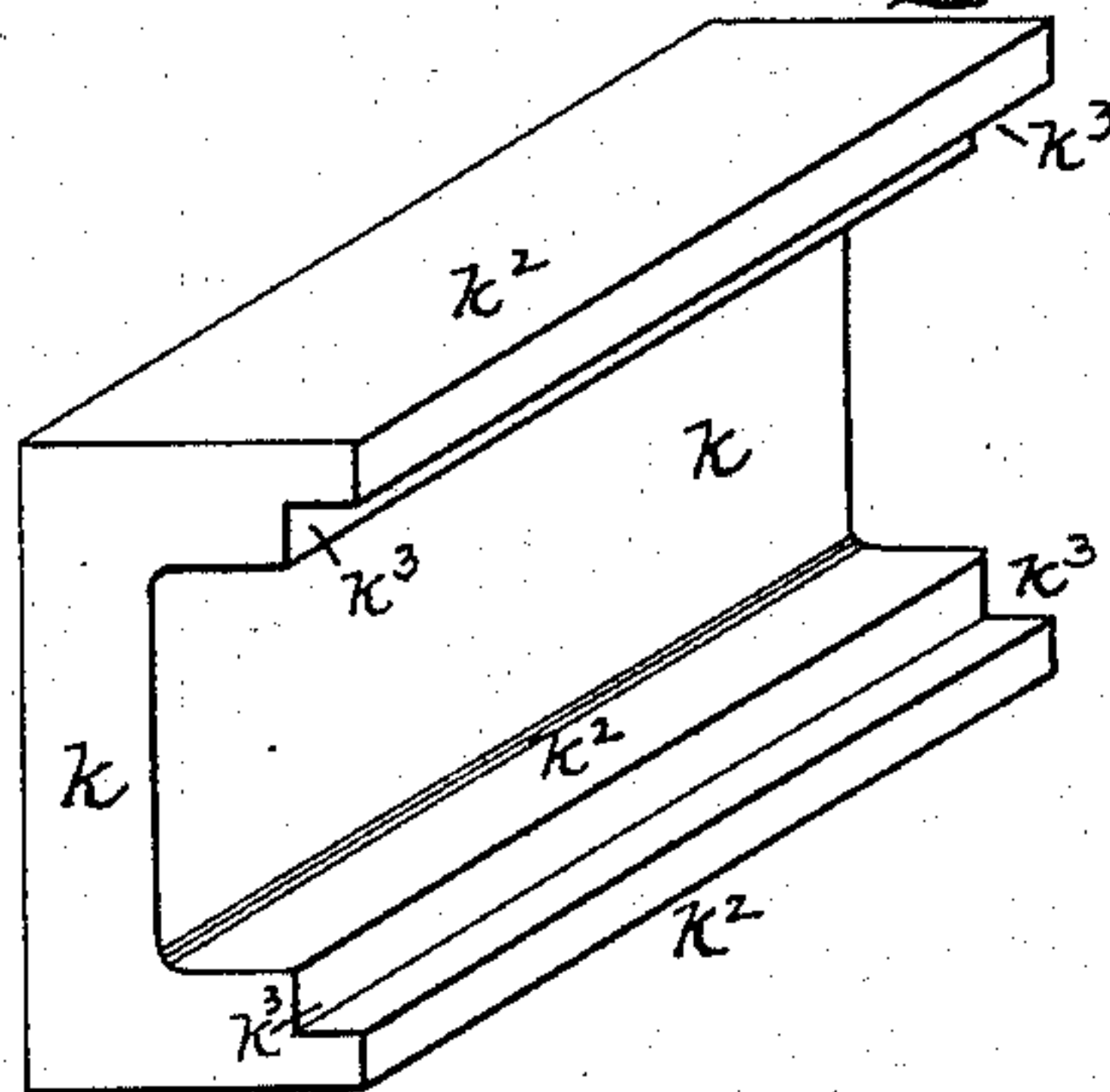


Fig. 10

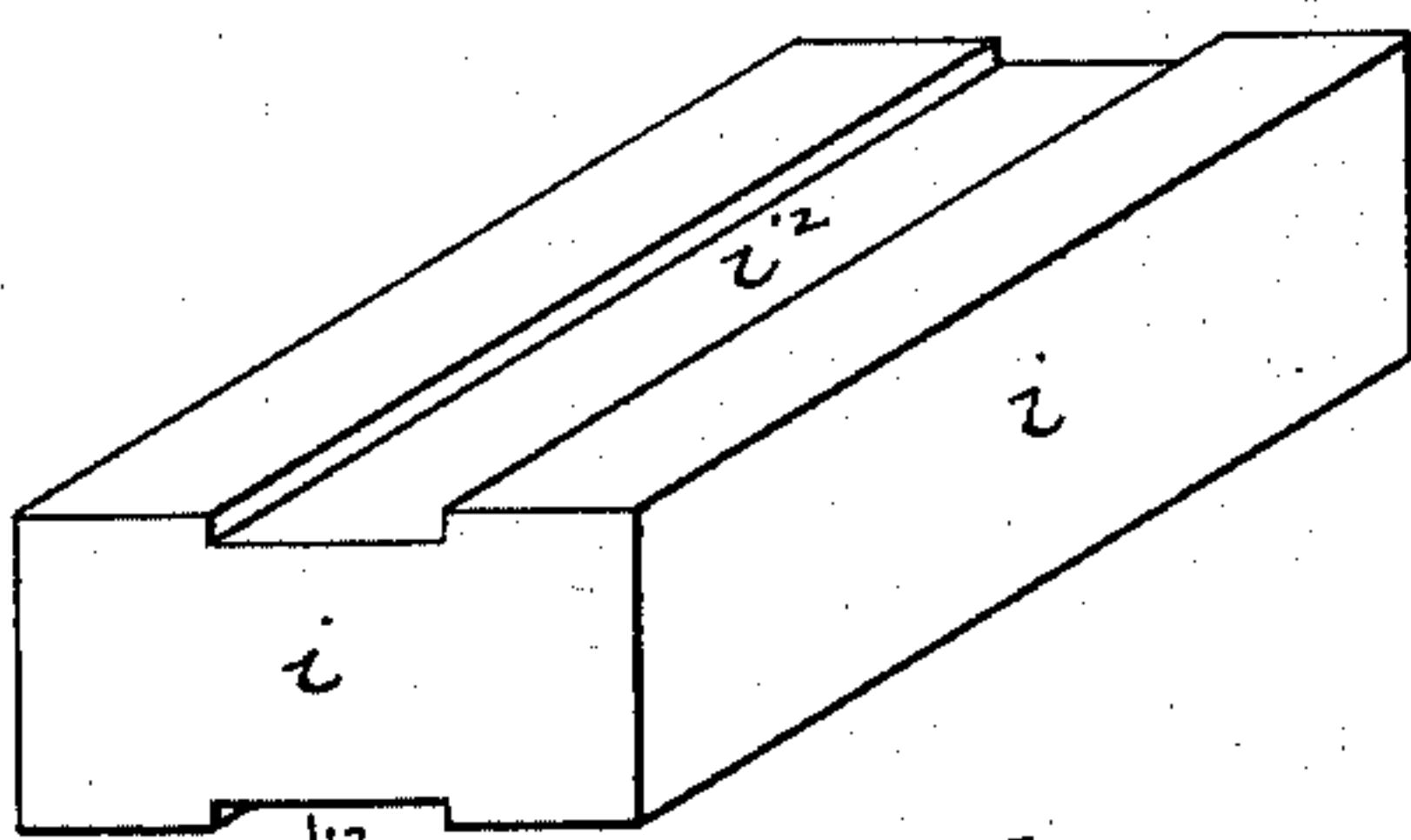


Fig. 9

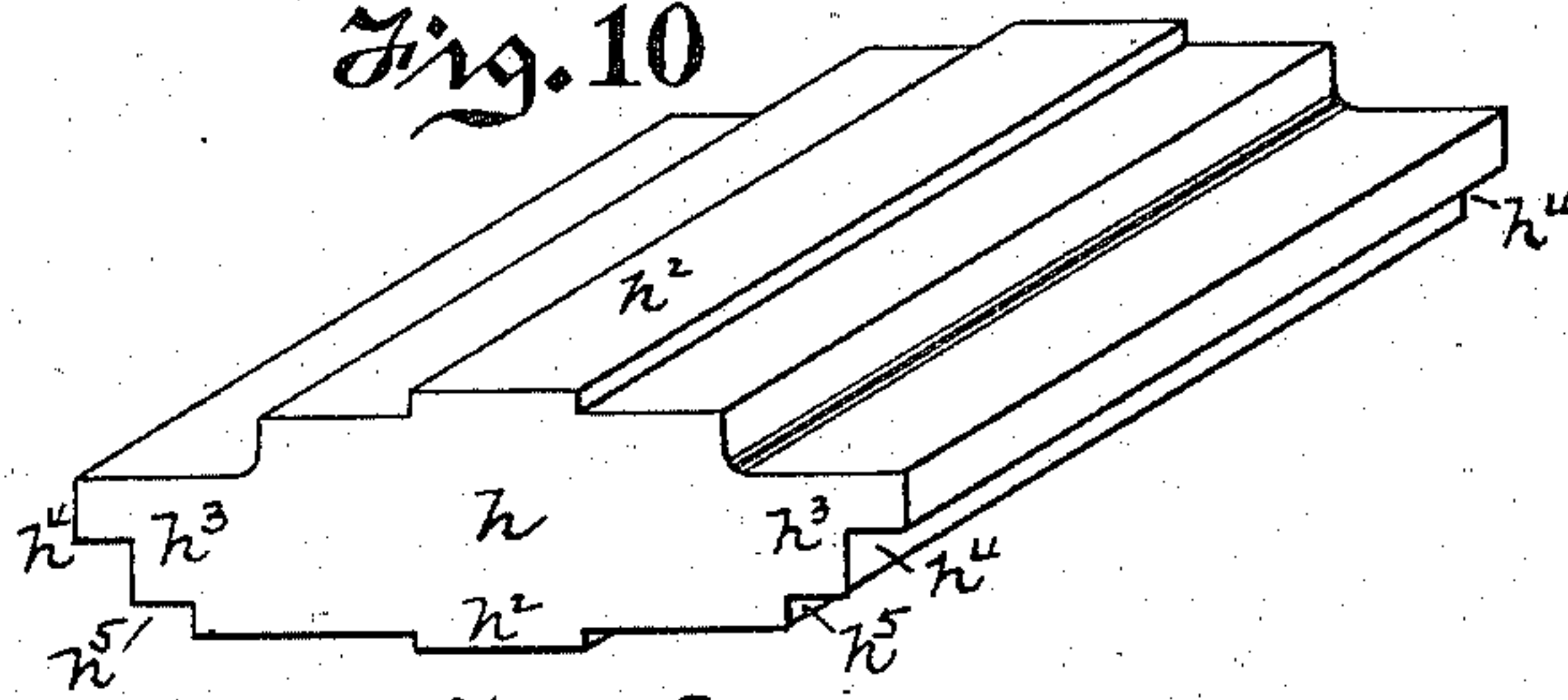


Fig. 8

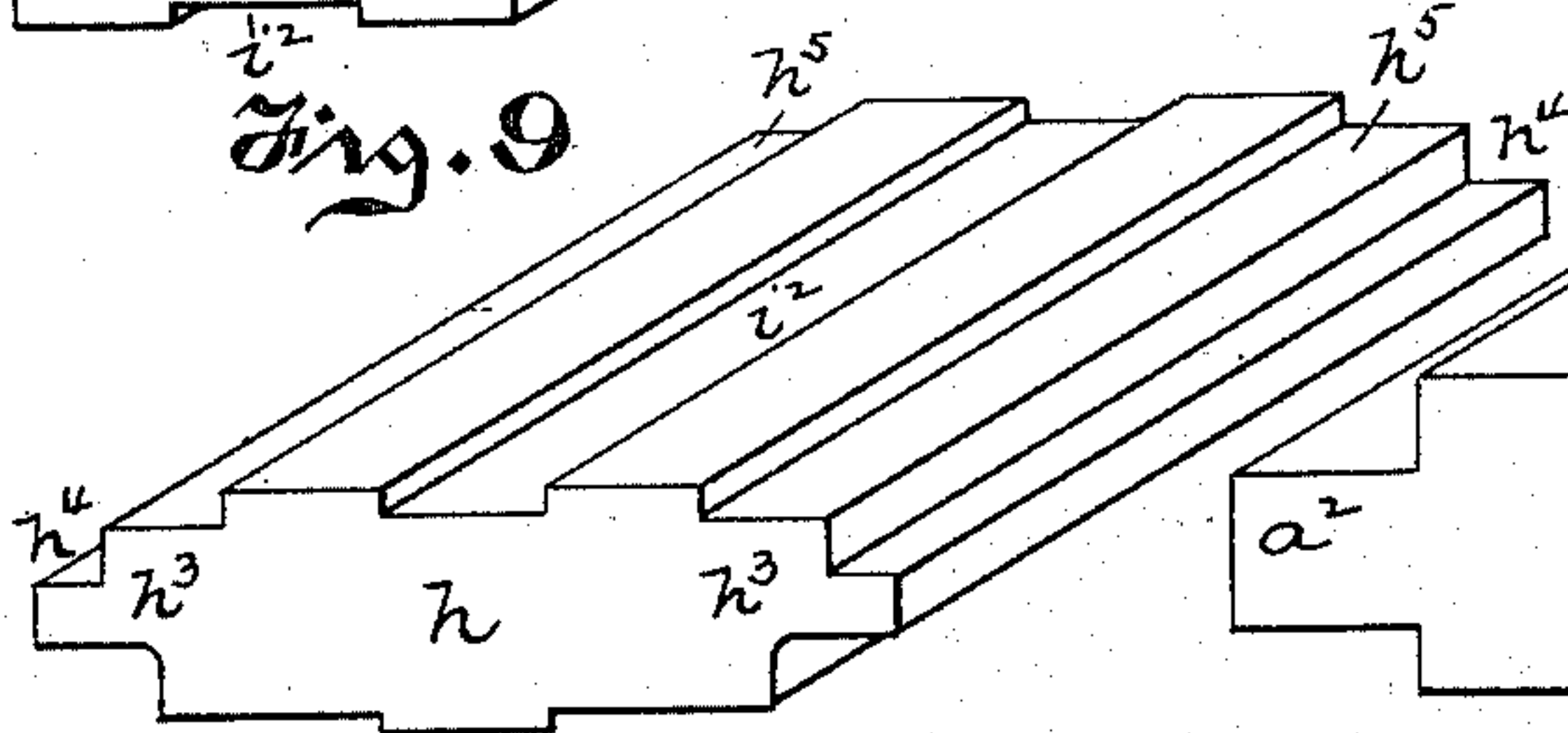


Fig. 7

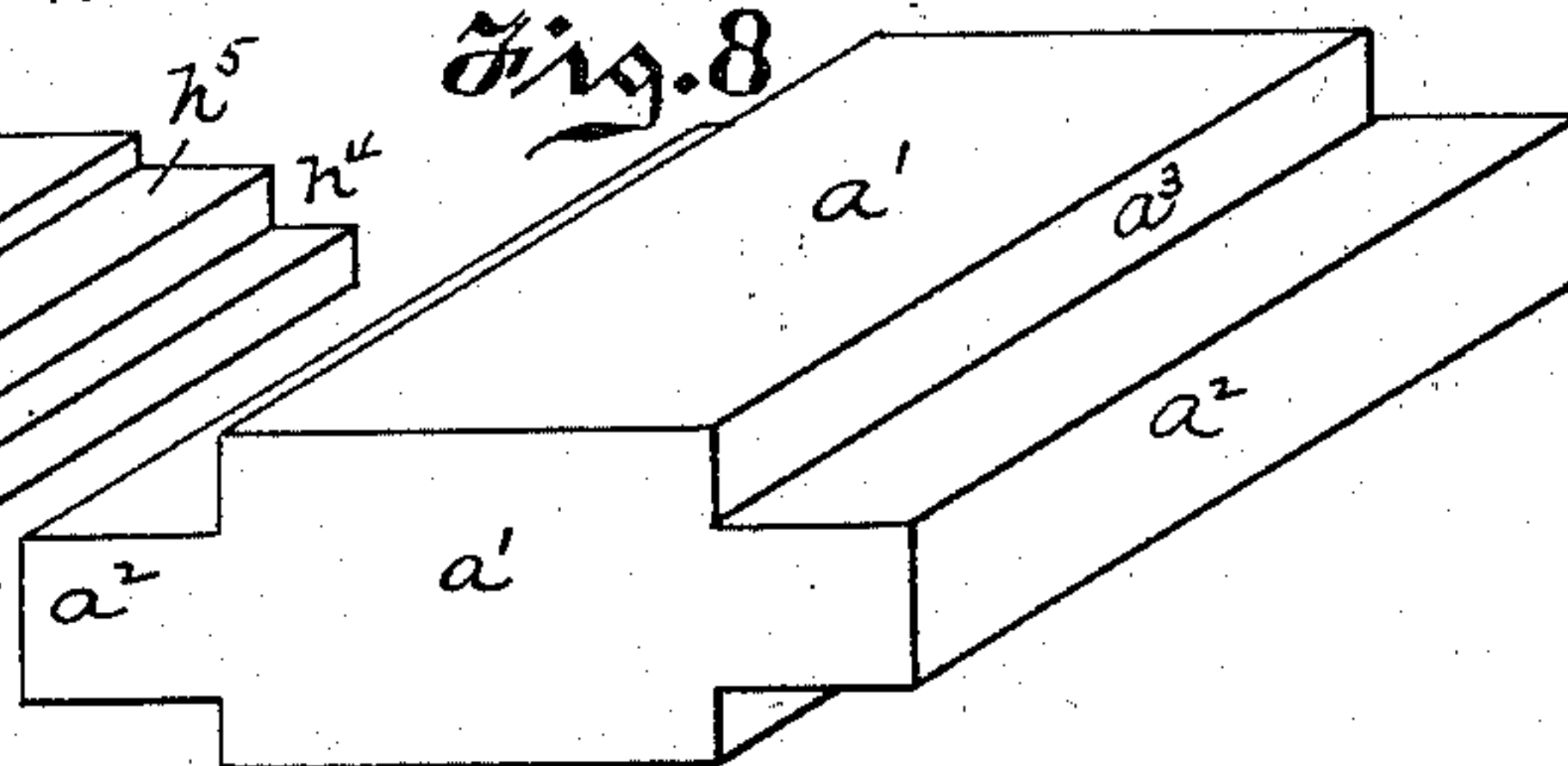


Fig. 6

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# UNITED STATES PATENT OFFICE.

FRANK L. SLOCUM, OF PITTSBURG, PENNSYLVANIA.

## COKE-OVEN.

SPECIFICATION forming part of Letters Patent No. 568,074, dated September 22, 1896.

Application filed May 23, 1895. Serial No. 550,336. (No model.)

*To all whom it may concern:*

Be it known that I, FRANK L. SLOCUM, a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Coke-Ovens; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to