

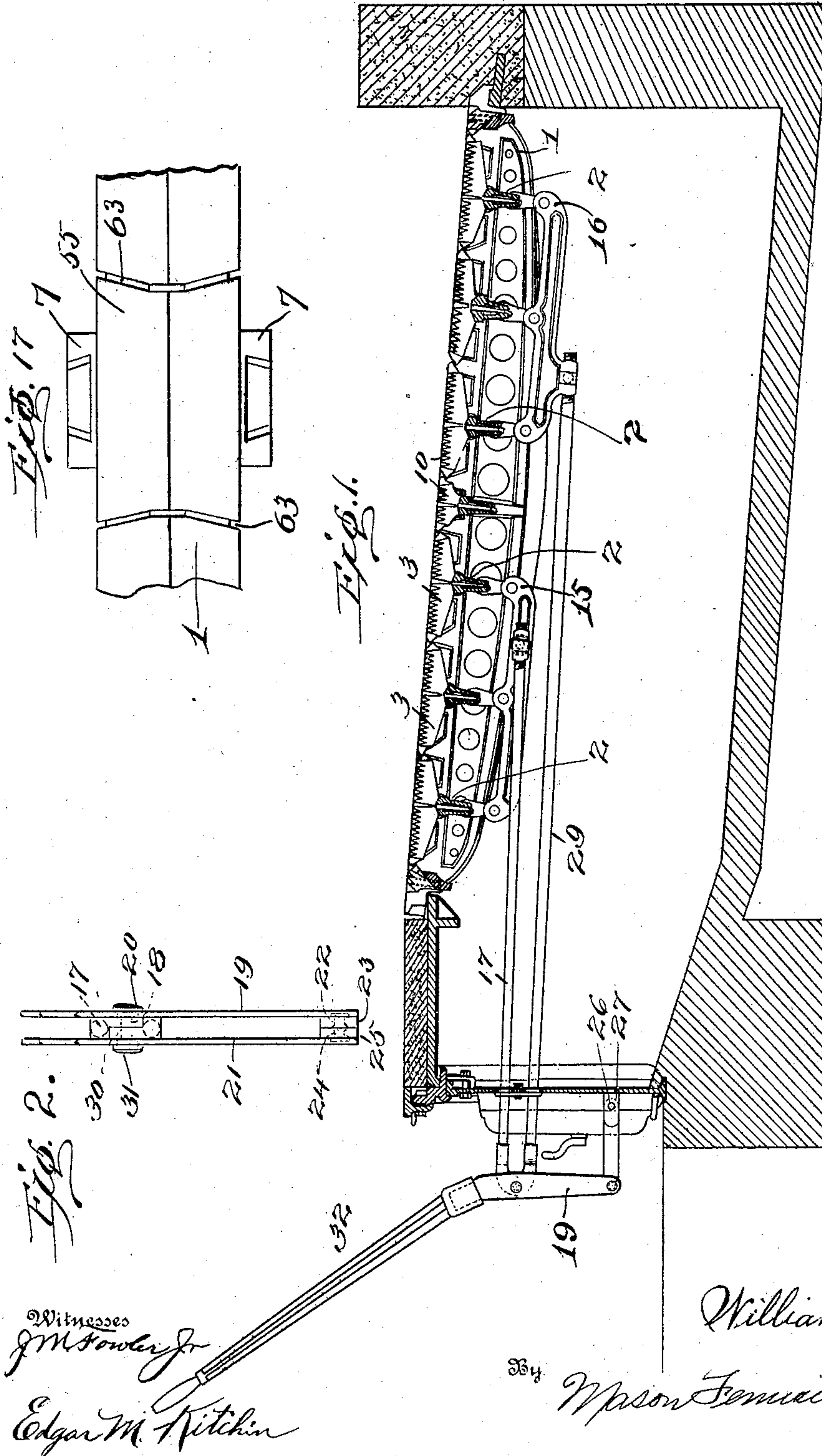
No. 865,929.

PATENTED SEPT. 10, 1907.

W. McCLAVE.  
GRATE.

APPLICATION FILED SEPT. 9, 1906.

5 SHEETS—SHEET 1.



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By

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Witnesses

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No. 865,929.

PATENTED SEPT. 10, 1907.

W. McCLAVE.

GRATE.

APPLICATION FILED SEPT. 6, 1906.

5 SHEETS—SHEET 2.

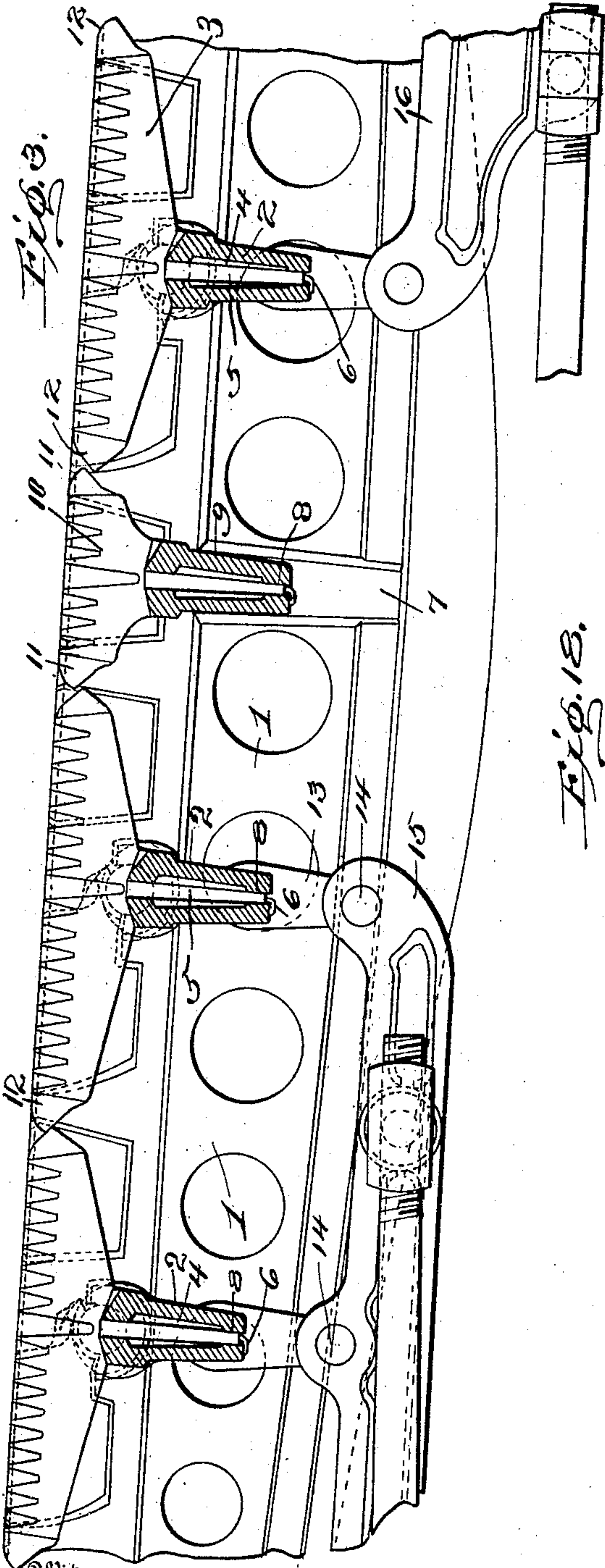


Fig. 3.

