(No Model.) 4 Sheets—Sheet 1.

J. REAGAN.

SHAKING GRATE FOR MARINE OR OTHER BOILERS.

No. 566,094. Patented Aug. 18, 1896.

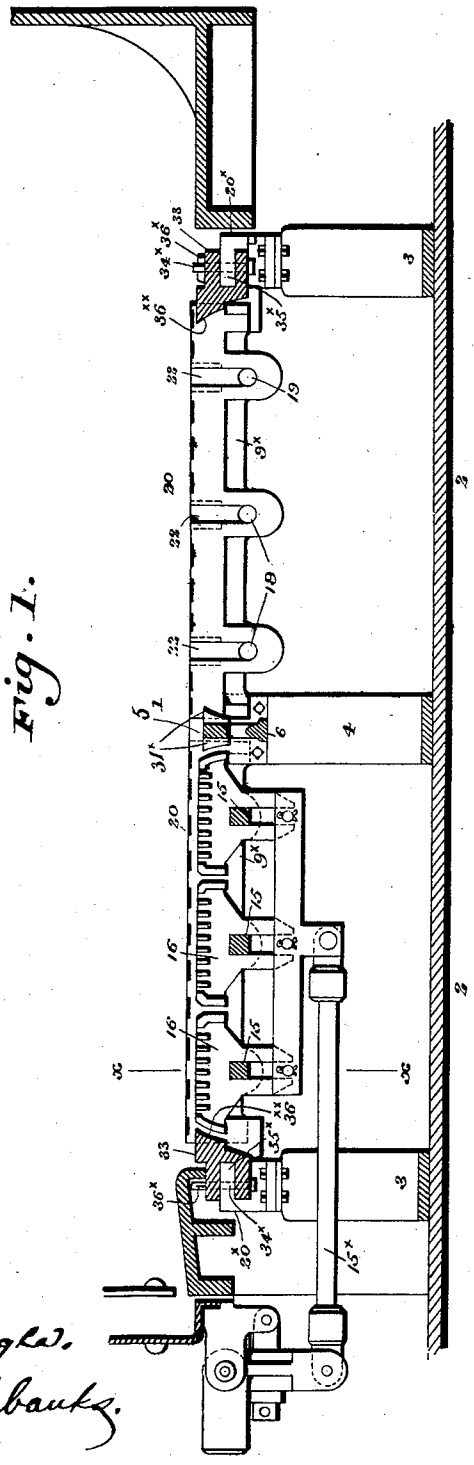

Fig. 1.

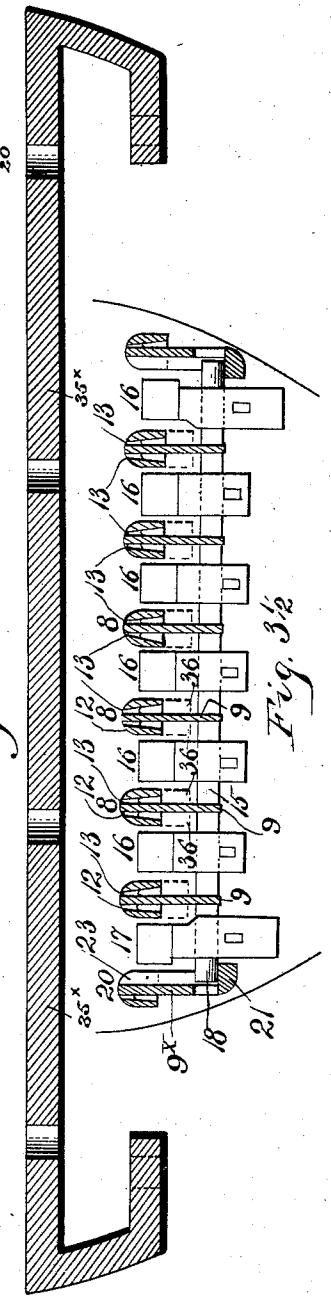

Fig. 2X

Fig. 3½

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(No Model.) 4 Sheets—Sheet 2.

J. REAGAN.

SHAKING GRATE FOR MARINE OR OTHER BOILERS.

