P. G. SCHMIDT.

WATER COOLED GRATE BAR.

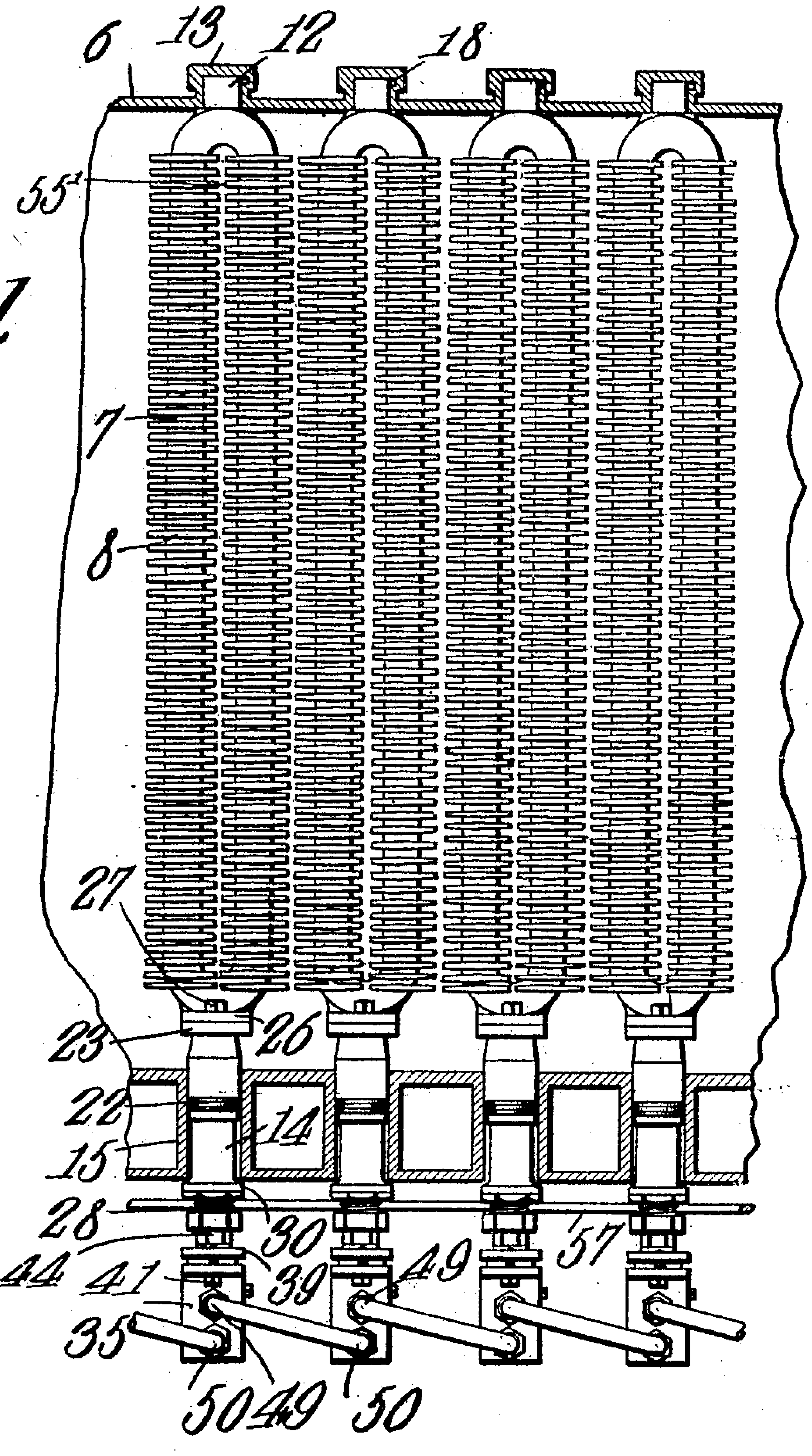
APPLICATION FILED MAR. 6, 1908.

916,609.

Patented Mar. 30, 1909.

3 SHEETS—SHEET 1.

Fig.1.