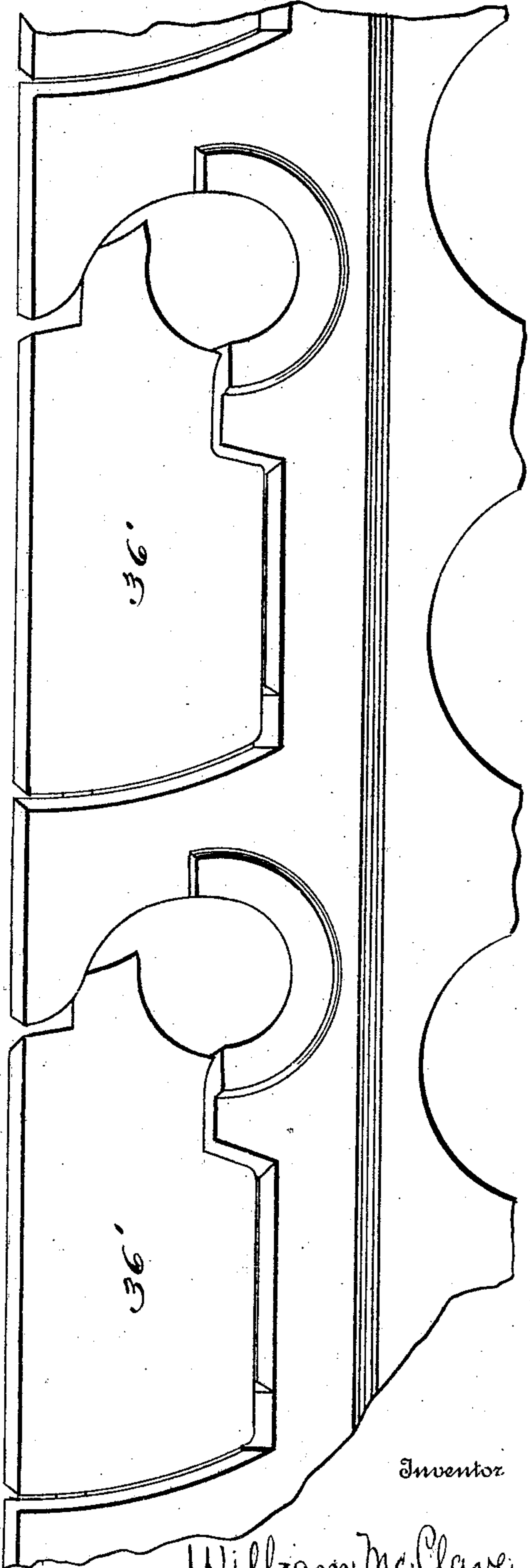


Fig. 18.

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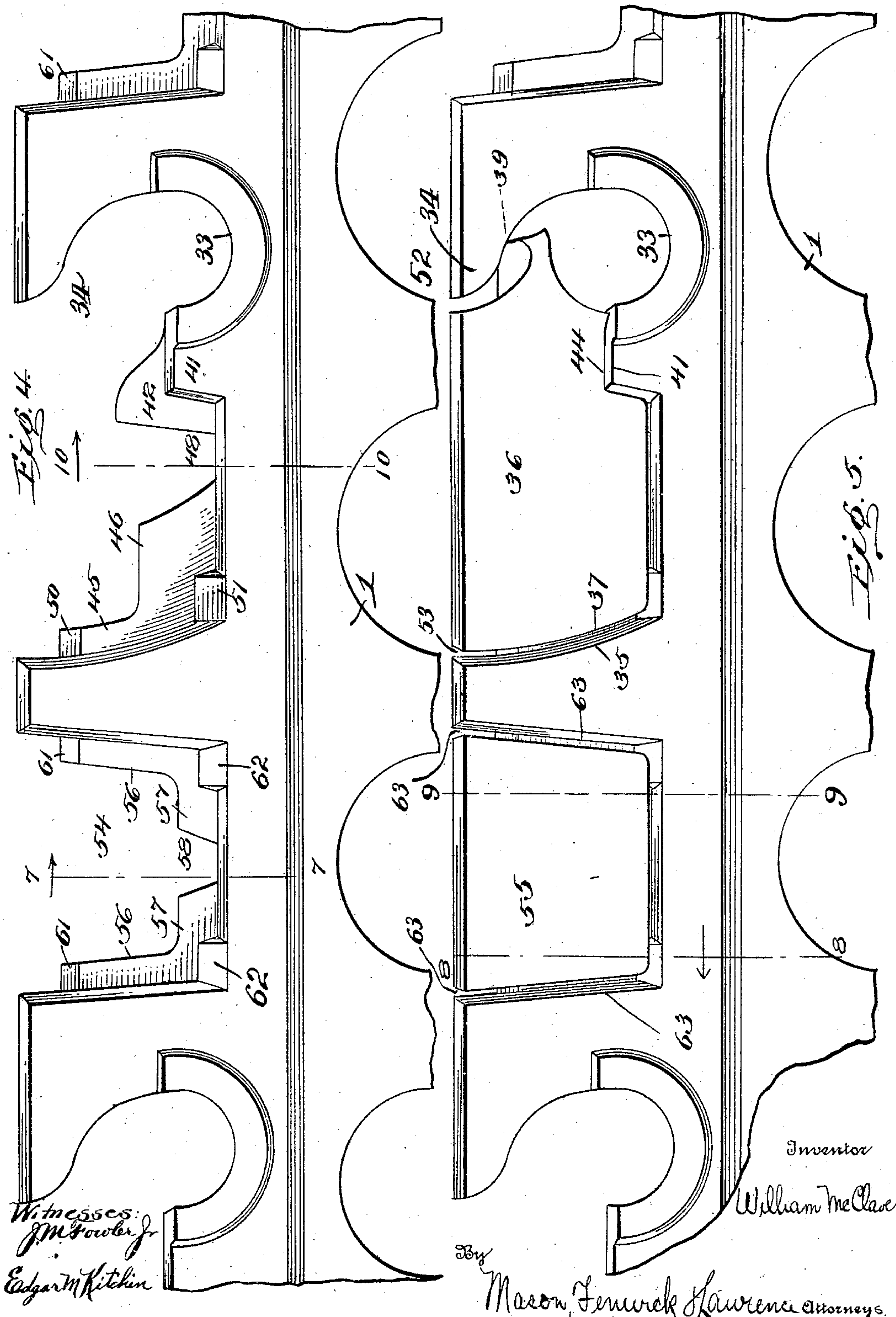
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APPLICATION FILED SEPT. 6, 1906.