ovens for coking coal, and relates to that class of coking-ovens having long horizontal coking or distilling chambers with heating-flues in the side walls, the principal object of the invention being to improve the construction of the walls inclosing such chambers, to increase their durability, and prevent leakage.

It consists, generally stated, in a longitudinally-extending coke-oven, and a chamber having heating-flues in the side walls thereof and having the inner side walls between the oven and flues formed of vertical slabs with horizontally and inwardly extending flanges projecting over the top and bottom of the side flues.

It also consists in forming the separating-wall between two such ovens of a central pier-wall having heating-flues on each side thereof and having tile extending out above and below the heating-flues, and vertical slabs forming the oven-walls and outer walls of the heating-flues.

It also consists in certain improvements in the construction of such walls and the tiles or blocks employed therefor.

To enable others skilled in the art to make and practice my invention, I will refer to the accompanying drawings, in which—

Figure 1 is a cross-section through a series of ovens. Fig. 2 is a sectional view on the line 2 2, Fig. 1. Fig. 3 is a longitudinal section on the line 3 3, Fig. 1, through the coking-chamber. Fig. 4 is a longitudinal section on the line 4 4, Fig. 1, through the side heating-flues; and Figs. 5 to 15 are perspective views of the special forms of blocks or tiles used in building the ovens.

My invention relates more particularly to the type of coking-ovens in which the gas is carried away from the ovens without being burned, the ammonia, tar, benzol, and other such products being removed therefrom, and the gas being then conducted to a holder from

which it may be distributed for illuminating or heating purposes or carried back to the coking-ovens and employed for coking other bodies of coal by the combustion of such gases within the heating or combustion flues. It therefore belongs to the class of coking-ovens in which the coke is formed practically by a distilling operation as distinguished from those in which the coke is formed by internal firing. The oven has the longitudinal horizontal coking-chamber *a*, on each side of which are the separating-walls *b*, containing a series of side heating-flues 1 2 3, and underneath which are the heating-flues *d*, the gas being burned within said heating or combustion flues *d*, and passing thence into the side flues, in which are placed auxiliary gas-entrances, the drawings showing the gas-entrances in the form of pipes *e* in the bottom flues *d* and auxiliary pipes *e'* *e''* in the side heating-flues, it being understood, however, that any suitable form of gas-entrance may be employed, such as from a gas-producer, which is preferably employed where the gas or a part thereof is to be saved for illuminating or heating purposes.

