

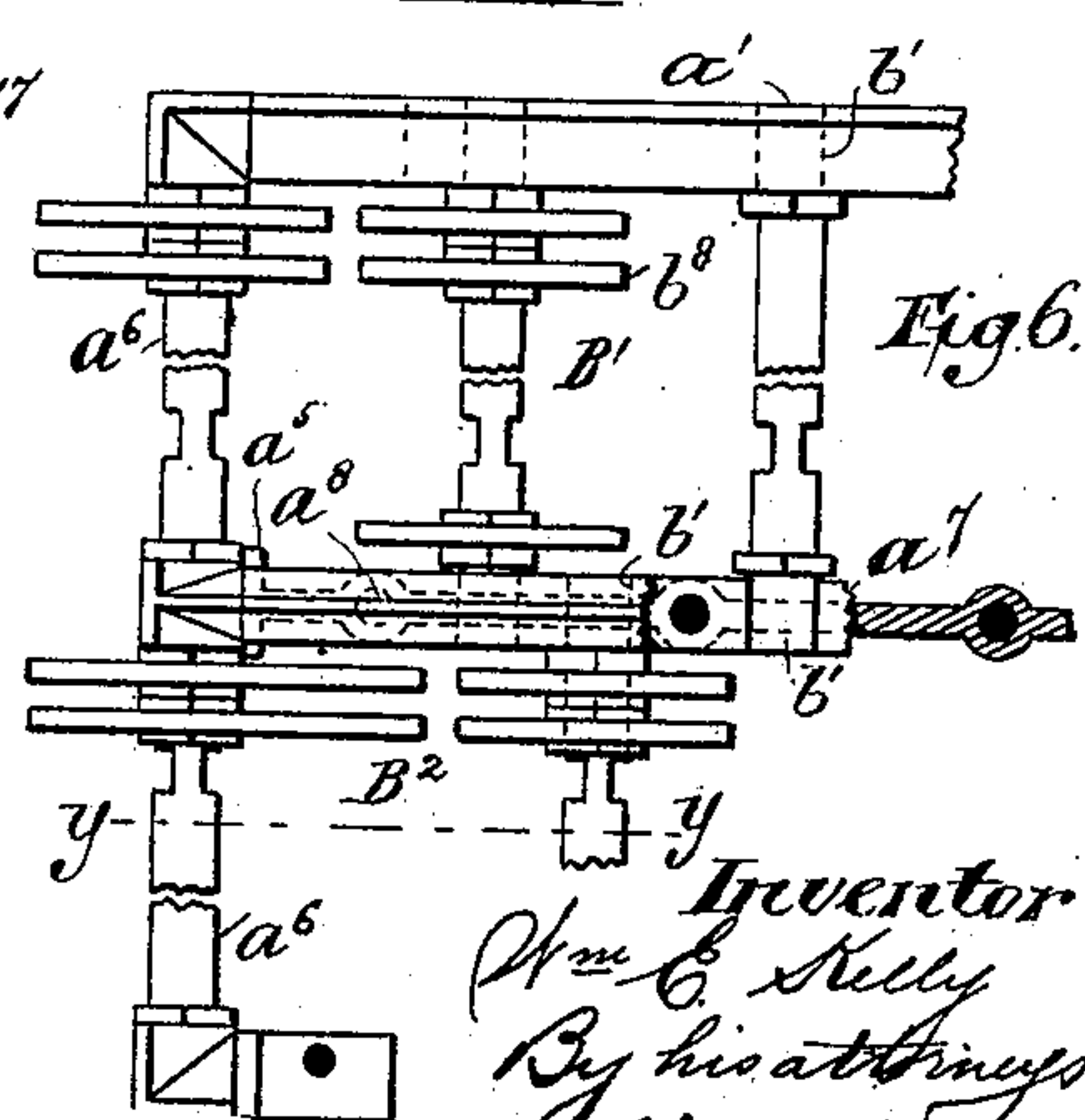
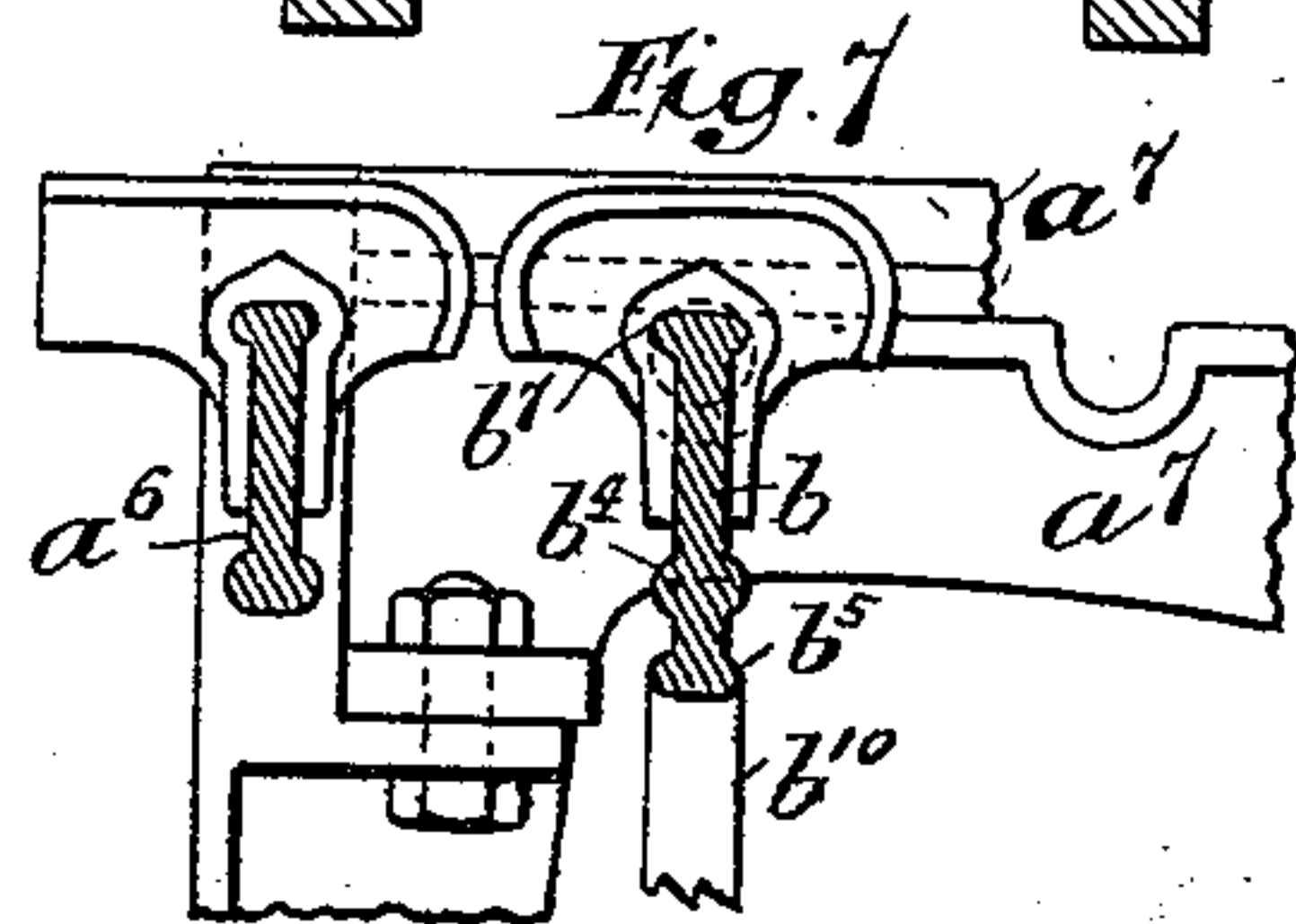