5 SHEETS—SHEET 3.



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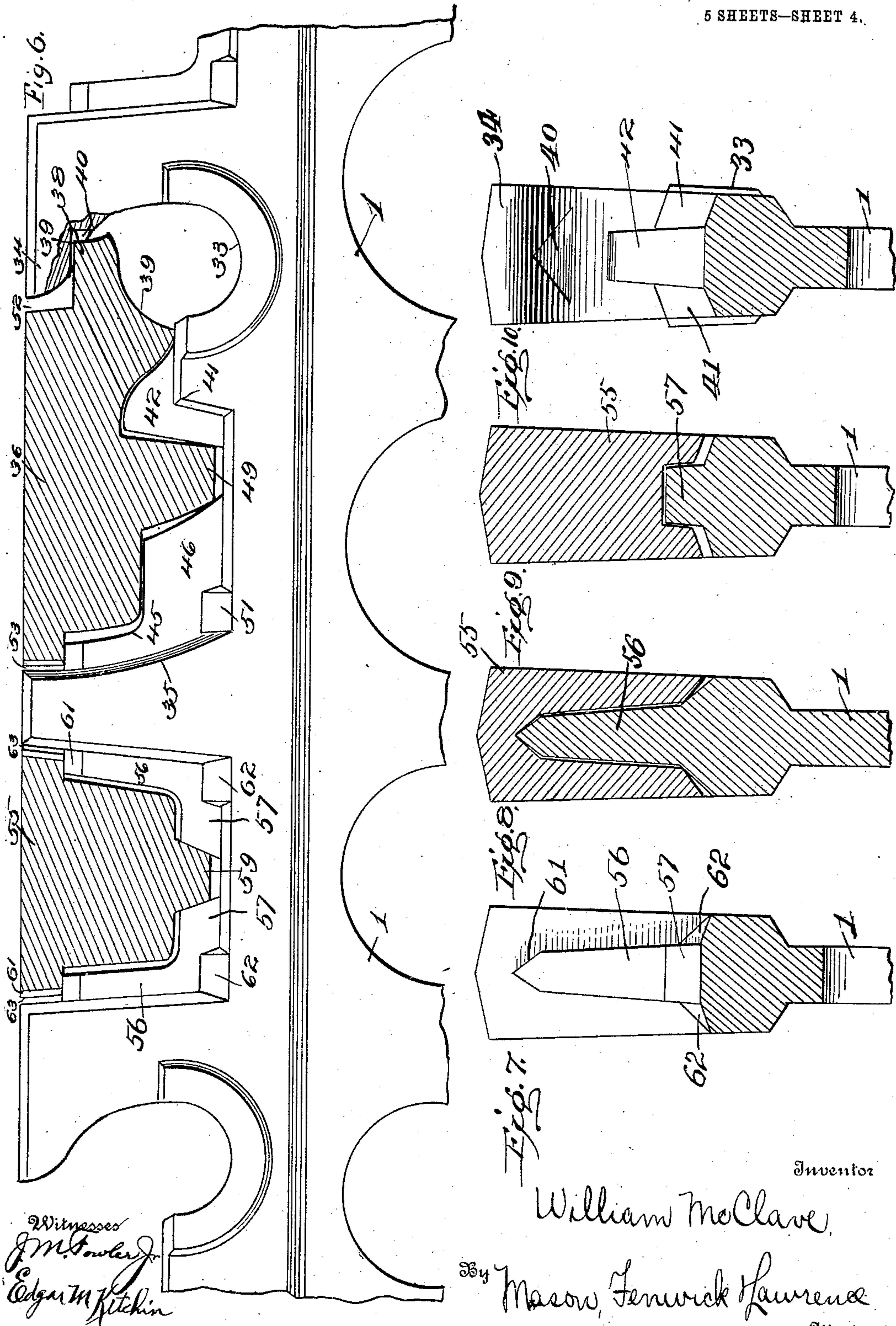
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APPLICATION FILED SEPT. 6, 1906.

5 SHEETS—SHEET 4.



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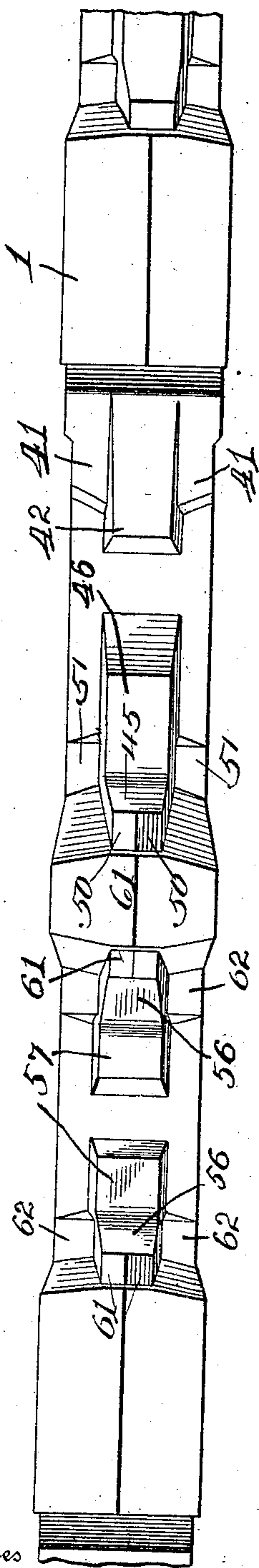
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GRATE.

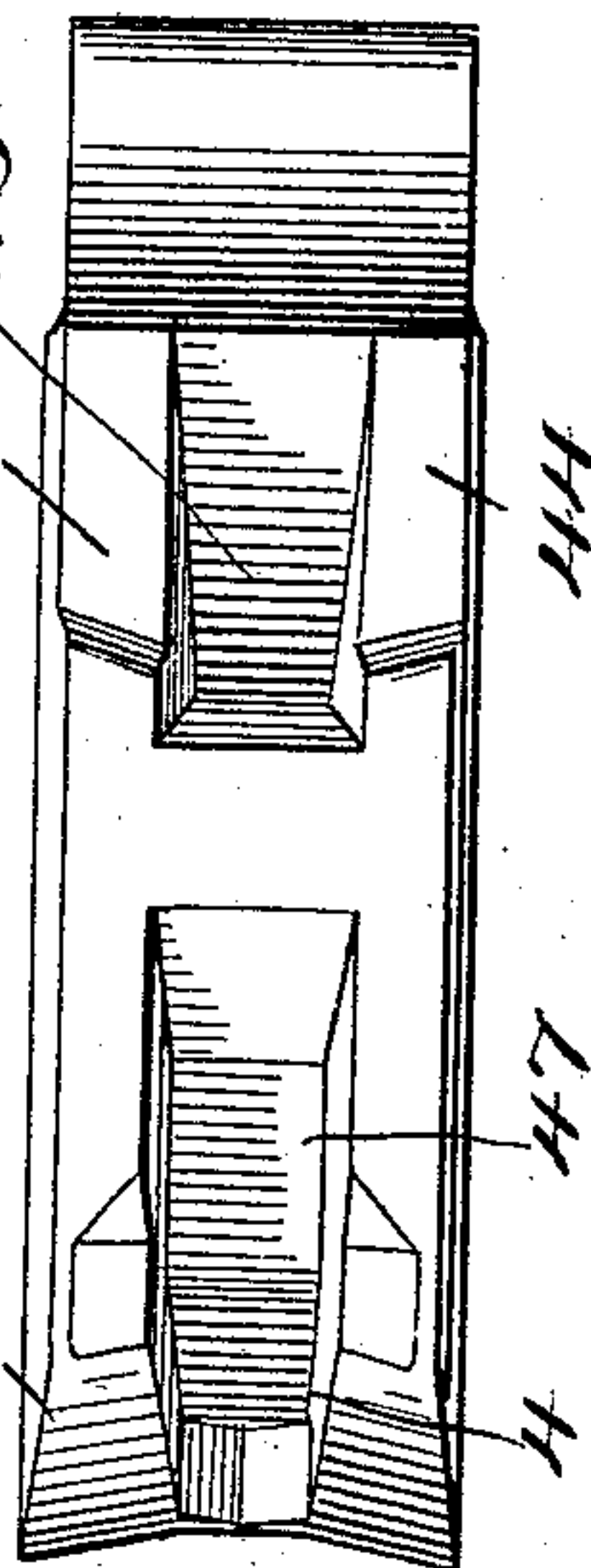
APPLICATION FILED SEPT. 6, 1906.