I will first describe the construction of the ovens and the special forms of tiles employed therewith, so that the advantages of the construction may be more fully understood. To support the bank of ovens, I employ on the bed *f* a series of vertical longitudinal walls *f'* *f''*, the dividing-walls *b* between the coking-chambers being supported on the walls *f'* *f''*, while the bottom tiles *a'* of the coking-chamber may, if desired, be centrally supported on the wall *f''* where two separate fire-chambers *d* are employed. Resting on the walls *f'* *f''* are the blocks or tiles *g*, two such tiles forming together about the width of the dividing-wall *b* being employed, and the tile blocks having, as shown, the seats *g'*, on which the flanges *a''* of the bottom blocks *a'* of the coking-chamber rest, and the blocks *g* having also the seats *g''* to center the blocks *h*, forming the bases of the center pier-walls *c* of the dividing-wall between the coking-chambers, the central ribs *h'* of such blocks *h* resting on the seats *g''* of the blocks *g*. I prefer to build up the central portion or pier of the dividing-wall of a series of such blocks *h* and of rectangular blocks *i*, though, as shown in



Fig. 15 of the drawings, I may employ a single tile  $s$ , uniting the shapes of the blocks  $h$  and  $i$  to form such parts, the two separate blocks  $h$  and  $i$  being preferred, however, because the blocks are more easily formed and less liable to warp in baking, and I will therefore describe the apparatus as formed of the separate blocks. These blocks  $h$  and  $i$  also form the inner walls of the side heating-flues, the outer walls of said flues being formed by the slabs or blocks  $k$ , and in the preferred construction the upper and lower walls of said side heating-flues being formed by inwardly-extending flanges  $k^2$  of the vertical slabs  $k$  and by the blocks  $h$ , which have the flanges or extensions  $h^3$  beyond the blocks  $i$ , the meeting edges of the flanges  $k^2$  and extensions  $h^3$  having rabbets  $k^3$  and  $h^4$  fitting within each other, so as to form as close joints as practicable between the blocks forming the side flues. The lower outer face of the lowest slab  $k$  fits against the shoulders  $a^3$ , and on the bottom blocks  $a'$  of the coking-chambers, which hold these lower or bottom vertical slabs in proper line, and resting on such slabs and extending between the tiles or blocks  $h$ , are the tile plates  $j$ , which are flat rectangular plates which enter the seats  $h^5$  between two such blocks  $h$  and extend between the vertical slabs  $k$ , so that said vertical slabs can move longitudinally over these plates and are free to expand and contract under the heat and to move longitudinally under such expanding or contracting action without weakening the central pier-walls  $c$  of the separating-walls  $b$  between the coke-ovens. To properly key together the blocks  $h$  and  $i$ , forming the central pier-wall, I prefer to form the central ribs  $h^2$  on the blocks  $h$  and the corresponding keyways  $i^2$  on the blocks  $i$  and like ribs and keyways may be formed between the blocks  $h$  where two of them fit against each other, the same being illustrated in Figs. 7 and 8. Such ribs and keyways are not essential, however, and may be omitted. This construction is carried to the upper part of the coke-ovens, and to form the top portions of each separating-wall I employ the blocks  $l$ , which rest on the slabs  $j$ , and the block  $m$ , which rests upon the central pier-wall  $c$  and preferably has a rib-and-keyway connection therewith, as shown.

The main supporting-arches  $n$  over the coking-chamber rest on the inclined or skewback faces  $m'$  of the abutment-blocks  $m$ , and in turn support the superposed brickwork forming the working floor  $P$ . Under this main arch is a fire-arch  $n'$ , supported on the blocks  $l$ , (shown in Fig. 13,) each of which has the rabbet  $l'$ , the inclined or skewback face  $l^2$ , and back of them the arc or curved face  $l^3$ , terminating at the shoulder  $l^4$ . Resting against the blocks  $l$  are the base-blocks  $n^2$  (see Fig. 14) of the arch  $n'$ , each of which has a corresponding shoulder  $n^3$  and inclined face  $n^4$  to fit against the rabbet and skewback of the block  $l$ . The arch  $n'$  is prevented from spread-

ing by these rabbet-and-shoulder connections, and is so held that a slight space is left between the main arch  $n$  and the fire-arch  $n'$ , which permits of the removal and replacement of the fire-arch, when burned out, without affecting the support of the floor.