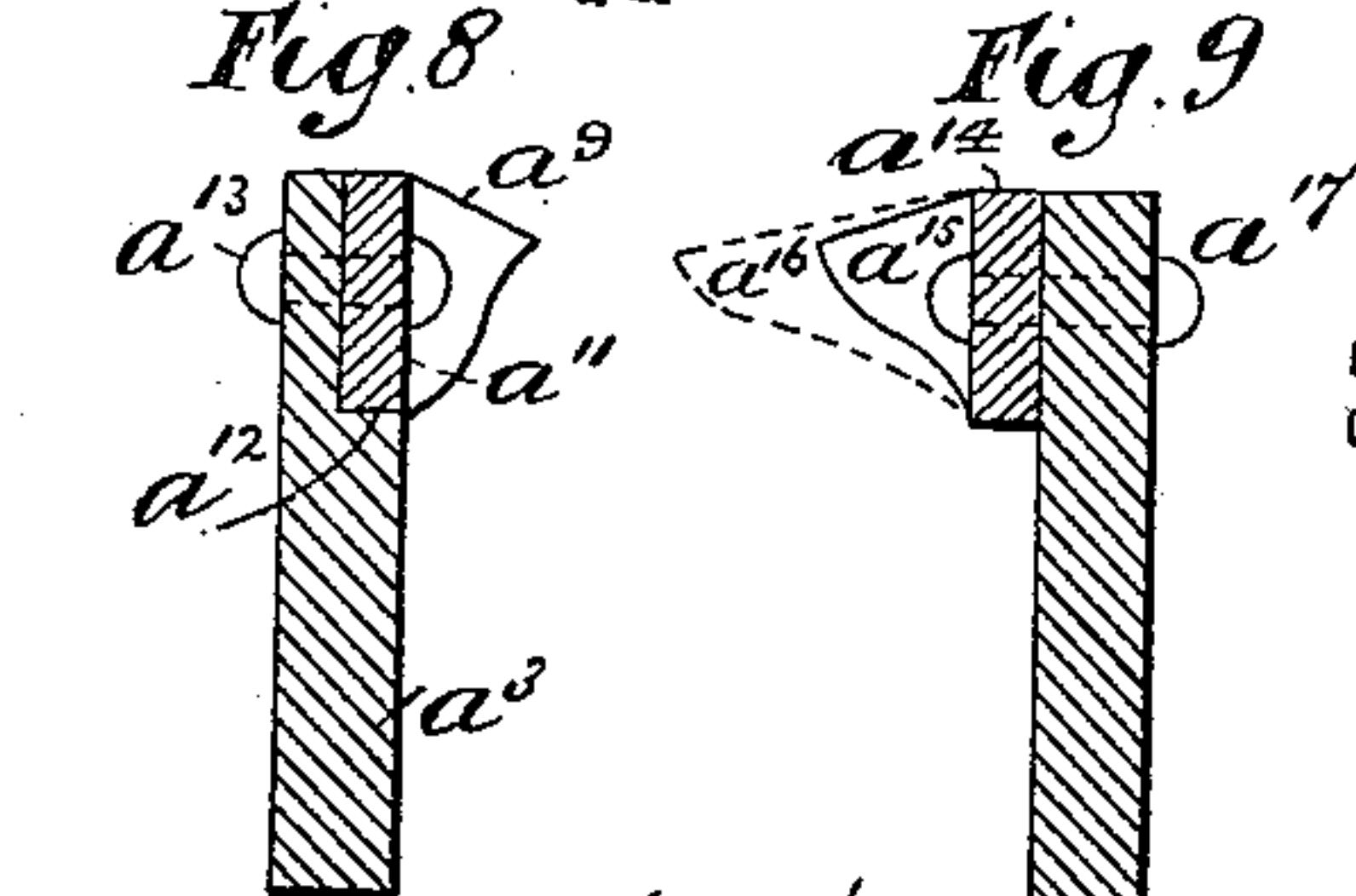
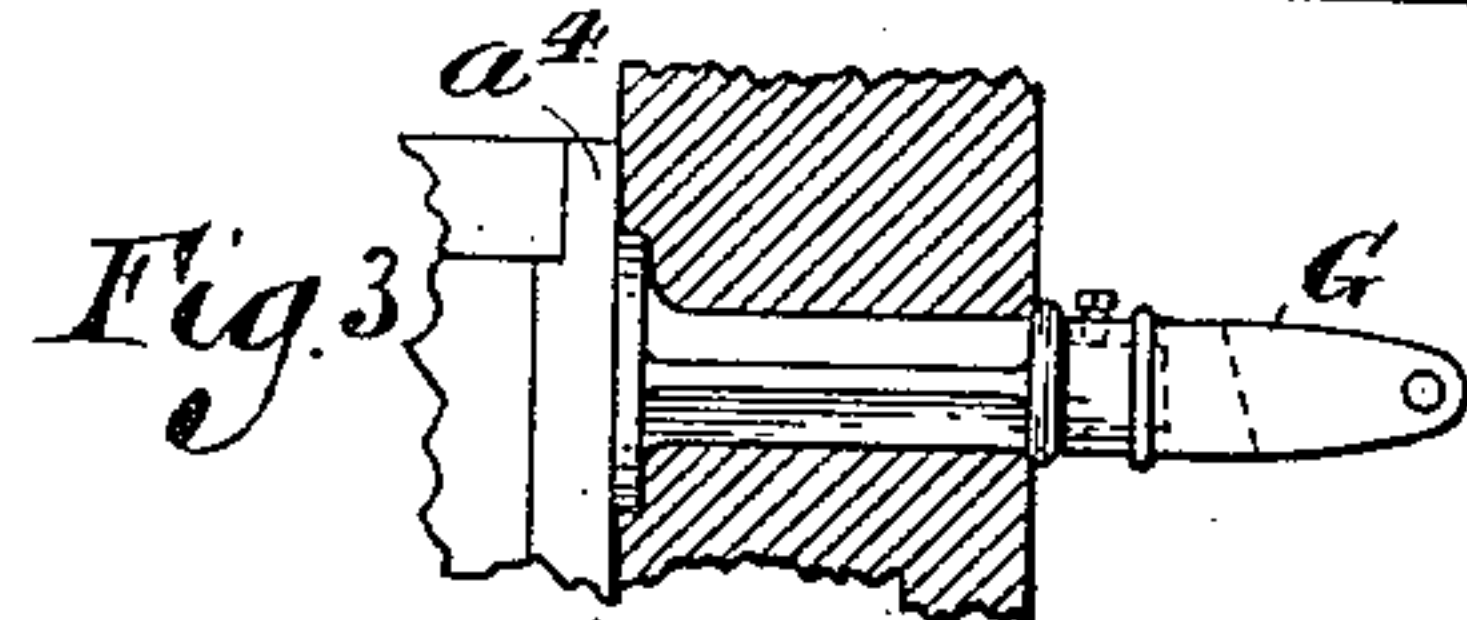