Witnesses

E. H. Stewart

L. N. Acker

Inventor

Peter G. Schmidt,

By C. A. Snow & Co

Attorneys

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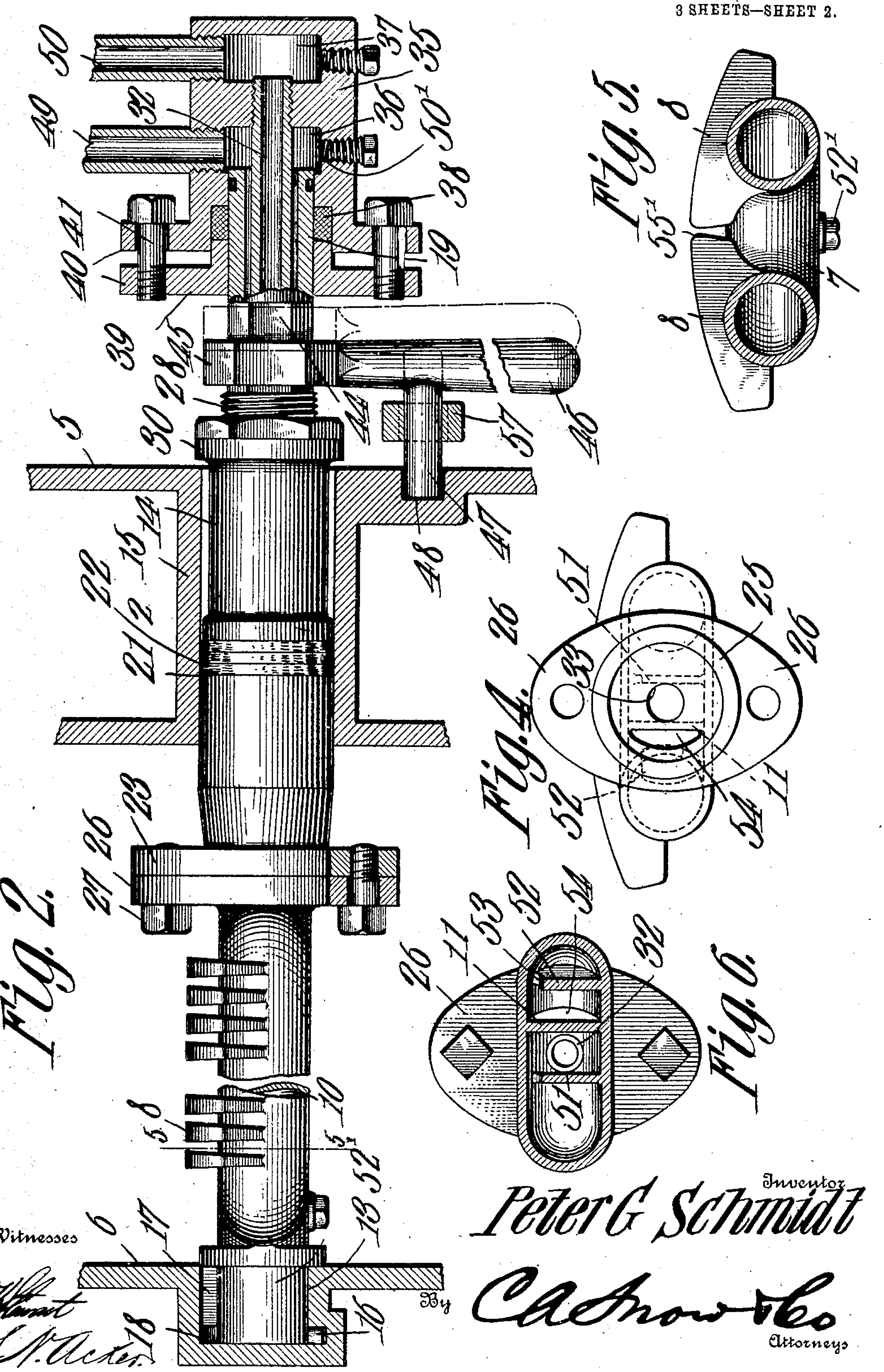
3 SHEETS—SHEET 2.



Witnesses

Inventor

Peter G. Schmidt

By C. A. Snow & Co

Attorneys

THE NORRIS PETERS CO., WASHINGTON, D. C.

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3 SHEETS—SHEET 3.

Fig. 3.