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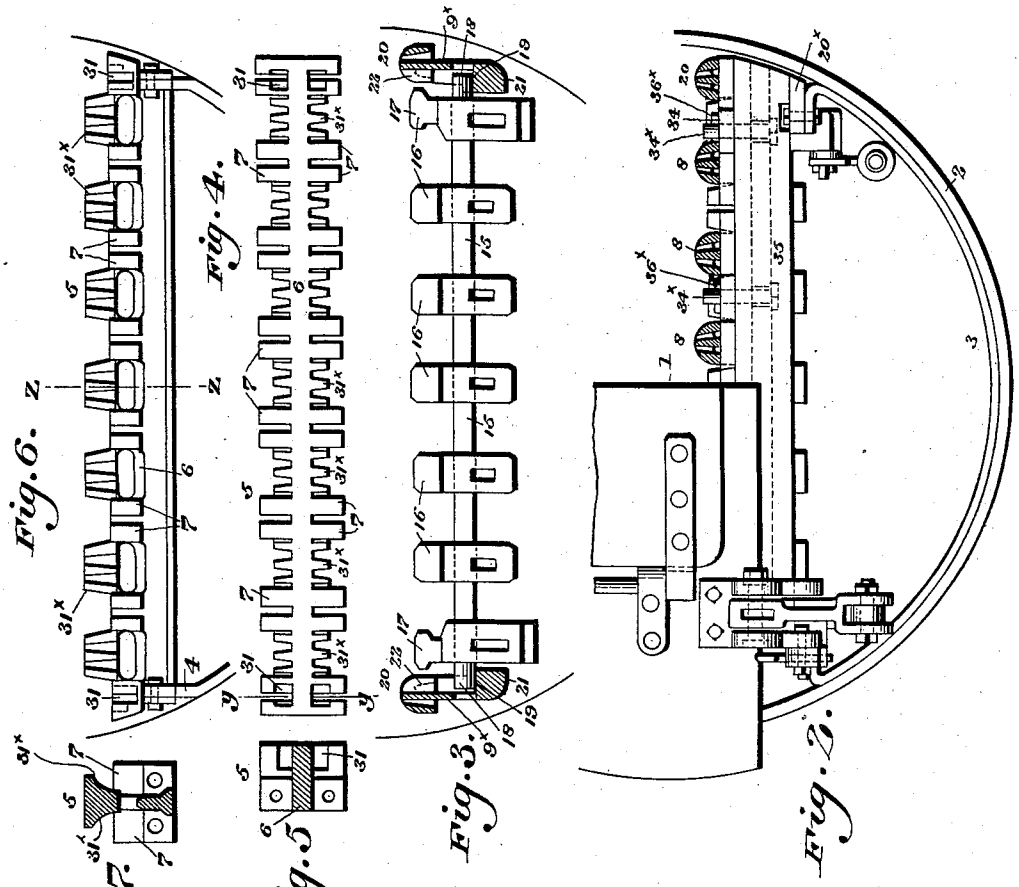

Fig. 6.

Fig. 4.

Fig. 3.

Fig. 2.

Fig. 7.

Fig. 5.

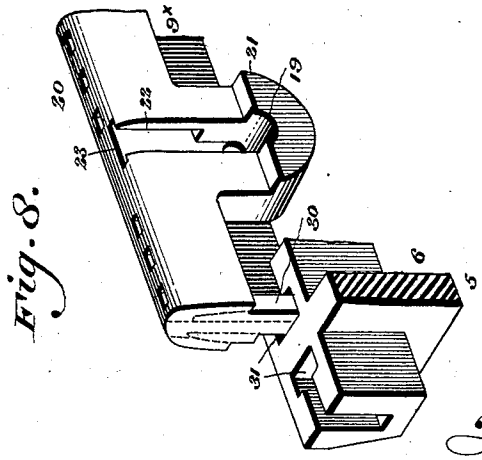

Fig. 8.

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J. REAGAN.