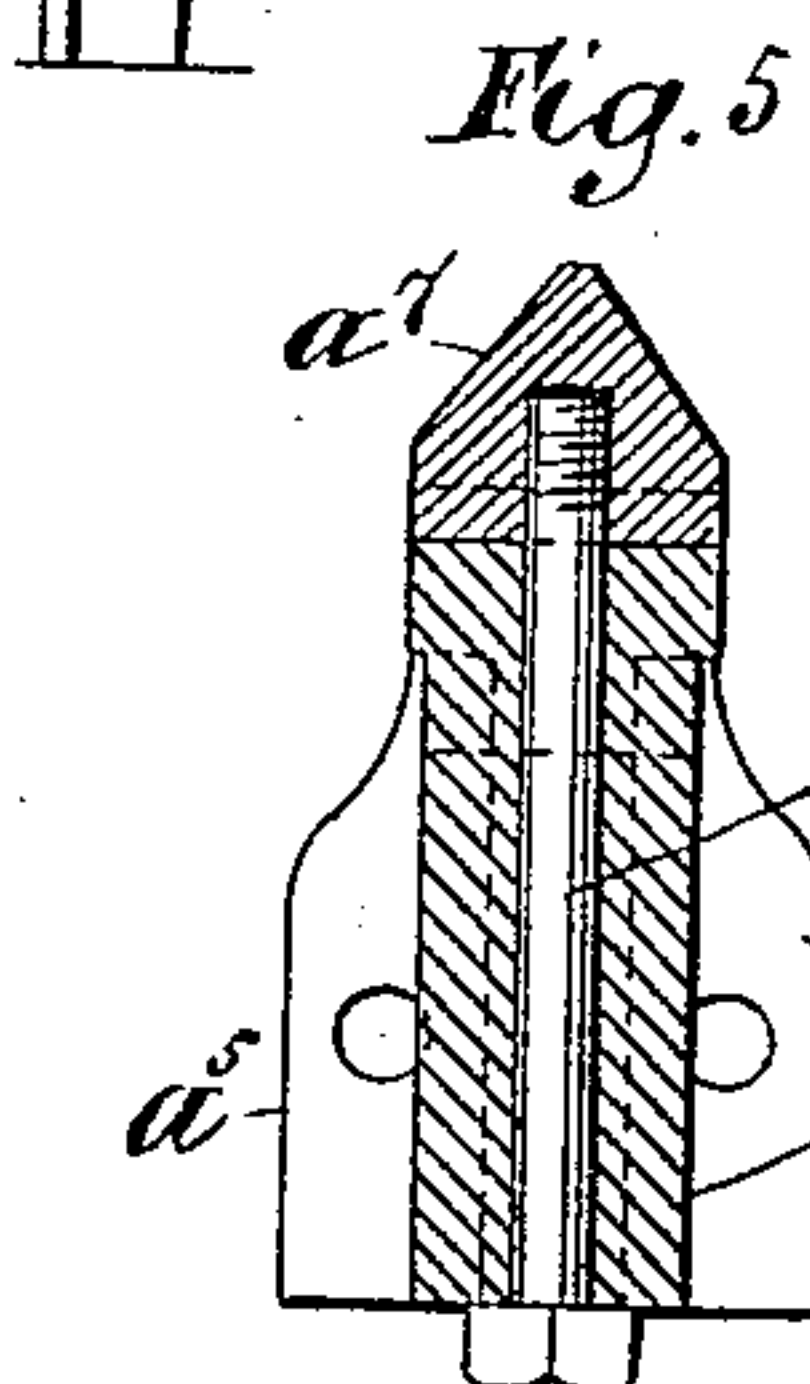