5 SHEETS—SHEET 5.

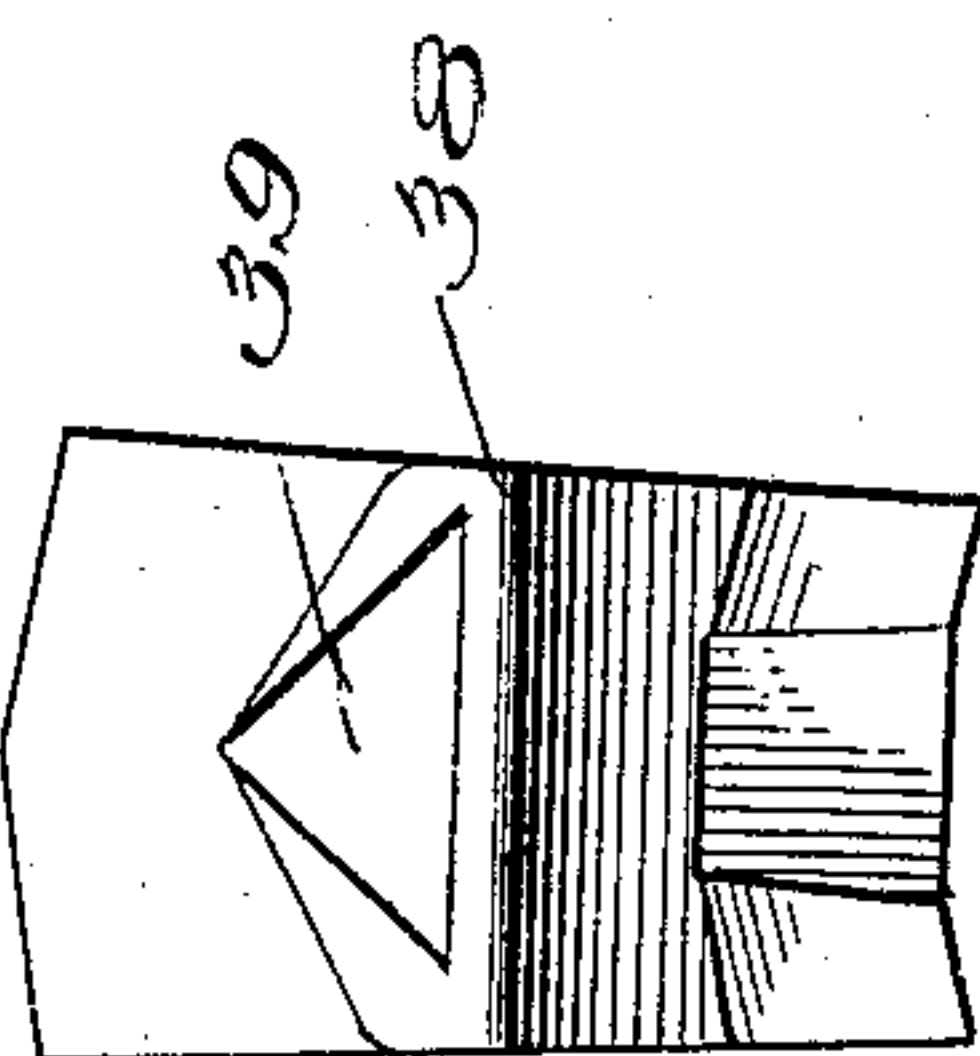
*Fig. 11.*



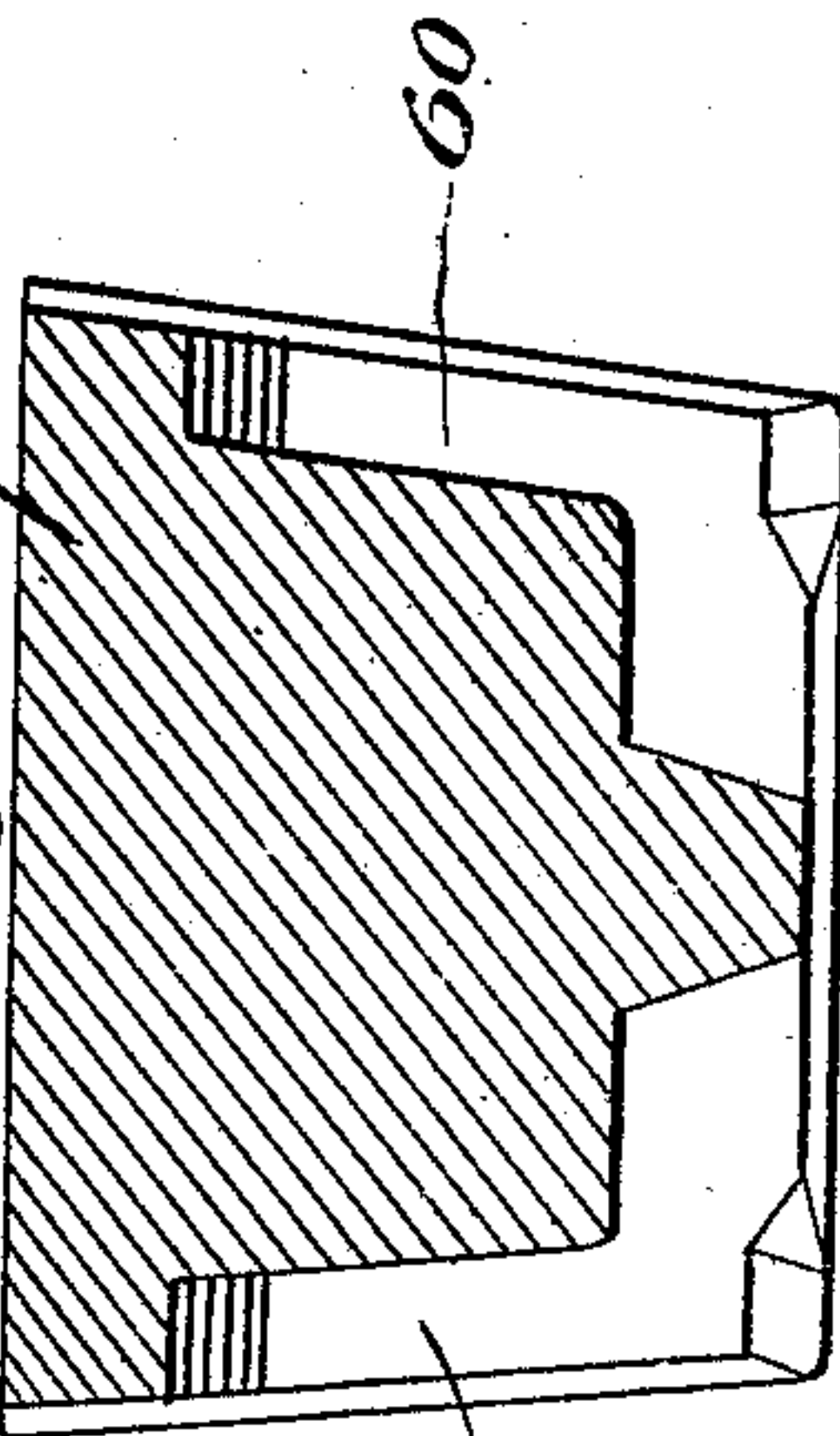
*Fig. 13.*



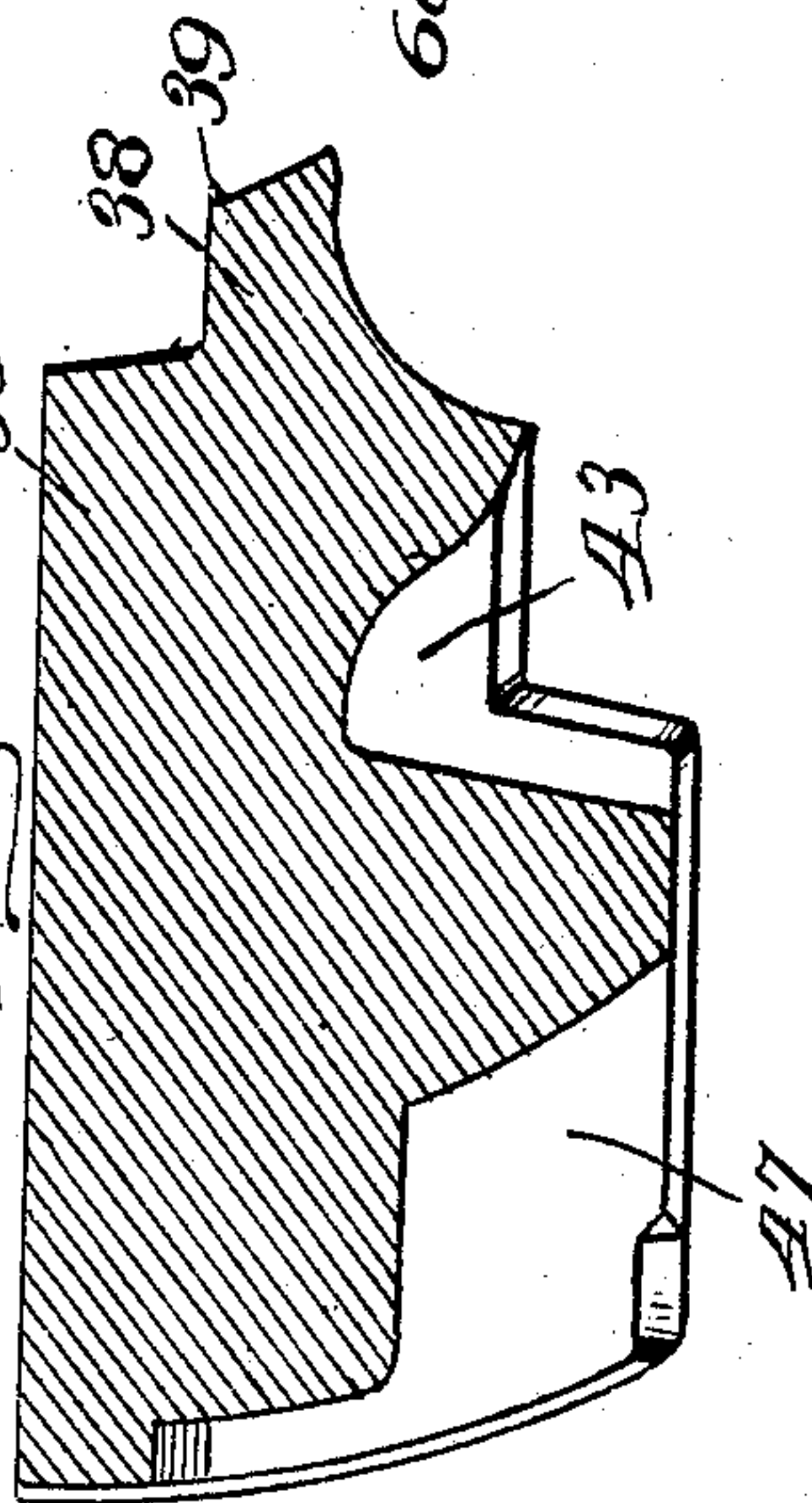
*Fig. 12.*



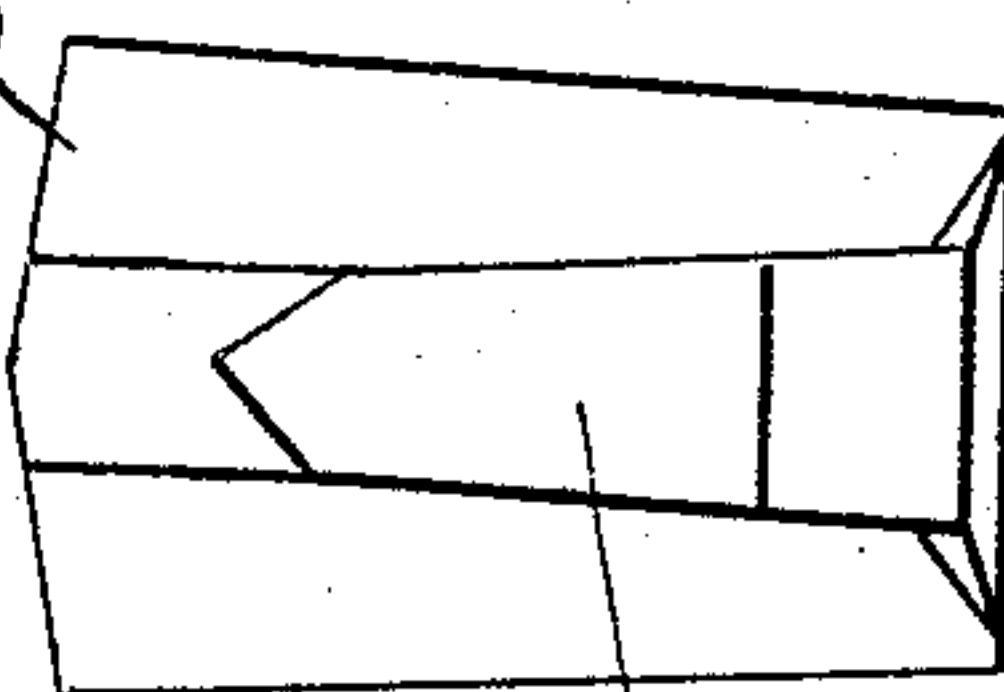
*Fig. 16.*



*Fig. 14.*



*Fig. 15.*



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# UNITED STATES PATENT OFFICE.

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## GRATE.

No. 865,929.

Specification of Letters Patent.

Patented Sept. 10, 1907.

Application filed September 6, 1906. Serial No. 333,484.