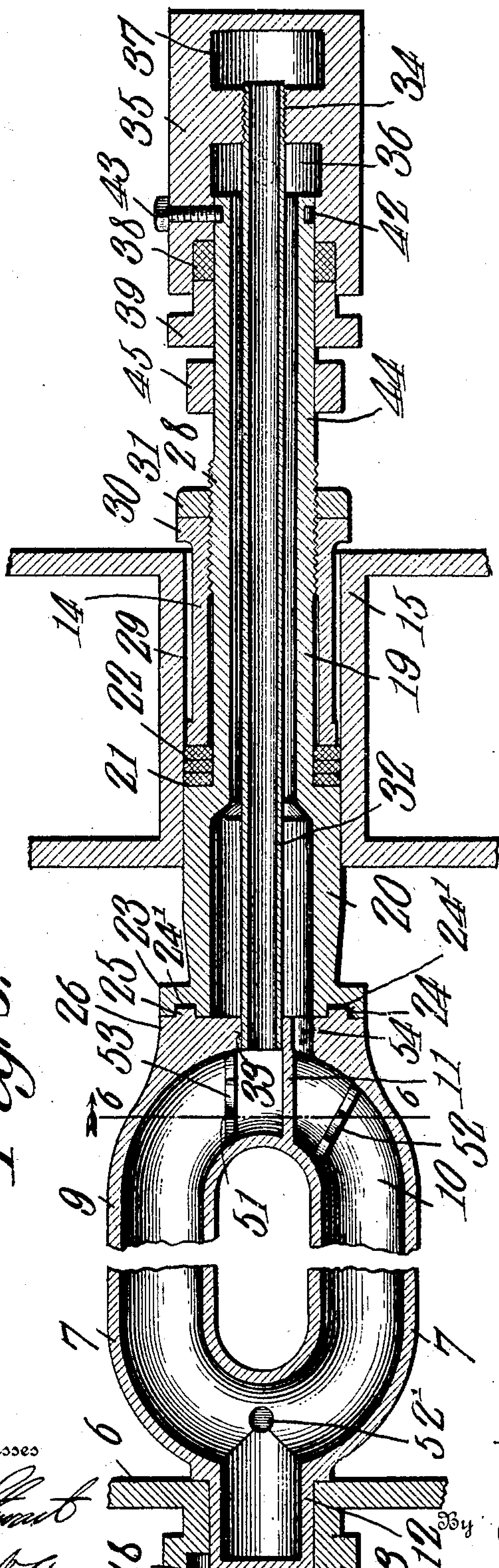
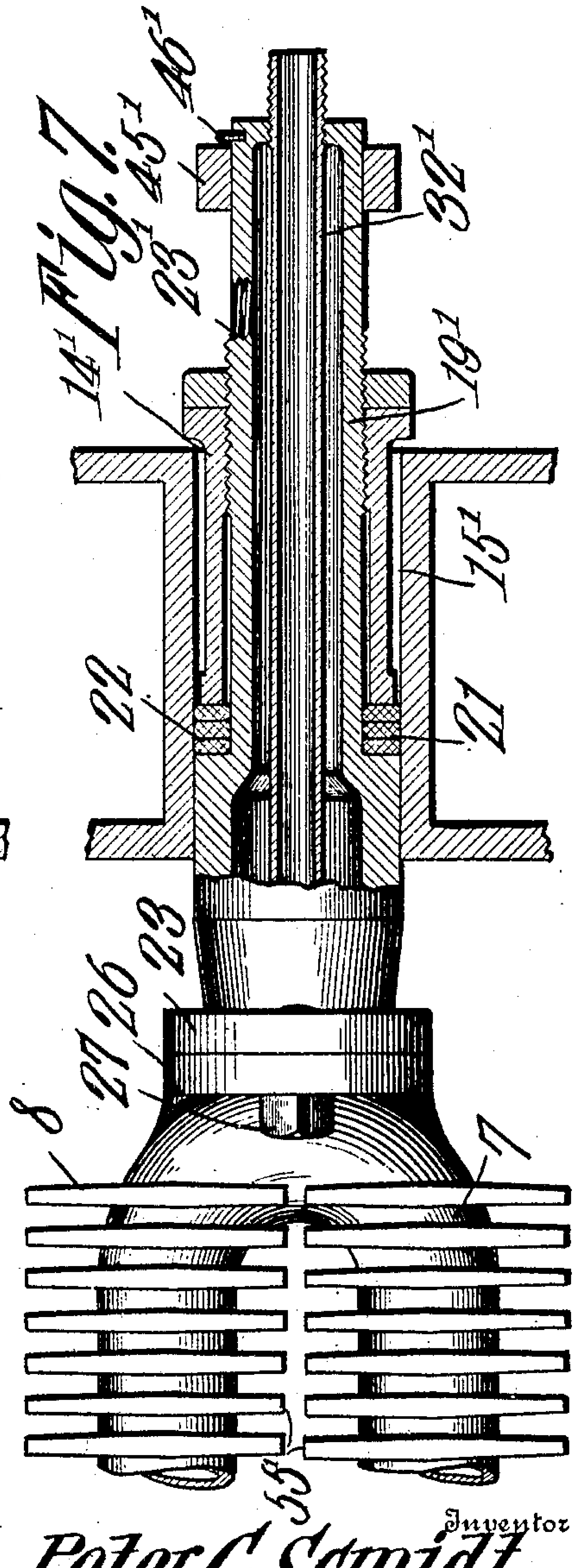


Fig. 7.