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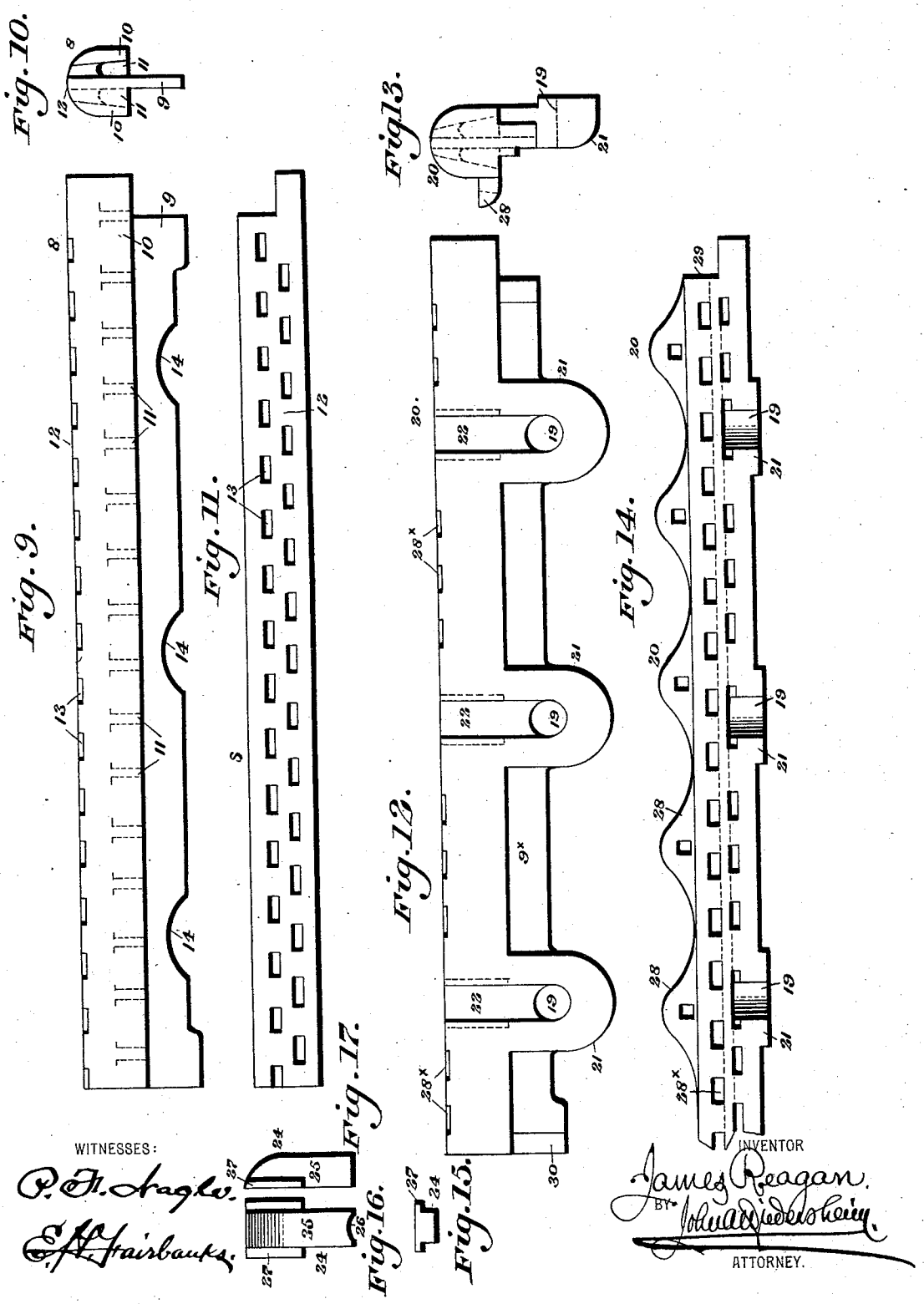

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SHAKING GRATE FOR MARINE OR OTHER BOILERS.

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Fig. 18.