*To all whom it may concern:*

Be it known that I, WILLIAM McCLAVE, a citizen of the United States, residing at Scranton, in the county of Lackawanna and State of Pennsylvania, have invented certain new and useful Improvements in Grates; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

10 In the accompanying drawings,—Figure 1 is a longitudinal vertical section taken through a grate embodying the features of the present invention. Fig. 2 is a detail edge view of the independent stub levers. Fig. 3 is a section similar to Fig. 1 of a fragment of the grate structure illustrated on an enlarged scale. Fig. 4 is a view in side elevation of a fragment of the grate journal bearing bar, the lower portion of the bar being broken away for the saving of space, and the expansion cap, and the expansion and locking cap being omitted. Fig. 5 is a similar view of the same with the expansion cap and expansion and locking cap illustrated in position. Fig. 6 is a similar view of the same, the expansion cap and expansion and locking cap being illustrated in section. Fig. 7 is a transverse vertical section taken on the plane indicated by line 7, 7 of Fig. 4, and looking in the direction indicated by the arrow. Fig. 8 is a similar section taken on the plane indicated by line 8, 8 of Fig. 5, and looking in the direction indicated by the arrow. Fig. 9 is a similar section taken on the plane indicated by line 9, 9 of Fig. 5. Fig. 10 is a similar section taken on the plane indicated by line 10, 10 of Fig. 4, and looking in the direction indicated by the arrow. Fig. 11 is a top plan view of the structure seen in Fig. 4. Fig. 12 is a view in end elevation of one of the expansion and locking caps. Fig. 13 is an inverted plan view of the same. Fig. 14 is a longitudinal central vertical section through the same. Fig. 15 is an edge view of one of the expansion caps. Fig. 16 is a longitudinal vertical central section thereof. Fig. 17 is a view similar to Fig. 11 of the central portion of the bearing bar illustrating the slotted pads for the reception of the rigid central grate bar. Fig. 18 is a view similar to Fig. 5 of a modified form of grate journal bearing bar.

45 In carrying out the present invention I provide as many of the journal bearing bars 1 as are necessary, the number provided depending of course upon the size of the grate, and each of said bars is provided with journal bearings for the journal ends of the grate bars 2, 2.

50 The fire bed or grate surface is made up of caps 3, 3, which are removably carried by the bars 2, each of the bars 2 being preferably formed with a suitable longitudinal central opening 4 into which the depending shank 5 of the respective cap 3 extends, the shank 55 being preferably provided with a retaining pin 6 pro-

jecting below the lower edge of the given bar 2 and bent into engagement with the lower edge of the bar for preventing accidental displacement of the cap 3.

Each of the bearing bars 1 is provided centrally with laterally projecting enlarged portions or projections 7, each formed with a dove-tail or under-cut vertical slot 8, into which are dropped the under cut beads at the ends of the central grate bar 9. The grate bar 9 is supported by the engagement with the pads 7, and is therefore held rigid and immovable. 60 65

The bar 9 carries a cap 10 similar in construction and arrangement to the caps 3, but preferably differing therefrom in size, the cap 10 being by preference approximately one-half the size of one of the caps 3. It is to be noted of course that the bar 9 is arranged centrally of the entire grate and the cap 10 divides the grate into two grate sections. 70

The cap 10 is formed at its edges with laterally projecting teeth 11, 11. Each of the caps 3 is provided with similar teeth 12, 12. By preference, the teeth 11 of the cap 10 overhang the teeth 12 of the contiguous caps 3 and the teeth at the rear edge of the cap 3 in the rear of cap 10 overhang the front teeth 12 of the next succeeding cap 3, and the teeth 12 at the front edge of the cap 3 in front of cap 10 overhang the teeth at the rear edge of the next preceding cap 3. Thus the caps 3 in front of the cap 10 may be dumped rearwardly without contact of the teeth 12 of the respective caps, but if it is undertaken to dump the forward caps 3 forwardly, the teeth 12 of one cap will engage the teeth of the next preceding and so on for the full set of caps, and thus prevent forward dumping of that section of the grate in front of the cap 10. The opposite action of the caps in the rear of the cap 10 will be found true, that is to say the caps in the rear of the cap 10 are free to dump forwardly, but are locked against dumping rearwardly by the overlapping of the teeth 12. 75 80 85 90

Each of the grate bars 2 is provided with a depending arm 13 provided with a wrist pin 14. The wrist pins 14 of all of the arms 13 carried by the grate bars 2 in front of the bar 9 are connected by an actuating link 15, and the wrist pins of the arms of the bars 2 in the rear of the bar 9 are all connected by a similar link 16. An actuating bar 17 engages the link 15 and extends forwardly therefrom to a point beyond the door of the ash pit and the front end of the bar 17 is preferably flattened and curved downwardly as at 18 to a point contiguous to a stub lever 19. A pin 20 is passed through the lever 19 and through the flattened end 18 and has its inner end formed with a head countersunk into the flattened portion 18. A similar stub lever 21 is arranged contiguous to the lever 19. A pin 22 is passed through the lower end of the lever 19 and through a supporting link 23 therefor, the inner end of the pin 22 being provided with a head countersunk into the link 23. A simi- 100 105 110



lar pin 24 is passed through the lever 21 and through a link 25, and is provided with a head countersunk into the head 25. The links 23 and 25 are of a thickness equal approximately to the thickness of the flattened portion 18, and the said links are arranged between the two levers 19 and 21, and have their rear ends pivotally supported by a pin 26 carried by a block 27 fixed to the front of the furnace. A bar 29 engages the link 16 and extends forwardly and is provided with a flattened portion 30, similar in construction and arrangement to the flattened portion 18 and interposed between the flattened portion 18 and the lever 21. A pin 31 is passed through the lever 21 and through the said flattened portion 30 and is provided with a head countersunk into said flattened portion 30. It is observed of course that the front end of the rod 29 at the point of the flattened portion 30 is bent upwardly while the rod 17 at the point of the flattened portion 18 is bent downwardly, so that the pins 20 and 31 are in axial alinement although the rods 17 and 29 are spaced apart vertically. In practice I preferably provide an operating lever 32 formed with a socket at its lower end adapted to engage the upper end of one of the stub levers 19 or 21 for facilitating actuation of the respective rod 17 or 29 for dumping the sections of the grate connected with the given rod.

It is to be observed that as the grate is divided into two sections one in the front and one in the rear of the cap 10, which sections dump in opposite directions, it is only necessary to provide one handle 32 which may be applied to the stub levers 19 and 21, independently and at different times, as it would not be desirable to move one of the stub levers in one direction at the same time the other stub lever is moving in the other direction.

It is to be observed that each of the caps 3 is not disposed centrally with respect to the bars 2, but in each instance a larger portion of the cap extends on one side of the bar than on the other and therefore the cap is overbalanced in one direction, and in each instance the overbalancing occurs on that side on which the teeth 12 overlap the teeth of the next succeeding bar, so that the caps are self-stopping and are not liable to be dumped accidentally.

Each of the journal bearing bars 1 is of special construction and the specific construction thereof is considered one of the essential features of the present invention. It is of course well known to those skilled in the present art that warping and deterioration occurs in the journal bearing bar if the bar is so positioned as to have the full line of its upper edge exposed to the intense heat of the lower surface of the fire on the grate, and various means have been provided for obviating the exposure of the upper edge of the journal bearing bar to the heat, and among the solutions of the problem is that found in my own prior patent No. 529,291, in which are seen removable sections arranged along the upper edge of the journal bearing bar, some of said sections serving to retain the journals in position against vertical displacement, but in the said patented structure it is found necessary to employ key plugs, which I propose to entirely eliminate from the present construction.