The general construction of the separating-walls above described is employed to provide for the different expansion and contraction in the walls of the coking-chambers, so as to permit the movement of the vertical slabs  $k$ , which are exposed to great changes of temperature, without affecting the central pier-walls. The custom has been to build these side heating or combustion flues of continuous hollow tile; and when the coke is removed from the coking-chambers the walls of the coking-chambers are exposed to the atmosphere, and when a new charge of coal is placed within the coking-chambers the contact thereof with the side walls causes greater contraction of the same, while the central portions of such dividing-walls remain at the high heat generated for the coking of the coal, and this leads to cracking of such hollow tile, so that it has been practically impossible to maintain the side walls intact. By the construction above described, however, as the walls of the coking-chamber (which also form the outer walls of the heating-flues) are formed of separate vertical slabs, these slabs are free to contract or expand under the changes of temperature, while the central pier-wall, which is maintained at a high heat, is not affected thereby. The slab  $k$  can, therefore, move with relation to the central pier-wall in contracting and expanding, the rabbeted joints between them allowing of such movement, while the flanges  $k^2$  slide over the bottom slabs  $a'$  and the horizontal dividing tile plates  $j$ , and free expansion and contraction for such vertical slabs  $k$  is permitted without affecting the central pier-wall, the dividing tile plates  $j$  being simply flat rectangular plates which can also expand and contract without affecting the central pier thereof. At the same time, on account of the width of the top and bottom faces of the vertical slabs and of the rabbeted joint between said slabs and the central pier-wall, any gas from the coke-chambers or products of combustion in the heating-flues have a long course to follow before they can pass between the coking-chambers and flues, and there is but little liability of leakage between such chambers and flues, so that I obtain capability of free movement of the slabs and plates forming the walls of the coking-chambers, with minimum liability of leakage.

As illustrated in Fig. 3, the coal to be coked is introduced into the coking-chambers through suitable drops  $o$ , tracks  $o'$  passing over the working bed  $P$ , so that the coal may be fed to the coking-ovens from suitable wagons or cars  $o^2$ . The gas passes from the coking-chamber through the passage  $p$  leading up through the brickwork superposed



above the coking-ovens and leading into the water seal  $p'$ , from which it is carried by the pipe  $p^2$  to the washing and scrubbing apparatus to recover the coal-tar, ammonia, benzol, &c., from the gas.

The combustion-flues  $d$  are shown with the gas-entrance pipes  $e$  and lead under the coking-chambers  $a$ , two such flues being generally employed under each coking-chamber, and at the rear end of the same said flues extend horizontally outward, as at  $d'$ , to the same vertical plane as the heating-flues  $c$ , and then rise, as at  $d^2$ , to communicate with the upper horizontal heating-flue 1 in the side walls, the heated products then passing to the forward end of such upper flue 1, and passing thence through a short downtake-flue to the horizontal flue 2, thence passing downwardly through the short flue at the rear end into the lowest horizontal flue 3, and leading thence by the escape-flue 4 to the stack. It will be seen that I employ the auxiliary gas-entrance  $e'$  at the mouth of the upper heating-flue 1 and the auxiliary gas-entrance  $e^2$  at the mouth of the middle flue 2, and the several gas-entrances have suitable air-entrances to support the combustion of the gas.

In coking coal in coking-ovens of the above construction the ends of the coking-chambers are closed by suitable doors and the coal is fed through the charging-holes  $o$  into the oven, and such charging-holes are then closed and sealed. Gas is then ignited in the bottom combustion-flues  $d$  and in the side combustion-flues 1 2 3, being introduced through the pipes  $e$   $e'$   $e^2$  above referred to, and the products of combustion from the flues  $d$  pass upwardly through the flues  $d^2$  and thence horizontally along the flue 1 and downwardly into the flue 2, and thence horizontally along that flue and downwardly, from which it passes into the flue 3, the escape-flue 4, and to the stack. The heat so generated passes through the bottom walls of the coking-chambers and through the side walls on each side of the same and distils off the gas, which passes through the eduction port or passage  $p$  into the water seal and thence by the pipe  $p^2$  to the washing and scrubbing apparatus. The heat generated of course raises the coking-chambers and the division-walls between them containing the side heating-flues to a very high heat, and this heat passes through the bottom tiles  $a'$  and the vertical slabs  $k$  into the coking-chambers and acts to distil off the gas from the coal. After the charge has been coked the doors are opened and the coke is removed through said doors by suitable machinery, and the doors are then closed and a fresh charge of coal introduced through the charge in the holes  $o$ . In this way the side walls of the coking-chambers are exposed to the atmosphere, which acts to cool them, and the coal introduced being of course cold and lying against the slabs  $k$  immediately absorbs a large amount of heat therefrom, causing the rapid contracting of the same.