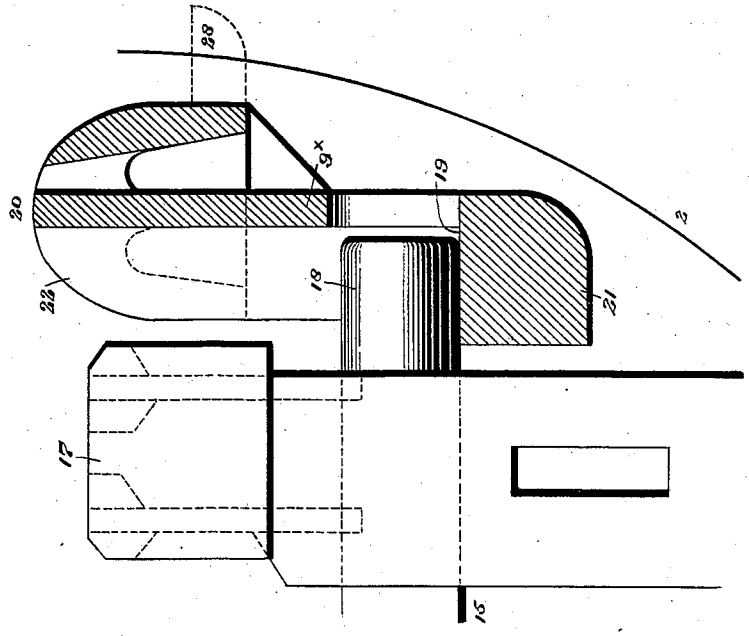


Fig. 21.

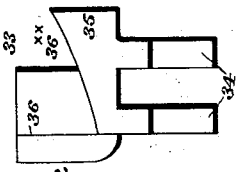


Fig. 19.

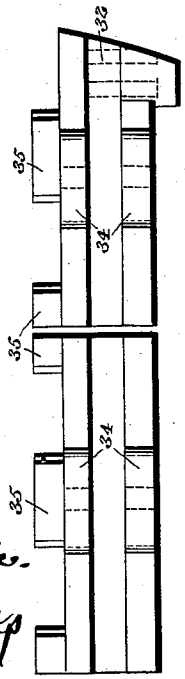


Fig. 20.

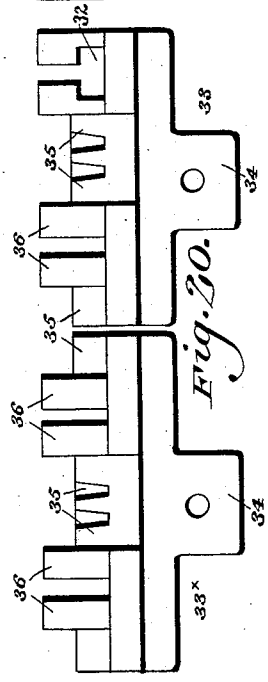
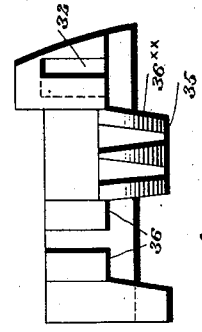


Fig. 22.



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UNITED STATES PATENT OFFICE.

JAMES REAGAN, OF PHILADELPHIA, PENNSYLVANIA.

SHAKING-GRATE FOR MARINE OR OTHER BOILERS.

SPECIFICATION forming part of Letters Patent No. 566,094, dated August 18, 1896.

Application filed March 26, 1896. Serial No. 584,928. (No model.)

To all whom it may concern:

Be it known that I, JAMES REAGAN, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Shaking-Grates for Marine or other Boilers, which improvement is fully set forth in the following specification and accompanying drawings.

My invention relates to improvements in grates; and it consists of a novel construction of side bar, which serves, in addition the function of a grate-bar, for admitting a maximum supply of oxygen to the fire, and also serves to support rock-shafts on which choppers are mounted, provision being made for placing my grate in any desired construction of boiler by the employment of supporting-feet, which are first placed within the boiler and sustain the aforesaid side grate-bars, after which the choppers can be readily placed in position by dropping their shafts into place.

It also consists of a novel manner of supporting and locking the side grate-bars, whereby any lateral or longitudinal shifting is prevented.

It further consists of novel details of construction, all as will be hereinafter fully set forth, and specifically pointed out in the claims.