Each of the journal bearing bars 1 is provided with as many journal bearings 33 as there are grate bars 2,

the journal of the respective end of the grate bar resting normally on the respective bearing 33. The bearing 33 is of course positioned at a suitable point beneath the upper edge of the journal bearing bar, and a portion of the journal bearing bar overhangs the journal 33 as at 34, the overhanging portion 34 in operation forming a part of the locking means for preventing upward displacement of the journal of the grate bar. Beyond the overhanging portion 34 the grate bar is cut away for a relatively great distance and to a depth slightly less than the lowest point of the journal bearing 33. At the end of the cut away portion the wall of the bearing bar is preferably struck on the arc of a circle as at 35, and an expansion and locking cap 36 is positioned for substantially filling the cut away portion. The cap 36 is preferably provided with a curved end 37 corresponding to the curve 35 and the forward end of the cap 36 is provided with a projecting nose 38, which is formed with a curved under surface 39 designed, when the cap 36 is in position to be substantially continuous of the curve of the bearing 33. The nose 38 is formed at its free end with an upwardly and forwardly extending polyhedral angular projection or lug 39' adapted in operation to project into a suitable recess 40 formed in the under face of the overhanging portion 34. The base of the cut away portion in front of each bearing 33 is of varying depths at one point being formed into a shoulder 41, the said shoulder carrying an upwardly and forwardly projecting web 42, which web in practice is designed to enter a recess 43 formed in the expansion and locking cap 36, the said expansion and locking cap being cut away as at 44, 44 for adapting the cap to fit loosely over the shoulder 41 as clearly seen in Fig. 5.

Projecting rearwardly from the curved wall 35 is a web 45 which is comparatively narrow at its upper end and is provided with a widened portion 46 at its base. The expansion and locking cap 36 is formed with a suitable recess 47 for receiving the web 45 with its widened portion 46. The widened portion 46 terminates at a relatively short distance from the front edge of the web 42 leaving a space 48 therebetween, which recess in practice is filled by the material 49 of the expansion and locking cap 36 occurring between the recess 43 and the recess 47. The upper end of the web 45 is beveled in opposite directions from the center as at 50, and at the lower end of the web 45 are arranged fillets 51, 51 on opposite sides, which are of triangular transverse section so that any fine ashes which may fall upon the beveled portion 50 will be caused to fall away from the bearing bar by coming in contact with the beveled faces of the fillets 51 after falling from the beveled portion 50.

The expansion and locking cap 36 is shorter and preferably smaller in every direction, except thickness, than the cut away portion of the bearing bar in which it is positioned. Thus when the said cap 36 is in position there is left a space 52 at the rear end between the cap and overhanging portion 44 and a similar space 53 at the front end, so that ample room for growth is provided. It is of course well known to all skilled in the art that wherever metal is subjected to continuous high temperature its molecules will not only separate but will be maintained in their separated condition for such length of time as will cause their angular faces to become deranged, and therefore said



molecules will not be able to reassume their compact form, resulting in the enlarged condition of the entire mass which enlargement is ordinarily termed growth. This growth is thus accommodated in the cap 36 and at the same time by reason of the webs 42 and 45, the said cap is retained against lateral or longitudinal displacement. The weight of the forward end of the cap 36 will prevent vertical displacement of such end, and the rear end of the cap is positively held against vertical displacement by the engagement of the lug 39 with the recess 40 of the overhanging portion 34. However, when it is desired to remove the cap 36 no difficulty is experienced in this operation, as it is only necessary to grasp the forward end of the cap and swing it upwardly with a pivotal movement until the lug 39 leaves the recess 40, and then the cap may be readily bodily removed. The formation of the wall 35 on the arc of a circle and the corresponding formation of the front end of the cap 36 insures the ready removal of the cap even though considerable growth may occur, and the spaces 52 and 53 be more or less filled.

In practice it is found that it is best when constructing comparatively large grates not to have the caps 36 of sufficient length to extend from one journal bearing 33 to the next succeeding journal bearing as the length of the cap would be too great for the spaces 52 and 53 to accommodate the amount of growth which may occur. Therefore as a matter of convenience, the expansion and locking caps 36 may be made shorter than the entire distance named, and a part of the remaining portion of the upper edge of the bearing bar may be cut away as indicated at 54, and the said cut away portion is preferably filled by an expansion cap 55. A web 56 extends from each vertical wall of the cut away portion 54 inwardly, and is provided with a foot portion 57, the ends of the foot portions 57 being spaced apart as at 58. In practice the upper part of the space 58 is filled by the material 59 of the cap 55 occurring between recesses 60, 60 formed in said cap for accommodating the webs 56 and their foot portions 57. The upper end of each of the webs 56 is beveled in opposite directions from the center as at 61, 61 for shedding the fine ashes which may strike the same, and fillets 62, 62 similar to the fillets 51 are arranged at the sides of the base of each web 56 for the same purpose. It is to be noted that the cap 55 tapers downwardly and is of less size in substantially every direction, except thickness, than the cut away portion 54 so that openings 63, 63 are left at the edges of the cap 55 for accommodating expansion and growth, and said openings 63 are smallest at their upper ends and increase in size toward their lower ends so that any ashes falling into the upper ends of the openings 63 will readily pass out the lower ends. The cap 55 at the same time is firmly held against lateral and longitudinal movement by its engagement with the webs 56. Thus it will be seen that when the bearings 33 are so far spaced apart that it would be a disadvantage to extend the caps 36 from one bearing to a point contiguous to another, it is only necessary to interpose one of the caps 55, or if a greater distance is required than can be accommodated by one cap 55, a second cap 55 or as many more may be employed as are required. It is however obvious that in those instances where the bearings 33 are sufficiently near, it will be unnecessary to interpose a cap 55 and such

construction is indicated in Fig. 18, in which the expansion and locking caps 36' are shown arranged in succession and constructed in every particular like the caps 36. Thus it will be seen that only comparatively small portions of the bearing bar itself is exposed to the action of the heat, and the portions which are exposed are so small as not to transmit a sufficient amount of heat to the main portion of the bearing bar as to injure the said bar. It is also to be noticed that no wedges or key plugs of any kind are employed and that the journals are effectually prevented from moving vertically by the overhanging portions or noses of the locking and expansion caps 36, the lifting movement of the journals into contact with said nose or overhanging portions tending to increase the locking effect.