The central pier-wall, however, remains at the high heat generated in the ovens and does not contract. As the vertical slabs  $k$  are separate therefrom, however, they are free to contract without injury to the central pier-walls, and they will contract freely, moving longitudinally or otherwise between the tile plates  $j$  and along the pier-walls or the blocks  $h$  thereof. As the coal in the coking-ovens is gradually heated the slabs will again become heated and expand, and provision is thus made for such contraction and expansion without affecting the parts of the division-walls which remain highly heated. Though the slabs  $k$  above the bottom one are not held from outward movement, the mass of coal resting against them and pressing upon them holds them in place, so that the principal movement under expansion and contraction is longitudinal. It will be noticed that by the construction of the division-walls the weight of the arches  $n$  and brickwork between the ovens and working floors is supported by the abutment-blocks  $m$ , which receive their support from the central pier-walls. By this construction the larger part of the weight is relieved from the slabs  $k$ , which form the walls of the coking-chambers, and they are left free to move under expansion and contraction, as above described.

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

1. A longitudinally-extending coke-oven having heating-flues in the side walls thereof and having the side walls between the coking-chambers and flues formed of vertical slabs with horizontally and inwardly extending flanges above and below the flues, and horizontal tiles forming tile plates between the vertical slabs extending into the central wall beyond the slabs, substantially as set forth.

2. In coke-ovens, a separating-wall between two longitudinally-extending coking-chambers containing heating-flues and formed of a central pier-wall having heating-flues on each side thereof, and vertical slabs forming the walls of the coking-chambers and having horizontally and inwardly extending flanges above and below the heating-flues, substantially as set forth.

3. In coke-ovens, a separating-wall between two longitudinally-extending coking-chambers formed of a central pier-wall having heating-flues on each side thereof and having tile plates extending out therefrom, and vertical slabs with horizontally and inwardly extending flanges fitting between the tile plate and forming the walls of the coking-chambers, substantially as set forth.

4. In coke-ovens, a separating-wall between two longitudinally-extending coking-chambers formed of a central pier provided with flanges extending out therefrom and forming part of the upper and lower flue-walls, and vertical slabs forming the walls of the coking-chambers and having horizontally and inwardly extending flanges forming the



remainder of the upper and lower flue-walls, substantially as set forth.

5. A longitudinally-extending coke-oven having heating-flues in the side walls thereof and having side walls between the coking-chamber and flues formed of vertical slabs with horizontally and inwardly extending flanges extending above the heating-flues, and a central pier-wall having flanges extending out therefrom, the flanges of the central pier-wall and the flanges of the vertical slabs having rabbeted joints between them, substantially as set forth.

6. A longitudinally-extending coke-oven having heating-flues in the side walls thereof and having the side walls between the coking-chamber and flues formed of vertical slabs with horizontally and inwardly extending flanges extending above and below the heating-flues, a central pier-wall and horizontal tile plates fitting between the blocks of the central pier-wall and between said outer vertical slabs, substantially as set forth.

7. In coke-ovens, a separating-wall between longitudinally-extending coking-chambers formed of a central pier-wall having heating-flues on each side, and formed of blocks having flanges extending out therefrom above and below the heating-flues, separate tile plates extending out from the pier-wall, and vertical slabs resting on the tile plates and forming the walls of the coking-chamber and the outer walls of the heating-flues, substantially as set forth.

8. A bank of coke-ovens having longitudinally-extending coking-chambers, and separate walls between the chambers formed of a central pier-wall having horizontal return heating-flues on each side thereof, and vertical slabs forming the walls of the coking-chambers and outer walls of the heating-flues, tilework above the top horizontal flues connecting the central pier-walls and the outer walls, main supporting-arches over the coking-chambers sustained by said central pier-walls, and inner fire-arches within the main arches sustained by the tilework above the horizontal flues, substantially as set forth.

9. The combination, in the separating-walls of coke-ovens, of the central pier-walls having heating-flues on either side thereof and vertical slabs forming the walls of the coking-chambers and the outer walls of said flues, of the blocks  $m$  having inclined or skewback faces  $m'$ , arches  $n$  supported thereby, the blocks  $l$  on each side of the blocks  $m$  having the rabbets  $l'$  and skewback faces  $l^2$ , the blocks  $n^2$  having the shoulders  $n^3$  and inclined faces  $n^4$  and fitting against the blocks  $l$ , and the arches  $n'$  supported by said blocks  $n^2$ , substantially as set forth.

In testimony whereof I, the said FRANK L. SLOCUM, have hereunto set my hand.

FRANK L. SLOCUM.

Witnesses:

JAMES I. KAY,  
ROBERT C. TOTTEN.