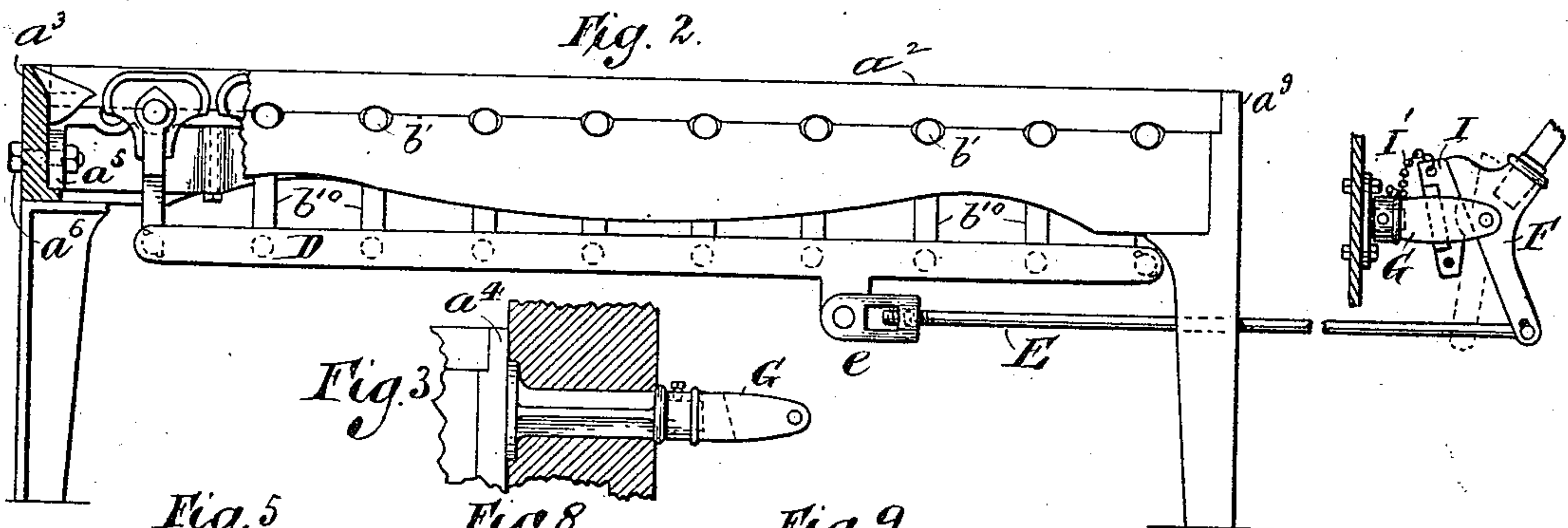
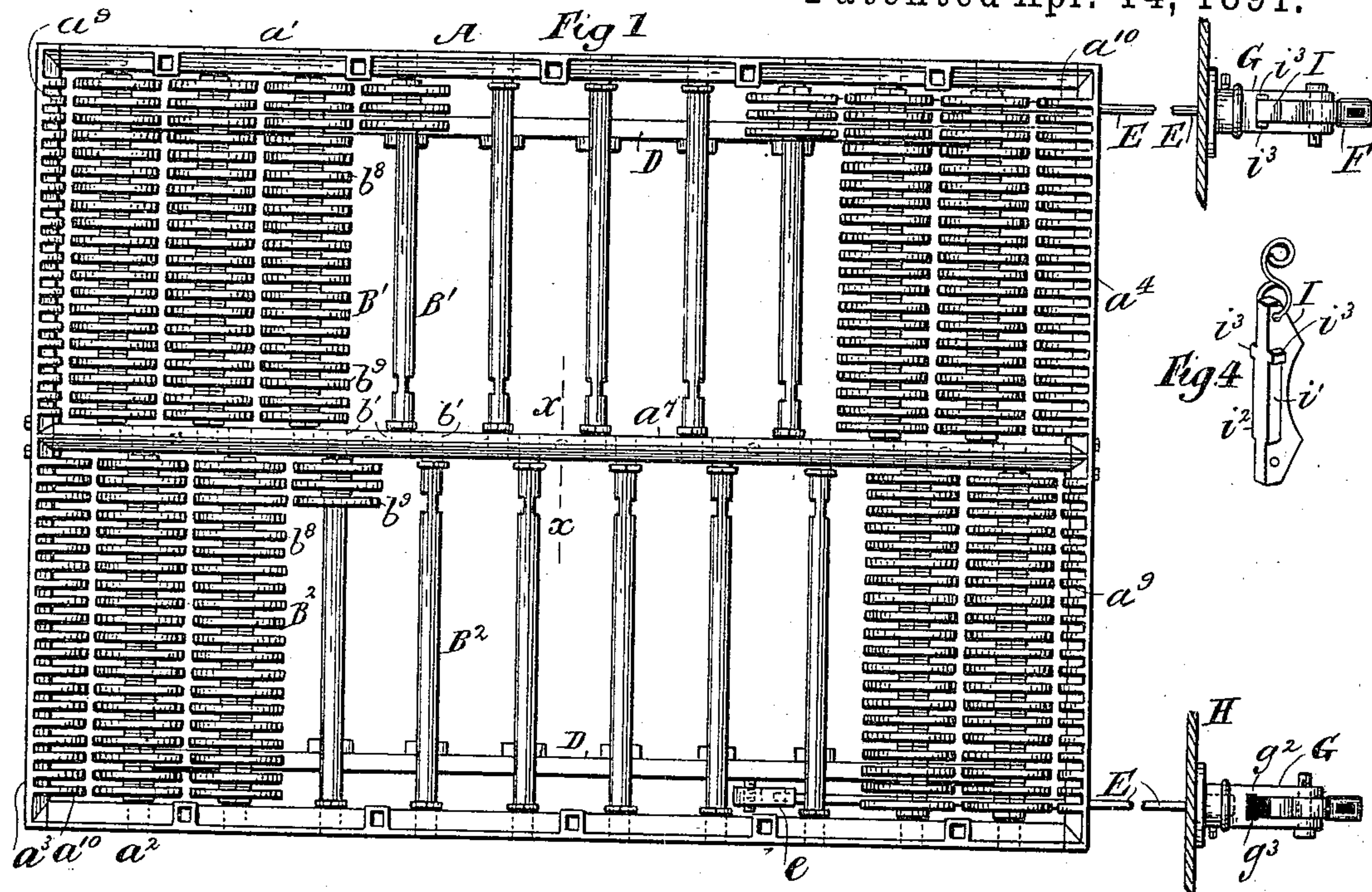
(No Model.)