What I claim is,—

1. In a grate structure, the combination with journal grate bars, of caps therefor, each having a greater amount of its weight on one side of the bar than on the other, teeth projecting from the edges of said caps, the teeth on the overbalanced side of each cap overlapping teeth of the opposite side of the next preceding cap and engaging the same for having the underlapping teeth serve as supports for the overlapping teeth, and means for oscillating the grate bars.
2. In a grate structure, the combination with sets of journal grate bars, grate caps for all of said bars, all of said caps being provided with teeth on opposite edges and the caps of one set being overbalanced at one side in one direction and the caps of the other set being overbalanced at the other side in the other direction, the teeth of the edge of the overbalanced side of each cap overlapping the teeth of the cap of the next contiguous grate bar for being supported thereby, whereby the caps of one of said sets of journal grate bars may be tilted only in one direction, the caps of the other set may be tilted only in the opposite direction, the respective sets being spaced apart for permitting such opposite tilting, independent operating rod connected with the respective sets of grate bars, a pivotally mounted stub lever pivotally engaged by one of said rods, a removable lever designed to be applied to said stub lever for actuating the same, and an independent pivotally mounted stub lever arranged parallel to the first-mentioned lever and pivotally engaged by the other of said actuating rods, said last-mentioned independent stub lever being adapted to be independently engaged by the removable lever for being actuated in an opposite direction from the actuation of the first-mentioned stub lever.
3. In a grate structure the combination with a journal bearing bar having a journal bearing and an opening leading therefrom to the edge of the bearing bar, of an expansion and locking cap arranged for closing said opening and having a preponderance of its bulk extending to one side of the journal, such preponderating bulk being retained in position against vertical displacement by gravity.
4. In a grate structure, the combination with a journal bearing bar having a journal bearing and an opening leading therefrom to the edge of the bearing bar and a grate bar journal resting on said bearing, of a cap for closing said opening, one end of said cap being retained by gravity against vertical movement, the journal bearing bar being formed with an overhanging portion projecting from the opposite side of said opening to that occupied by the gravity retained end of said cap and overhanging a portion of the cap for preventing upward movement of the journal.
5. In a grate structure, the combination with a journal bearing bar having a journal bearing and an opening leading therefrom to the edge of the bar and a grate bar journal resting on said bearing, of a cap for closing said opening, retained by gravity at one end against vertical movement, and means arranged on the opposite side of the opening to that occupied by the gravity retained end of said cap overhanging the journal for locking the op-



posite end of said cap for preventing upward movement of the journal.

6. In a grate structure, the combination with a journal bearing bar having a journal bearing and an opening leading therefrom to the edge of the bar and a grate bar journal resting on said bearing, of a cap for closing said opening retained at one end against vertical movement by gravity, and means formed integral with the bar projecting from the opposite side of the opening to that occupied by the gravity retained end of said cap and overhanging the other end of the cap for locking the same for preventing upward movement of the journal.

7. In a grate bar structure, the combination with a journal bearing bar having a journal bearing and an opening leading therefrom to the edge of the bar, a portion of the bar being cut away at one side of said opening, and the material of the bar at the opposite side of the opening being formed with a recess, of a cap arranged for closing said opening and extending into the space of the cut away portion beyond the opening in such manner as to be locked for preventing upward movement of a journal on said bearing, a portion of the cap projecting into the said recess.

8. In a grate structure, the combination with a journal bearing bar having a journal bearing and an opening leading therefrom to the edge of the bar, the material of the bar being cut away at one side of the opening, of a cap loosely filling the cut away portion and closing said opening, and locking means formed integral with the bar at the side of said opening opposite the cut-away portion and overhanging a portion of said cap.

9. In a grate structure, the combination with a journal bearing bar having a journal bearing and an opening leading therefrom to the edge of the bar, of a cap lying across said opening and projecting to one side thereof, and means on the opposite side of the opening for locking the cap for preventing upward movement of a journal resting on said bearing.

10. In a grate structure, the combination with a journal bearing bar having a journal bearing and an opening leading therefrom to the edge of the bar, the material of the bar being cut away at one side of said opening, of an expansion and locking cap loosely filling the space of the cut away portion and having one end overhanging the journal bearing, means for locking said overhanging end for preventing upward movement of a journal resting on said bearing, and means for preventing lateral displacement of the cap.

11. In a grate structure, the combination with a journal bearing bar having a journal bearing and an opening leading therefrom to the edge of the bar, the material of the bar being cut away at one side of said opening, of an expansion and locking cap loosely and removably fitted within said cut away portion and overhanging a portion of said bearing, means formed integral with the bar for preventing lateral displacement of said cap, and means also formed integral with the bar at that side of the opening opposite the cut-away portion and overhanging the cap for preventing vertical displacement of the overhanging portion of the cap.

12. In a grate structure, the combination with a journal bearing bar having a journal bearing and an opening leading therefrom to the edge of the bar, the material of the bar being cut away at one side of said opening and formed with an overhanging device at the other side of the opening, of an expansion and locking cap arranged within said cut away portion and extending above the bearing and the overhanging device.

13. In a grate structure, the combination with a journal bearing bar having a journal bearing and an opening leading therefrom to the edge of the bar, the material of the bar being cut away at one side of the opening and formed with an overhanging device at the opposite side, the end wall of the cut away portion being struck on the arc of a circle, a locking and expansion cap arranged within the cut away portion and having a curved end next to the curved wall, the opposite end of said cap projecting above the bearing and beneath the overhanging portion.

14. In a grate structure, the combination with a journal bearing bar having a journal bearing and an opening lead-

ing therefrom to the edge of the bar, of a locking device overhanging the journal, the material of the bar being cut away on the opposite side of the journal bearing from the overhanging locking device, and a removable cap arranged within said cut away portion, and having one end projecting beneath the overhanging locking device, the opposite end being struck on the arc of a circle, the wall of the cut away portion contiguous to the curved end of said cap being correspondingly curved.

15. In a grate structure, the combination with a journal bearing bar having a journal bearing and an opening leading therefrom to the edge of the bar, of an overhanging device projecting above the bearing, the material of the bar being cut away on the opposite side of the bearing from the overhanging device, a locking and expansion cap arranged in the cut away portion and having one end projecting beneath the overhanging device, the cap being of less length than the distance between the overhanging portion and the end wall of the cut away portion.

16. In a grate structure, the combination with a journal bearing bar having a journal bearing, the material of the bar being cut away at one side of the journal bearing, of a locking and expansion cap arranged in said cut away portion and having one end extending over the bearing and locking means on the bar overhanging the end of said cap which extends over the bearing for preventing upward movement of such end, the cap being of less length than the length of the cut away portion and arranged substantially centrally thereof, and means for preventing longitudinal play of said cap, whereby an opening is left between each end of the cap and the contiguous portion of the bar.

17. In a grate structure, the combination with a journal bearing bar having a plurality of bearings, the material of the bar being cut away contiguous to each bearing, a locking and expansion cap arranged in each cut away portion and overhanging the bearing for preventing upward movement of the journal on the bearing, each cap being of less length than the length of the cut away portion, the bar being formed with a second set of cut away portions between the first mentioned cut away portions and the bearing spaced from the respective first mentioned cut away portion, and expansion caps arranged in the second mentioned set of cut away portions.

18. In a grate structure, the combination with a journal bearing bar, having a plurality of bearings and formed with a plurality of cut away portions between each two of the bearings, a locking and expansion cap arranged in one of the cut away portions and formed with a portion overhanging the contiguous bearing, and an expansion cap arranged in the other cut away portion and of less length than the length of said cut away portion, and means for retaining the said expansion cap substantially centrally of its cut away portion for leaving spaces between its ends and the contiguous walls.

19. In a grate structure, the combination with a journal bearing bar having cut away portions in its upper edge, of expansion caps arranged in said cut away portions, centering webs projecting from the material of the bar into each of the cut away portions, each of the caps being formed with pockets for inclosing said webs, each cap being of a less length than the length of the cut away portion and being retained by said webs substantially centrally with respect to the cut away portion for leaving spaces between the ends of the cap and the walls of the cut away portions.

20. In a grate structure, the combination with a journal bearing having a cut away portion in its upper edge, of an expansion cap of less length than the cut away portion arranged therein, and means for centering the cap with respect to the cut away portion, the cap being tapered downwardly so that the space between its ends and the contiguous walls of the cut away portions increases downwardly.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM MCCLAVE.

Witnesses:

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EDGAR M. KITCHIN.