Witnesses

[signatures]

Inventor

Peter G. Schmidt,

By C. A. Snow & Co

Attorneys

THE NORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

PETER G. SCHMIDT, OF TUMWATER, WASHINGTON.

WATER-COOLED GRATE-BAR.

No. 916,609. Specification of Letters Patent. Patented March 30, 1909.

Application filed March 6, 1908. Serial No. 419,542.

To all whom it may concern:

Be it known that I, PETER G. SCHMIDT, a citizen of the United States, residing at Tumwater, in the county of Thurston and State of Washington, have invented a new and useful Water-Cooled Grate-Bar, of which the following is a specification.

This invention relates to hollow grate bars for gas producers, boiler furnaces and other heating apparatus and more particularly to that class of grate bars in which provision is made for preventing overheating of the grate bars by maintaining a constant circulation of water or other cooling fluid within the same.

The object of the invention is to provide a hollow grate bar having the greatest practical width thereby to insure the greatest practical space between bars when dumping the same, for the removal of ash and clinkers.

A further object is to provide a hollow grate bar the several parts of which are thoroughly cooled by the circulation of water or other cooling fluid through communicating passages within the bar, said passages being so disposed with relation to the fuel supporting ribs as to insure the effective conduction of heat to said cooling fluid and thus prevent destruction of the ends of the ribs especially when working down draft.

A further object is to construct the grate bar in such a manner as to render it unnecessary to use very cold water or other fluid as the cooling medium and also to render it unnecessary to circulate the cooling medium as rapidly as is necessary in other types of hollow grate bars.

A further object is to provide a hollow grate bar the fluid passages of which are each provided with a transverse barrier which forms a partial obstruction to the flow of cooling medium and thus prevents the steam generated in the fluid passages from forcing the fluid through the outlet and thereby draining said passages.

A further object of the invention is to provide a hollow grate bar including spaced tubular members having transverse fuel supporting bars secured thereto with their inner ends spaced apart to allow for expansion and contraction of the metal, said fuel supporting bars being extended above the tubular members so as to permit free circulation of air and gas between the same.

A further object is to provide a hollow rocking grate the several members of which may be connected to stationary fluid conductors so that water or other cooling fluid introduced at one end of the grate is free to flow from one member to the other, the conductors being connected to the grate members in such a manner as to allow for expansion and contraction and slight oscillatory movement of ends of the grate bars.

A further object is to provide improved means for mounting the grate bars in the walls of the furnace and means for preventing air or gas leakage to or from the ash pit at the bearings of said grate bars when the latter are used in down draft and pressure producers.

A still further object of the invention is generally to improve this class of devices so as to increase their utility, durability and efficiency.

Further objects and advantages will appear in the following description, it being understood that various changes in form, proportions and minor details of construction may be resorted to within the scope of the appended claims.

In the accompanying drawings forming a part of this specification: Figure 1 is a top plan view of a hollow grate constructed in accordance with my invention. Fig. 2 is a side elevation partly in section of one of the grate bars. Fig. 3 is a horizontal sectional view of the same. Fig. 4 is an end view of one of the grate bars with the supply pipe detached. Fig. 5 is a transverse sectional view taken on the line 5—5 of Fig. 2. Fig. 6 is a similar view taken on the line 6—6 of Fig. 3. Fig. 7 is a top plan view partly in section illustrating a modified form of the invention.

Similar numerals of reference indicate corresponding parts in all of the figures of the drawings.

The improved grate forming the subject matter of the present invention may be used in connection with gas producers, boiler furnaces or other heating apparatus and by way of illustration is shown applied to a gas producer in which 5 designates one wall of the fire box and 6 the opposite wall thereof.

As the number of grate bars employed to form a complete grate varies according to the size of the fire box in which the same is used, a detailed description of a single grate bar will suffice.