Figure 1 represents a longitudinal section of a grate for marine or other boilers embodying my invention, certain parts of the same being shown in elevation and the boiler-shell being removed for the sake of clearness of illustration. Fig. $2^{\times}$ represents on an enlarged scale a sectional view of a transverse bar or brace to which the supporting-blocks are attached. Fig. 2 represents a front elevation of the grate seen in Fig. 1, a certain portion of the boiler-front being removed and a portion of the stationary grate-bars being shown in transverse section. Fig. 3 represents a section on line $x\,x$, Fig. 1, the choppers and their shaft being shown in elevation. Fig. $3\frac{1}{2}$ represents a cross-section on line $x\,x$ similar to Fig. 3, showing the longitudinally-extending curved stationary bars in position and the choppers therebetween. Fig. 4 represents a plan view of a bridge-bar employed, the same being shown in detached position. Fig. 5 represents a section on line $y\,y$, Fig. 4, showing the recesses in the extremity of said bridge-bar for supporting and locking the ends of the side grate-bars. Fig. 6 represents a side elevation of the bridge-bar seen in Fig. 4 and its adjuncts, showing also the means for supporting the same. Fig. 7 represents a section on line $z\,z$, Fig. 6. Fig. 8 represents a perspective view of a detached portion of one of the side bearing-bars, which has also the function of a grate-bar, and the bridge-bar, showing the means for supporting said side bar, the end of the latter being interlocked with said bridge-bar. Fig. 9 represents a side elevation of a longitudinally-extending stationary grate-bar employed, which is located intermediate the choppers. Fig. 10 represents an end elevation of Fig. 9. Fig. 11 represents a plan view of Fig. 9. Fig. 12 represents a side elevation of one of the stationary side grate-bars, which serves also the function of a bearing-bar and is employed to hold the shafts upon which the choppers are mounted in proper position. Fig. 13 represents an end elevation of Fig. 12. Fig. 14 represents a plan view of the side bar seen in Fig. 12. Figs. 15, 16, and 17 represent a plan, front, and a side elevation, respectively, of a filling-piece employed, which is dropped into a recess located in the side grate-bar above the bearing therein and is adapted to hold the shafts upon which the choppers are mounted in their proper position. Fig. 18 represents on an enlarged scale an end elevation of one of the choppers employed and its shaft and a side bearing-bar therefor, which has the double function of a side grate-bar, said side bearing-bar being shown in section. Fig. 19 represents a front view of detachable supporting-blocks employed, which are sustained in the front and rear of the furnace, and are provided with devices for receiving and locking in position both the side and the intermediate stationary grate-bars, ledges being further provided which coact with the adjacent choppers. Figs. 20, 21, and 22 represent plan, end, and rear elevations of said blocks, to be hereinafter referred to.

Similar numerals of reference indicate corresponding parts in the several figures.

Referring to the drawings, reference being first had to Fig. 1, 1 designates a furnace-grate embodying my invention, and 2 the

lower portion of the boiler-shell of a furnace or flue in which the same is placed, it being understood that while my invention is especially applicable to internally-fired tubular boilers of the Cornwall, Lancashire, or similar type the same is equally adapted to any tubular boiler or to any type of the same in which it is desired for any reason to place a grate quickly in position or to remove the same or obtain ready access thereto.

3 3 designate the front and rear, and 4 the intermediate supporting-feet upon which the grate proper is sustained, it being understood that the number of the said feet may be varied according to requirements, and that their base portions may be adapted to fit the corrugations of the boiler in which they are placed, in case said boiler is corrugated, or they may be of uniform diameter, as herein shown.

The intermediate foot 4 has supported thereon the bridge-bar 5, whose construction will be best understood from Fig. 4, the same consisting of the longitudinal web or body portion 6, which is provided with ledges mounted on either side thereof which serve to support thereupon the longitudinally-extending grate-bars 8, whose construction is best seen in Figs. 9, 10, and 11.

The grate-bars 8 are provided with the longitudinally-extending web 9 and the depending wings 10 on either side thereof, said wings and web having common thereto the transverse strengthening-ribs 11.

12 designates a curved raised crown of the bar, which is struck from a shorter radius than the adjacent surfaces of said bar, said crown having the ports 13 therein arranged in longitudinally-staggered order.

The above grate-bar 8 is substantially the same as the bar described and claimed in the contemporaneously pending application filed by me February 28, 1896, Serial No. 581,114, to which bar *per se* I herein make no claim.

14 designates recesses which are cut in the bottom of the web 9, in order to provide sufficient play for the shafts 15, upon which the choppers 16 are mounted, it being noted that there will of course be as many recesses 14 as there are chopper-shafts 15, which in the present instance are three in number for each bar, although this number may of course be increased or diminished according to requirements, the above choppers being actuated in any suitable manner, as by the rod $15^{\times}$, the latter having suitable connections therefrom to said choppers.