W. E. KELLY.
GRATE.

3 Sheets—Sheet 1.

No. 450,315.

Patented Apr. 14, 1891.



Witnesses
M. Roach.
C. H. Johnson.

Inventor
Wm. E. Kelly
By his attorneys
Gifford & Brown

(No Model.)

3 Sheets—Sheet 2.

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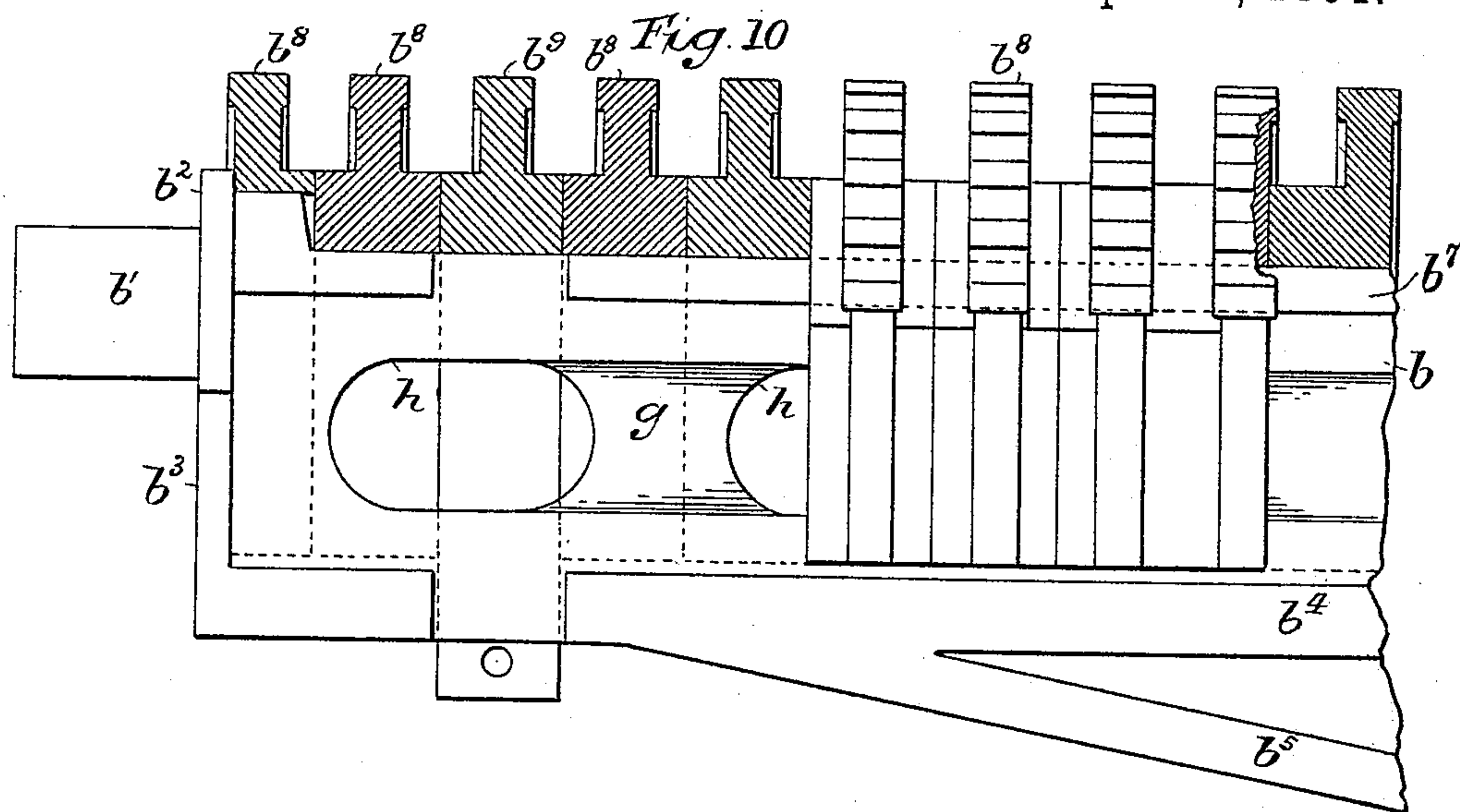
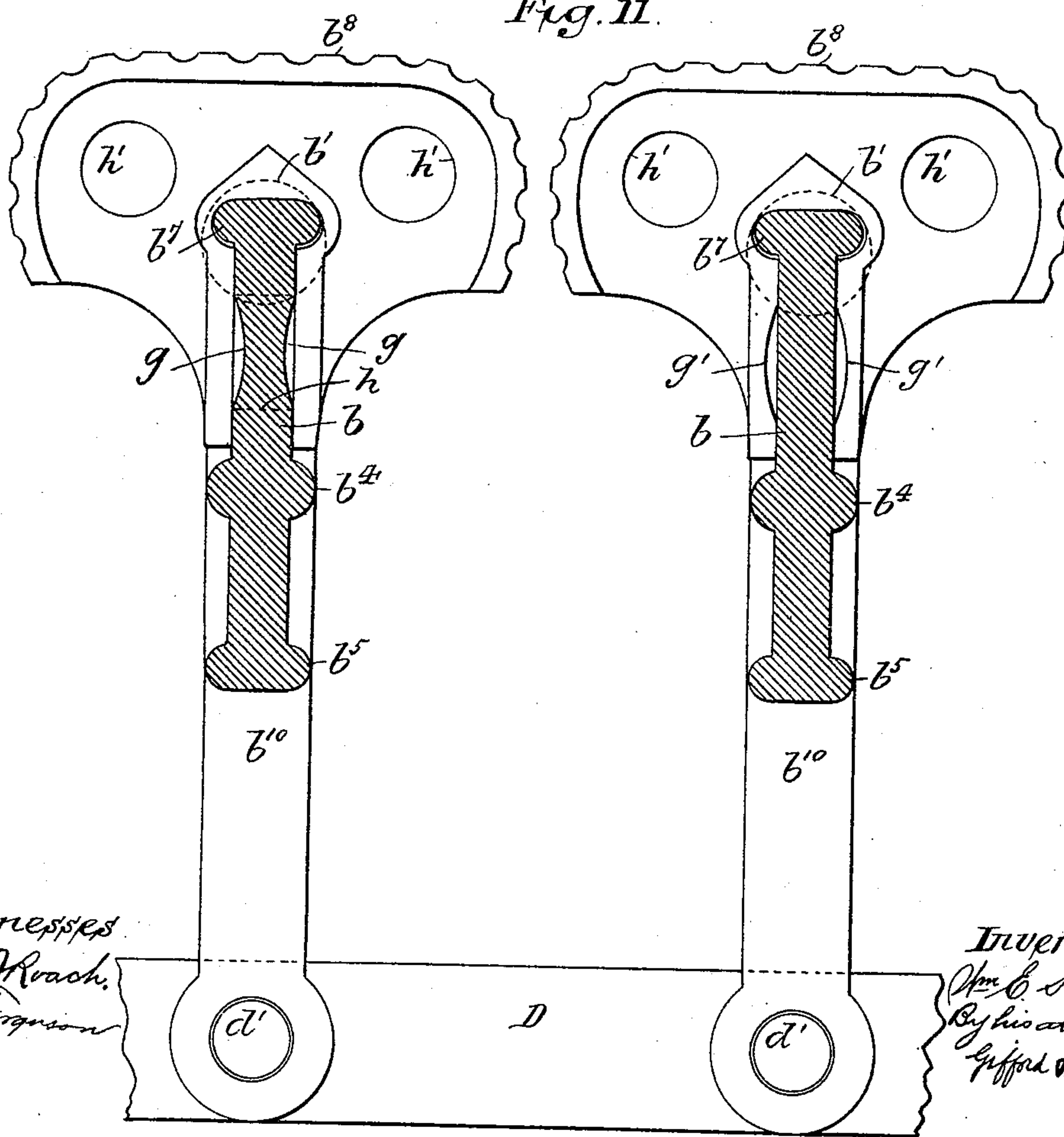


Fig. 11.