The grate bar comprises a body portion

consisting of spaced tubular members 7 having transverse bars 8 secured thereto for supporting the fuel upon the grate and for the purpose of shaking down ashes, breaking up the clinkers as the grate bars are agitated, or dumping part or all of the ash, clinkers or fire into the ash pit or onto a lower grate. The tubular members 7 are provided with longitudinal fluid passages 9 and 10 communicating with each other at one end of the grate bar and separated at the opposite end of said grate bar by a partition 11.

One end of the grate bar is provided with a trunnion 12 which is journaled in a corresponding bearing 13 formed in the adjacent wall 6 of the fire-box, while the opposite end of the grate bar is supported in a collar 14 journaled in a bearing 15 formed in the wall 5 of the furnace, as shown. The trunnion 12 is provided with a lateral lug 16 which enters a slot 17 formed in the bearing 13, said lug being adapted to enter a groove 18 when the grate bar is oscillated, thereby to assist in maintaining the grate bar in proper position within the fire box. Extending through the bearing collar 14 and mounted for rotation therewith is a tubular member or supply pipe 19 having its forward end provided with a head or enlargement 20 defining an annular stop shoulder 21 for engagement with a packing 22, the latter being interposed between the shoulder and the adjacent end of the collar 14 so as to form an air and steam tight joint at the bearing 15. The head or enlargement 20 is provided with a laterally extending flange 23 having an annular groove 24 formed therein for the reception of a correspondingly shaped rib 25 preferably formed integral with a similar flange 26 on the adjacent end of the grate bar, the flanges 23 and 26 being clamped in engagement with each other and with a packing 24′ by bolts or similar fastening devices 27 piercing said flanges, as shown.

The exterior walls of the supply pipe 19 are threaded at 28 for engagement with corresponding threads on the collar 14, the latter being preferably formed with an annular groove or recess 29 and a terminal stop flange 30. Engaging the threads 28 on the supply pipe is a nut 31 which bears against the stop flange 30 and serves to lock the collar against accidental displacement.

Disposed within and extending longitudinally of the supply pipe 19 is an outlet tube 32, the inner end of which passes through a bearing 33 in the flange 26 and communicates with the fluid receiving passage 9, the outer end of said tube being threaded at 34 in a stationary casting or housing 35. The casting 35 is provided with independent fluid receiving chambers 36 and 37 one of which communicates with the longitudinal tube 32 while the other communicates with a passage or chamber 37 surrounding the tube 32 and discharging into the fluid passage 10. The inner end of the casting or housing 35 is formed with a recess for the reception of a packing 38, which latter surrounds the supply pipe and is retained in position by a gland 39. The gland 39 and casting 35 are formed with lateral lugs 40 having transversely alined openings formed therein for the reception of bolts or similar fastening devices 41 whereby the packing may be adjusted to form a tight joint at the point of entrance of the supply pipe into the casting.

An annular groove 42 is preferably formed in the exterior walls of the supply pipe 19 for the reception of a pin or screw 43, which latter keeps the casting 35 from blowing off and assists in preventing longitudinal movement of the supply pipe within the casting while at the same time permitting the supply pipe and its associated parts to rotate in the bearings 15, the casting 35 remaining stationary. That portion of the exterior walls of the supply pipe 19 between the threads 28 and the gland 39 is angular in cross section, as indicated at 44, and slidably mounted on the angular portion 44 of the supply pipe is the head 45 of an operating lever 46. The operating lever 46 is provided with a laterally extending finger 47 which enters a depression or recess 48 in the adjacent wall 5 of the furnace. It will thus be seen that by sliding the head 45 of the operating lever to the dotted line position shown in Fig. 2 of the drawings and oscillating the handle of said lever the grate bar may be partially rotated or oscillated to effect the shaking of the fire or dumping of the grate and that when the operating lever is moved to the full line position shown in Fig. 2 the finger 47 will enter the recess 48 and thus lock the grate bar against accidental rotary movement.

Threaded in the casting 35 and communicating with the chamber 36 is a pipe or conductor 49 leading from a suitable source of fluid supply and through which the cooling medium is introduced into the hollow grate bar, there being a similar pipe or conductor 50 communicating with the chamber 37 to permit the discharge of the fluid from said grate bar. Suitable openings or drains 50′ are preferably formed in the casting or housing 35, said drains being in communication with the chambers 36 and 37 and normally closed by plugs, as shown. The discharge pipe or conductor 50 of one grate bar is connected with the receiving chamber 36 of an adjacent grate bar so that water or other cooling fluid introduced through the pipe 49 at one end of the grate is free to flow from one hollow grate bar to the other, as best shown in Fig. 1 of the drawing.