17 designates the exterior choppers, which are provided with an offset and are mounted near the ends of the shafts 15, which latter are provided with the journals 18, which rest in suitable bearings 19, which are provided in the side bars 20, the latter, as will be explained, serving the double function of a side grate-bar and a side bearing-bar.

The side bar 20 in its general contour has the general appearance of the bar seen in Figs. 9, 10, and 11, being substantially the same in construction, and having the raised crown, longitudinal central web, depending wings, and transverse strengthening-wings, heretofore referred to, the additional novel features being hereinafter referred to. The depending rib $9^{\times}$ of said bar 20 has an outwardly-projecting lug or boss 21 thereon, in which is provided the aforesaid bearing 19, which is a passage extending transversely through the bar. An upright slot 22 extends from the bearing to the top of the bar, as will be clearly understood from Figs. 1, 8, and 12, the inner wall of said slot being provided with a T-shaped recess 23, forming ways, (best seen in Fig. 8,) which is adapted to receive the filling-piece 24, said filling-piece being dropped into the slot 22 after the shafts 15 have been placed in position, and being provided with a body portion 25 and the arc-shaped recess 26, which bears upon the journals 18 of the shafts 15.

27 designates wings or guides attached to the said filling-piece 24, whereby the position of the latter relative to the side bar 20 will always be assured, it being apparent that when the parts are placed in assembled position the filling-pieces 24 will have a double function, namely, to prevent soot, ashes, refuse, &c., from falling upon the journals of the shafts 15, while at the same time they serve to keep the latter in their proper position, although it will of course be understood that the weight of the choppers 16 and their shafts 15 will ordinarily be entirely sufficient for this.

28 designates a curved or corrugated portion of the bar 20, the same being located on the side opposite to the bosses 21 and the bearings 19, as will be evident from Fig. 14, the object of said corrugated portion being to fit loosely against and fill the corrugation of the boiler-shell or fire-chamber in which the grate is placed, and thus assist to prevent longitudinal shifting, it being of course understood that in case the grate and the side bars 20 are placed in tubular boilers of uniform diameter the corrugated portion 28 would be omitted, if desired.

The ends 29 of the side bars, as well as of the bars 8, may be stepped, if desired, as indicated at the right of Fig. 14, or such construction may be dispensed with or changed, as may be expedient.

30 designates the preferred manner of constructing the ends of the bars, the same being best seen on the left of Figs. 8 and 12, the said bars being provided with a thickened or T-shaped portion, which is adapted to seat in the T-shaped recesses 31 of the bridge-bar 5, it being evident from Fig. 8 that when the bars have once been dropped into position that the same will be interlocked in such a way that lateral as well as longitudinal movement is prevented.

$31^{\times}$ designates raised serrated ledges on the bridge-bars 5, which are provided with

curved faces, which are adapted to coact with the faces of the adjacent choppers.

The extremities of the bars 20, which are contiguous to the bridge-bar 5, are held and locked in position in the manner indicated in Fig. 8, while their outer ends interlock with the T-shaped recess 32 of the supporting-blocks 33, the construction of which will be best understood from Figs. 1 and 20, said blocks being provided with ears 34, which engage the body portion $35^{\times}$ of the brace $20^{\times}$, (seen in Fig. 1,) which has its ends mounted upon the inturned ends of the feet 3, as will be evident from Fig. 2, the said blocks being held in position by means of the bolts $34^{\times}$, which are provided with a key $36^{\times}$ for retaining all the parts in assembled position, as will be understood from Figs. 1 and 2.

35 designates serrated ledges which have their inner portion, $36^{\times\times}$ arc-shaped, as indicated in Figs. 1, 21, and 22, said arc-shaped under portion or face being adapted to coact with the faces of the adjacent choppers.

36 designates ledges which extend from the body portion of the supporting-blocks 33, the function of said ledges being the same as the ledges 7, (seen in Figs. 4 and 6,) and serving to support the stationary grate-bars 8 in position.

The construction of the supporting-blocks 33 and $33^{\times}$ will be clearly understood from Figs. 19 to 22, inclusive, the right-hand block in Figs. 19 and 20 being the right-hand block which would be seen adjacent the right-hand furnace-wall in Fig. 2, if certain of the parts were removed, while the block $33^{\times}$ is similar to the block 33, but not provided with the T-shaped slots 32 for obvious reasons.