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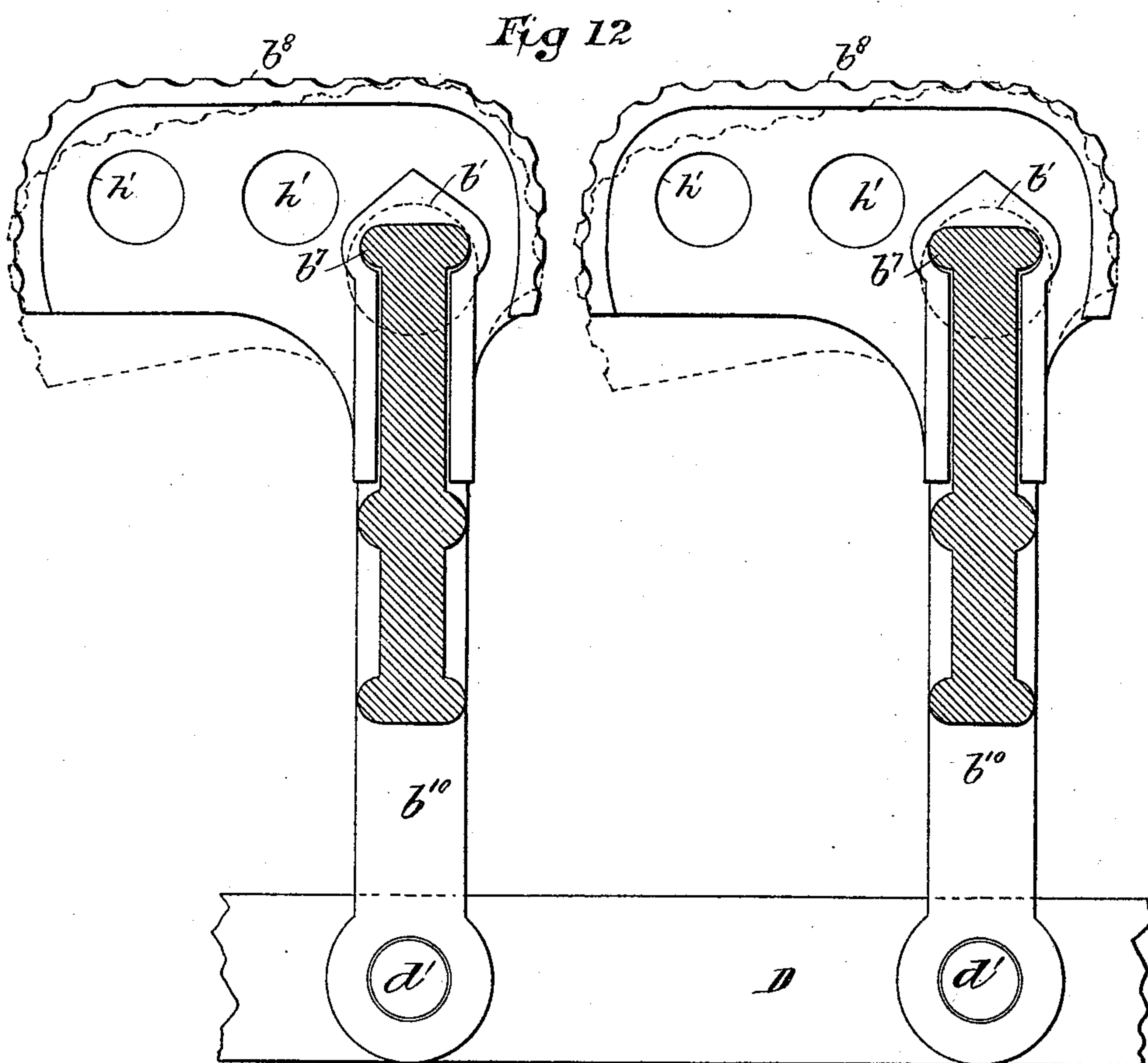
(No Model.)

W. E. KELLY.
GRATE.

3 Sheets—Sheet 3.

No. 450,315.

Patented Apr. 14, 1891.



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UNITED STATES PATENT OFFICE.

WILLIAM E. KELLY, OF NEW BRUNSWICK, NEW JERSEY.

GRATE.

SPECIFICATION forming part of Letters Patent No. 450,315, dated April 14, 1891.

Application filed September 22, 1888. Serial No. 286,100. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM E. KELLY, of New Brunswick, in the county of Middlesex and State of New Jersey, have invented a certain new and useful Improvement in Grates, of which the following is a specification.

I will describe a grate embodying my improvement in detail, and then point out the novel features in claims.

In the accompanying drawings, Figure 1 is a plan or top view of a grate embodying my improvement, certain of the leaves of the grate-bars being removed and other parts broken away. Fig. 2 is a side elevation of this grate, partly in section. Fig. 3 is a side elevation of a portion of the grate and a vertical section of a wall adjacent thereto. This view illustrates a modification of certain parts which are represented in Fig. 2. Fig. 4 is a perspective view of a locking-key used in the grate. Fig. 5 is a vertical section, taken as indicated by the dotted line $x x$, Fig. 1. Fig. 6 is a plan or top view of a grate illustrating a modification. In this view certain of the leaves of the grate-bars and other parts are removed to simplify the drawings. Fig. 7 is a vertical section, taken as indicated by the dotted line $y y$, Fig. 6. Fig. 8 is a vertical section of one of the outer bars of the grate, illustrating a modified construction. Fig. 9 is a vertical section of one of the outer bars of the grate, illustrating another modified construction. Fig. 10 is partially a side view and partially a vertical section of one of a number of rocking bars comprised in the grate. Fig. 11 is a vertical section of two of the rocking grate-bars and a connecting-rod, this section being taken transversely to the length of such grate-bar. Fig. 12 is a view similar to Fig. 11; but it illustrates a modified construction of the rocking bars.

Similar letters of reference designate corresponding parts in all the figures.

A designates the frame of the grate. It is composed of two parallel bars $a' a^2$ and two shorter intermediate bars $a^3 a^4$. These bars are secured together at the ends in any suitable manner—as, for instance, by lugs a^5 (see Fig. 2) on some of the bars, and bolts a^6 extending through such lugs and through the continuous bars. A rectangular frame is thus formed, as may be readily understood by reference

to Fig. 1. Lengthwise of this frame I have shown a bar a^7 as extending. It is shown as arranged about midway between the two bars $a' a^2$. It may be secured to the bars $a^3 a^4$ in any suitable manner—for instance, by lugs and bolts such as I have already referred to.

The end bars $a^3 a^4$ of the grate-frame are shown as provided with teeth or leaves. Of these I shall have more to say hereinafter.