Extending transversely across the fluid passages in spaced relation to the partition 11 are plates or barriers 51 and 52 each of which forms a partial obstruction to the flow

of fluid in the hollow grate bar and thus prevents, in case of a liquid cooling medium, the steam or gas generated therefrom in the passages 9 and 10 from forcibly ejecting the liquid through the outlet and thus draining said passages. The upper portion of each plate or barrier is spaced from the adjacent wall of the tube 7, as indicated at 53, so as to allow the passage of a relatively small volume of liquid and thus permit circulation of the fluid in the passages 9 and 10 of said grate bar.

By providing both fluid receiving passages of the grate bar with a transverse plate or barrier the function of the members 19 and 32 may be reversed, that is to say, the supply pipe 19 may be used as an outlet and the outlet tube 32 used as an inlet or supply pipe so that the cooling medium may be introduced into the grate bar on either side of the partition 11. It will also be observed that by arranging a barrier in each passage, cross connections outside are rendered unnecessary thereby simplifying the connections and preventing mistakes when reversing the flow of fluid in the grate bars. It will thus be seen that fluid entering the chamber 37 through the conductor 49 will flow through the mouth 54 of said chamber into the passage 10 of the grate bar and thence into the passage 9 and through the opening 53 into the outlet tube 32 from whence it passes through the pipe 50 into the receiving chamber 36 of the adjacent grate bar, in the manner before stated.

Attention is here called to the fact that the fuel supporting bars are extended vertically above the tubes 7 constituting the grate bar so as to partially prevent the fuel from coming in direct contact with the grate bar and also to permit free circulation of air and gas between the same. The inner ends of the fuel supporting bars are also preferably spaced apart at 55′ to allow for expansion and contraction of the same. A grate constructed in this manner permits all the open space or real grate area possible at the same time allowing proper cooling of all parts. The opposite ends of the fuel supporting bars 8 are also preferably deflected downwardly to assist in dumping the fuel and breaking up the clinkers as the grate bars are agitated.

In Fig. 7 of the drawings there is illustrated a modified form of the invention in which the supply pipe 23′, collar 14′ and outlet tube 32′ are mounted for rotation within the bearing 15′ as a unit, the stationary casting or housing 35 shown in Fig. 3 of the drawing being dispensed with in this form of the device.

One end of the tubular member 19′ is extended longitudinally beyond the adjacent wall of the furnace and is angular in cross section to form a support for an operating lever 45′ similar in construction to the operating lever shown in Fig. 2 of the drawings, the lever 45′ being retained in position on the angular portion of the tubular member 19′ by a screw, pin or similar fastening device, indicated at 46′.

A drain opening is preferably disposed at the juncture of the tubes 7 in both types of grate bar, said drain openings being arranged in advance of the trunnions 12 and normally closed by removable plugs 52′.

If desired, the several operating levers shown in Figs. 1 and 2 of the drawings may be connected by links or a rod 57 so that all or several groups of grate bars may be simultaneously actuated to effect the movement of the grate bars from one end or side of the furnace.

While I have shown and described a grate bar formed of spaced tubes having communicating passages, it is obvious that the same may be constructed of a single tube or other hollow body having a partition arranged within the same to form said passages, without departing from the spirit of the invention.

Having thus described the invention what is claimed is:

1. A hollow grate bar having communicating fluid passages, one of which is connected with a source of fluid supply and the other provided with an outlet, and a barrier disposed within one of said passages and having its upper portion spaced from the adjacent wall thereof to form a partial barrier to the flow of fluid through said passage to the outlet.

2. A hollow grate bar having fluid passages communicating with each other at one end of the grate bar and separated at the other end thereof, one of said passages being connected with a source of fluid supply and the other provided with an outlet, and a barrier disposed within and extending across the grate bar at the outlet of one of the fluid passages, said barrier having its upper portion spaced from the adjacent wall of the fluid passage thereby to form a partial obstruction to the flow of fluid through said passage to the outlet.

3. A hollow grate bar having fluid passages communicating with each other at one end of the grate bar, a partition separating said passages at the opposite end of the grate bar, one of said passages being connected with a source of fluid supply and the other provided with an outlet, and a barrier disposed within one of the fluid passages in spaced relation to the partition and having its upper portion spaced from the adjacent wall of said passage to form a partial obstruction to the flow of fluid through said passage to the outlet.

4. A hollow grate bar including spaced tubes each provided with a fluid passage com-

municating with the fluid passage of the other tube at one end of the grate bar, a partition separating the fluid passages at the opposite end of the grate bar, one of said passages being connected with a source of fluid supply and the other provided with an outlet, and a barrier disposed within one of said passages and having its upper end spaced from the adjacent wall of said passage to form a partial obstruction to the flow of fluid through said passage to the outlet.

5. A hollow grate bar including spaced tubes having transverse fuel supporting bars and each provided with a fluid passage communicating with the fluid passage of the other tube at one end of the grate bar, a partition disposed at the juncture of the tubes at the other end of the bar, one of said passages being connected with a source of fluid supply and the other provided with an outlet, and a barrier extending transversely across one of the passages in spaced relation to the partition and having its upper portion spaced from the wall of the adjacent tube to permit the passage of a portion of the fluid through the outlet.

6. A hollow grate bar having fluid passages communicating with each other at one end of the grate bar, a partition separating the passages at the opposite end of said grate bar, one of the passages being connected with a source of fluid supply and the other provided with an outlet, and barriers disposed within said passages and each having a portion thereof spaced from the wall of the adjacent passage to form a partial obstruction to the flow of fluid through the same.

7. A hollow grate bar having a fluid passage and provided with spaced transverse fuel supporting bars formed integral with the walls of the fluid passage and projected above the upper surface of the grate bar said fuel supporting bars being formed in sections with the inner ends of the sections of each bar spaced apart to permit free expansion and contraction of the same.

8. A hollow grate bar having a fluid passage and provided with two series of transverse fuel supporting bars having their upper longitudinal edges inclined downwardly and projected above the upper surface of the grate bar, the inner ends of the bars of one series being spaced from the inner ends of the bars of the other series to produce an intermediate air space.

9. A hollow grate bar including spaced tubes having communicating fluid passages, and sectional fuel supporting bars extending transversely across said tubes and having their upper longitudinal edges projected above the upper surface of said tubes, the inner ends of the sections of each fuel supporting bar being spaced apart to produce an intermediate air space.

10. The combination with a furnace, of a grate bar journaled in the walls thereof and provided with communicating fluid passages, one of which is connected with a source of fluid supply and the other provided with an outlet, and a barrier extending transversely across one of the passages and having a portion thereof spaced from the adjacent wall of said passage to form a partial obstruction to the flow of fluid through said passage to the outlet.

11. The combination with a furnace, of a grate bar journaled in one wall of the furnace, a tubular member journaled in another wall thereof and connected to and movable with the grate bar, said grate bar being provided with communicating fluid passages, one of which is connected with a source of fluid supply and the other with an outlet, and a barrier extending transversely across one of the passages and forming a partial obstruction to the flow of fluid through said passage to the outlet.

12. The combination with a furnace, of a grate bar journaled in one wall of the furnace, a tubular member mounted for rotation in another wall thereof and secured to and movable with the grate bar, said grate bar being provided with communicating fluid passages one of which is connected with a source of fluid supply and the other provided with an outlet, a shoulder formed on the tubular member, a collar spaced from the shoulder, a packing interposed between the shoulder and collar, and means for locking the collar in engagement with the packing.

13. The combination with a furnace, of a grate bar journaled in one wall of the furnace, a tubular member mounted for rotation in another wall thereof and secured to and mounted for rotation with the grate bar, said grate bar being provided with communicating fluid passages one of which is connected with the interior of the tubular member, a fluid conductor disposed within the tubular member and having one end thereof seated in a bearing in the grate bar and communicating with the other passage, and means for supplying fluid to and discharging fluid from said passages.

14. The combination with a furnace, of a grate bar journaled in the walls of the furnace and provided with communicating fluid passages, a tubular member communicating with one of said fluid passages and forming a bearing for one end of the grate bar, a longitudinal tube disposed within the tubular member and communicating with the other fluid passage, said tubular member having its exterior walls threaded and provided with a shoulder, a collar surrounding the tubular member and spaced from the shoulder, a packing interposed between the collar and shoulder, a clamping nut engaging the threads on the tubular member and bearing against the collar, and conductors for sup-

plying fluid to and discharging fluid from said passages.

15. The combination with a furnace, of a grate bar journaled in one wall thereof and provided with an angular rib, a tubular member journaled in another wall of the furnace and provided with an angular groove for the reception of said rib, said grate bar being provided with communicating fluid passages, one of which opens into the tubular member, a stationary longitudinal tube communicating with the other fluid passage, means for locking the tubular member in engagement with the grate bar, and conductors operatively connected with the tubular member and longitudinal groove for supplying fluid to and discharging fluid from said passages.