Two series of rocking grate-bars $B' B^2$ are arranged within the grate-frame. One series of these rocking bars B' is arranged between the bar a' and the bar a^7 of the grate-frame. The other series of these rocking bars B^2 is arranged between the bar a^7 and the bar a^2 of the grate-frame. The rocking bars have journals at the ends. These journals fit in bearings formed in the upper edge of the bars of the grate-frame, whereby they are supported. The construction of these bearings may be clearly understood by reference to Fig. 7, as one is there shown with the grate-bar for which it is intended removed.

The bars $a' a^7 a^2$ of the grate-frame are provided with caps extending along them throughout their length and secured over the bearings for the trunnions of the rocking grate-bars by means of screws, bolts, or otherwise. In Fig. 5 I have shown a screw a^8 extending up through the bar a^7 between the trunnions of adjacent rocking grate-bars and engaging with a tapped hole in the cap, so that its thread or screw portion is protected from the fire. There may be any number of these screws a^8 .

It will be seen by reference to Fig. 1 that the rocking grate-bars B' are not in line with the rocking grate-bars B^2 , but that each series of these rocking grate-bars is arranged opposite the spaces between those of the other series. Owing to this the bar a^7 can be made very light, for obviously it need not be so wide as if it had to accommodate the trunnions of bars in line, and by this arrangement of the two series of grate-bars the ends come close together and a more thorough agitation of the fuel at the center of the grate is accomplished. The rocking grate-bars $B' B^2$ are shown as provided with removable leaves. The construction of these leaves and their combination with the rocking grate-bars proper I will explain fully hereinafter.

will be observed that the bar a^1 of the e-frame has a series of short teeth a^2 throughout that portion which is opposite the series of rocking grate-bars B^1 and a series of longer teeth a^{10} throughout that portion of length which is opposite the series of rocking grate-bars B^2 . It will also be noticed that bar a^4 of the grate-frame has a series of teeth a^{10} opposite the series of rocking grate-bars B^1 , and consequently opposite the series of short teeth a^2 of the bar a^3 of the e-frame. It is also apparent that the bar a^4 of the grate-frame throughout that portion of its length which is opposite the series B^2 of rocking grate-bars is provided with a series of short teeth a^9 . The teeth of the bars a^3 and a^4 are made in two series of different lengths, as I have just explained, in order that they may extend close to the adjacent rocking grate-bars B^1 and B^2 . To be more explicit, it is because the two series of rocking grate-bars are arranged out of line that the teeth of the bars a^3 and a^4 are of different lengths opposite the different series of rocking grate-bars.

I desire to remark that the two bars a^3 and a^4 are alike, and therefore may be made from the same pattern. This is manifestly an advantage.

Fig. 8 I have illustrated a modified construction for the end bars a^3 and a^4 . In this modification the teeth are formed integral with a plate a^{11} , made independently of the bar. The end bar is formed with a rabbet or recess a^{12} to receive this plate, and rivets or analogous devices passing through the plate and through the end bar of the e-frame secure the two together.

Fig. 9 I have shown that any of the bars forming the grate-frame may, if desired, have its surfaces furnished with teeth secured to their surfaces to fill up any space which may be around the outside of the grate-frame. In this figure a^{14} designates the plate, a^{15} one of the teeth, a^{16} one of a number of teeth of different length, and a^{17} a device—such, for instance, as a rivet—for securing the plate a^{14} to the bar of the grate-frame.

Figs. 6 and 7 I have shown that the end of the grate-frame may be provided with a device which can be slipped over the end bars and interlocked therewith. These figures show that I have made use on the end of the grate-frame of leaves extending outwardly toward the leaves of the rocking grate-bars, and also outwardly beyond the e-frame. It will be seen that the construction of the end bars of the grate-frame, as indicated in these figures, and of the portions of the leaves which engage therewith, is similar to the construction of the webs or portions of the rocking grate-bars and the portions of the leaves engaging with them.

The construction of the rocking grate-bars may be best understood by reference to the side views, Figs. 10 and 11. Each con-

sists of a bar b , provided at the ends with trunnions b^1 , flanges b^2 , adjacent to the trunnions, strengthening-ribs b^3 , b^4 , b^5 , and ribs b^7 , which serve not merely to strengthen the bar b , but constitute a means of securing a number of detachable leaves b^8 thereto. The particular details of trunnions, flanges, and ribs are not involved in my present improvement. This remark is also true of the particular construction of those portions of the leaves b^8 which interlock with the bars. Each of the leaves b^8 has an opening extending from the bottom upwardly. Such opening is in the main parallel-sided, but may have grooves or cavities, as I shall explain hereinafter. At the upper end of each opening it is expanded laterally, so as to be capable of fitting upon the ribs b^7 of the grate-bar proper.

It will be observed by reference to Figs. 1, 6, and 10, that the ribs b^7 of the bar b are interrupted at a certain point in each bar b for a distance approximately equal to the width of one of the leaves. Owing to this interruption each leaf b^8 can be dropped down over the bar b and then slid lengthwise thereof to engage with the ribs b^7 . Each of the bars b has combined with it a master-leaf b^9 , which is dropped over the bar at that portion where its ribs b^7 are interrupted after all of the leaves b^8 shall have been fitted into place. The master-leaf may be secured by a linchpin below the bar, it being longer than the bar is thick, so that its lower ends extend below the bar. The sides of the bars upon which the leaves fit are shown as provided with grooves g . These grooves are represented as extending lengthwise of the bars. They are shown as intersected by holes h , extending directly through the bars. These features of construction may best be understood by reference to Figs. 10 and 11. The sides of the openings in the leaves may also be provided with grooves g' . These grooves g' may be employed in addition to the grooves g , or instead of the latter. The grooves and holes g and h are advantageous, in that they afford provision for the circulation of air. This is a desideratum, because it enables the parts to remain cooler than otherwise would be possible. It will be seen that the leaves are provided with holes h' , extending transversely through them. These afford additional provision for the circulation of air. By making the leaves separate from the bars upon which they fit the forming of holes in the leaves is rendered practicable. Not only are the grooves and holes g , g' , h and the holes h' advantageous, because they afford provision for the circulation of air; but they are desirable, because they lighten the grate-bars and cheapen them.