16. The combination with a furnace, of a grate bar journaled in one wall thereof and provided with communicating fluid passages, a tubular member journaled in another wall of the furnace and having means for interlocking engagement with the adjacent end of the grate bar, said tubular member being in communication with one of the fluid passages and having its exterior walls at one end of angular cross sectional formation, a stationary tube disposed within the tubular member and communicating with the other fluid passage, a packing surrounding the tubular member, a collar bearing against the packing, an operating lever slidably mounted on the angular portion of the tubular member for oscillating the grate bar, and conductors operatively connected with the tubular member and stationary tube for supplying fluid to and discharging fluid from said passages.

17. The combination with a furnace, of a grate bar journaled in one wall thereof and including spaced tubes having communicating fluid passages, a tubular member journaled in another wall of the furnace and secured to and movable with the grate bar, said tubular member being connected with one of the fluid passages and having its exterior walls threaded and provided with a circumferential shoulder, a longitudinal tube extending through the tubular member and communicating with the other fluid passage, a collar surrounding the tubular member, a packing interposed between the collar and shoulder, means for oscillating the grate bar, and conductors operatively connected with the tubular member and longitudinal tube for supplying fluid to and discharging fluid from the passages in the grate bar.

18. The combination with a furnace, of a grate bar having one end thereof journaled in one wall of the furnace, a tubular member carried by another wall of the furnace and secured to and forming a support for the opposite end of the grate bar, said grate bar being provided with communicating fluid passages, the wall of one of which is pierced by an opening, the other passage being in communication with the interior of the tubular member, a stationary tube extending through said opening and communicating with the adjacent fluid passage, a packing surrounding the tubular member, and conductors operatively connected with the tubular member and stationary tube for supplying fluid to and discharging fluid from the passages in said grate bar.

19. The combination with a furnace, of a grate bar journaled in the walls of the furnace and provided with communicating fluid passages, a tubular member connected with one of the fluid passages and forming a bearing for the adjacent end of the grate bar, a stationary casting mounted on the tubular member and having spaced chambers formed therein, one of which communicates with the interior of the tubular member, a longitudinal tube having one end thereof communicating with the other chamber and its opposite end opening into the other fluid passage, and conductors for supplying fluid to and discharging fluid from said passages.

20. The combination with a furnace, of a grate bar journaled in the walls of the furnace and formed with communicating fluid passages, a tubular member communicating with one of the fluid passages and forming a bearing for the adjacent end of the grate bar, a stationary casting on the tubular member and having spaced chambers formed therein, one of which communicates with the interior of the tubular member, a longitudinal tube having one end thereof communicating with the other chamber and its opposite end passing through an opening in the grate bar and in communication with the other passage, a gland surrounding the tubular member, said tubular member being provided with a circumferential groove and having an intermediate portion of angular cross sectional formation, a fastening device carried by the casting and extending within the groove in the tubular member, an operating handle slidably mounted on the angular portion of the tubular member for oscillating the grate bar, and conductors connected with both chambers for supplying fluid to and discharging fluid from the passages in the grate bar.

21. The combination with a furnace, of a grate bar journaled in the walls of the furnace and provided with communicating fluid passages, a tubular member forming a bearing for the adjacent end of the grate bar, a stationary casting mounted on the tubular member and having spaced chambers formed therein one of which communicates with the interior of the tubular member, a longitudinal tube having one end thereof communicating with the other chamber and its opposite end opening into the other fluid passage, said casting being provided with perforated lugs and having an annular recess formed

therein, a collar slidably mounted on the tubular member and provided with corresponding perforated lugs, said collar being formed with a flange working within the recess, a packing seated in the recess, fastening devices piercing the perforations in the lugs, and an operating lever slidably mounted on the tubular member for oscillating the grate bar, said operating lever being provided with a laterally extending finger adapted to engage a notch in or lug on the adjacent wall of the furnace for locking the grate bar against accidental rotation.

22. The combination with a furnace, of a plurality of grate bars journaled in the walls thereof and each provided with communicating fluid passages having inlet and discharge pipes, conductors connecting the discharge pipe of one grate bar with the inlet of another, and barriers extending transversely across the fluid passages of each grate bar and forming a partial obstruction to the flow of fluid through said passages to the adjacent discharge pipe, thereby to permit circulation of the cooling medium in either direction with the same cooling effect within the bars.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

PETER G. SCHMIDT.

Witnesses:
D. H. MEANY,
B. NORUM.