I have shown at the right-hand portion of Fig. 10 that the leaves may be so constructed as to be provided with spacing-pieces at one side only. This may be found advantageous in the casting. It will be observed that the leaves are at their end or side surfaces convex

at all points, and are of peculiar shape. Their upper surfaces are approximately flat, and their opposite side or end portions are curved outwardly in such manner that the distance from the center of the trunnion to the periphery or outer side is greater on a longitudinal line than it is from the trunnion-center to any point on the curve above the longitudinal line when the leaf is in its normal position. The top and end surfaces are transversely corrugated or ribbed, the depressions between the ribs being concave or rounded in cross-section, so that large clinkers may be carried in them. The shape of the top and side surfaces of the leaves is such with respect to the trunnions b' of the grate-bars that whenever the grate-bars are rocked the space between the sides or adjacent portions of opposite leaves will be reduced instead of enlarged. This feature, particularly when associated with the other feature of construction consisting in corrugations, will serve to break up clinkers and the like between opposite leaves, so that when the grate-bars resume their normal positions and the spaces between opposite leaves are again enlarged the disintegrated clinkers or like substances will fall through. This feature may, perhaps, be best understood by reference to Fig. 12.

In Fig. 11 I have shown the leaves as projecting equally beyond the two sides of the grate-bars upon which they are fitted, whereas in Fig. 12 I have shown the leaves as extending a slight distance from one side but a very considerable distance from the other side of the grate-bar. The rocking grate-bars of each series are provided at or near one end with downwardly-extending arms b^{10} . These arms are pivotally connected at the lower end to a rod D, extending horizontally below the grate-frame, as here represented. The pivotal connection may be made by providing the rod D with integral lugs of cylindrical shape d' , and providing the lower extremities of the arms b^{10} with cylindrical holes adapted to fit the lugs d' . Certain of the lugs d' —as, for instance, those nearest the ends of the rod D—may have linchpins or other cross-pins passed through them near their ends and beyond the adjacent arms b^{10} . The rod D is shown as provided with a downward extension, which is connected by a cross-pin with the head e of a rod E. The rod E extends to a lever F, whereby motion may be imparted through said rod and the rod D to the rocking grate-bars. The rod E is shown as having an adjustable connection with its head e , so as to provide for shortening or lengthening the connection between the lever F and the rod D. The lever F is shown as fulcrumed to a fulcrum-piece or bracket G. This lever is shown as an angular or elbow lever; but it may be of other styles. The fulcrum-piece may be secured to a front plate H, where the furnace is provided with one. I have thus illustrated it in Figs. 1 and 2. Where there is no front plate the fulcrum-piece may be se-

cured to one of the end bars of the grate-frame, as illustrated in Fig. 3. Then it will extend through the wall of masonry, which is at the front of that part of the grate-frame.

The fulcrum-piece G is shown as of bifurcate form at the outer extremity to receive the lever F, the latter being secured in place by a transverse pin forming the fulcrum. The back of the opening between the bifurcate portions of the fulcrum-piece is shown as inclined; but this feature is immaterial.

I designate a key or wedge, which may be slipped into the bifurcate portion of the fulcrum-piece to limit the oscillations of the lever. This wedge may be best understood by reference to Fig. 4, where it will appear that it has upon that edge which is intended to fit against the back of the opening in the bifurcate portion of the fulcrum-piece two ribs $i' i^2$, terminating at the upper end in flanges i^3 . The ribs $i' i^2$ fit in grooves $g^2 g^3$ in the fulcrum-piece. The flanges i^3 rest upon the tops of the grooved portions of the fulcrum-piece and prevent the wedge from falling through the fulcrum-piece. A chain I' is shown as extending between the upper end of the wedge and the fulcrum-piece, so as to connect the wedge and obviate any possibility of its loss. The front or outer faces of the wedge are inclined and permit of the oscillation of the lever F far enough to enable it to rock the grate-bars sufficiently to shake the fire upon them. Whenever it is desired to dump the fire, the wedge may be removed from its place and the lever F can then be oscillated sufficiently far to rock the grate-bars enough to dump the fire.

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

1. In a grate, the combination, with a frame consisting of side bars, end bars, and a light bar running lengthwise midway between the side bars, the said side bars and light bar having trunnion-bearings, of two series of rocking grate-bars arranged so that the inner trunnions of those constituting one series will operate in bearings of the light bar between the inner trunnions of those constituting the other series, and the said end bars being provided opposite each series of grate-bars one with short teeth and one with long teeth, the said end bars being duplicates of each other, substantially as specified.

2. The combination of rocking grate-bars having the upper surfaces of their removable leaves flat and the end portions of said leaves curved outwardly and presenting a less distance from the center of the trunnion to the periphery of a leaf on a horizontal line, when the leaf is in its normal position, than from the center of the trunnion to any point on the curve above the horizontal line, whereby the space between leaves of opposite grate-bars will be reduced when the bars are rocked, substantially as specified.

3. The combination of rocking grate-bars comprising leaves having their upper surfaces

and the end portions corrugated, the said end portions being curved outwardly and having a less distance from the trunnion center to the periphery on a horizontal line, when in a normal position, than from the center of the trunnion to any point above the horizontal line, whereby the space between leaves of opposite grate-bars will be reduced when the bars are rocked, substantially as specified.

4. The combination of rocking grate-bars, a rod connected thereto, a lever for imparting motion to said rod, a fulcrum-piece having a bifurcated end and grooved sides, and a wedge having side ribs and flanges engaging with the fulcrum-piece, substantially as specified.

5. The combination of rocking grate-bars having leaves, means for simultaneously rocking the bars, the ribbed end edges of the leaves on the grate-bars being convex at all points and having a less distance from the trunnion-center to the periphery on a horizontal line, when in a normal position, than from the center of the trunnion to any point above the horizontal line, whereby the space between

leaves of opposite grate-bars will be reduced when the bars are rocked, substantially as specified.

6. The combination of grate-bars and attachable leaves constructed one with grooves on the surfaces adjacent to the other, and holes through the bar intersecting the grooves, substantially as specified.

7. The combination, with grate-bars provided with grooves in their sides or webs and holes extending through them and intersecting the grooves, of detachable leaves, substantially as specified.

8. The combination, with a grate-frame and grate-bars having two series of leaves of different projection, of two series of leaves of different projection extending from the end bars of the frame, the said leaves being independently and detachably secured to said end bars, substantially as specified.

WILLIAM E. KELLY.

Witnesses:

C. S. ATKINSON,

C. BONTECOU SMITH.

It is hereby certified that in Letters Patent No. 450,315, granted April 14, 1891, upon the application of William E. Kelly, of New Brunswick, New Jersey, for an improvement in "Grates," an error appears in the printed specification requiring correction, as follows: In lines 50-51, page 1, the word "continuous" should read *contiguous*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 28th day of April, A. D. 1891.

[SEAL.]

CYRUS BUSSEY,
Assistant Secretary of the Interior.

Countersigned:

C. E. MITCHELL,
Commissioner of Patents.