The operation and manner of assembling the parts are as follows:

The feet 3 and 4 are first placed in position, after which cross bars or braces corresponding to the brace $20^{\times}$ are placed in position thereupon. The side grate-bars 20 are next placed in position, the location and manner of holding the same in position being evident from Figs. 3 and 8. After this the shafts 15, carrying the ends of the intermediate and outer choppers 16 and 17, are placed in position, the same being simply dropped through the slots 22 until the journals 18 rest upon their bearings 19, after which the filling-pieces 24 are placed in position, the function of the same having been already explained. The stationary bars 8 can now be placed in position, the same being supported upon the ledges 7 and 36, as stated, and the grate will then be in assembled and operative position.

I desire to call especial attention to the function attained by the use of the side bars 20 and the novel construction thereof, it being evident that said bars when placed in position in a corrugated boiler are prevented from longitudinal shifting because of the corrugation 28, and by reason of their being provided with the ports $28^{\times}$, arranged in staggered order, and the raised crown and strengthening web and ribs all the advantages of the bar seen in Figs. 9 to 11 are retained, while at the same time a most efficient bearing-bar is provided for the shafts upon which the choppers are mounted, whereby the different sections of the grate are enabled to be assembled or dismantled with but slight expense, and provision being further made for enabling a grate embodying my invention to be readily placed in position without necessitating the employment of skilled labor, a feature which is of great importance and one to which especial attention is directed.

It will of course be evident that the upper face or crown of the stationary longitudinal bars 8 or 20 can be chilled to the desired degree according to requirements, and it will further be apparent that slight changes may be made by those skilled in the art without departing from the spirit of my invention, and I therefore reserve to myself the right to make such modifications as will come within the scope of my invention and do not desire to be restricted in every instance to the exact construction I have herein shown and described.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a grate for marine and other boilers, a side bar having the double function of a grate-bar and a bearing-bar, said bar being provided with a curved, raised crown having ports therethrough, a longitudinally-extending, depending web, wings depending from either side of the latter, and transverse strengthening-ribs common to said web and wings, one of the latter having depending portions in which bearings are formed, which are adapted to receive the journals of shafts carrying choppers thereon, substantially as described.

2. In a grate for marine and other boilers, side grate-bars located opposite to each other, and having also the function of bearing-bars, said bearing-bars having a longitudinal web, wings depending from either side thereof, and a raised crown with ports therethrough arranged in staggered order, the inner wings having depending portions which are common to their adjacent webs, in which portions bearings are formed, in combination with shafts seated in said bearings with choppers mounted thereon, and longitudinal grate-bars suitably supported intermediate said choppers, substantially as described.

3. In a grate for marine and other boilers, side grate-bars having portions depending from a side thereof, in which bearings are formed, and supporting-blocks located at the front and rear of the furnace and adapted to assist in supporting said bars, in combination with an intermediate bridge-bar, and locking devices common to the ends of said grate-bars

and bridge-bar, whereby lateral and longitudinal shifting is prevented, substantially as described.

4. In a grate for marine and other boilers, a bridge-bar having at its extremities T-shaped slots for the reception of the ends of stationary side bearing grate-bars, said bridge-bar being provided with arc-shaped faces adapted to coact with the faces of adjacent choppers, and having also ledges to support intermediate stationary grate-bars, substantially as described.

5. In a grate for marine and other boilers, the combination of a bridge-bar having T-shaped slots at the extremity thereof, with the side grate-bars having T-shaped ends adapted to be interlocked with said bridge-bar, wings depending from either side of said side bars; the latter having a longitudinal web, a curved crown and ports arranged in staggered order, and being further provided with bearings adapted to receive chopper-shafts, substantially as described.

6. In a grate for marine or other boilers, a pair of side bars provided with a longitudinal web and a raised crown having ports therethrough, the outer surface of said side bars being corrugated, and their inner faces having bearings, shafts adapted to have their ends supported in said bearings, and choppers mounted on said shafts, in combination with stationary bars intermediate said choppers, substantially as described.

7. In a grate for marine and other boilers, a side bar having a longitudinal web, wings depending from either side thereof, one side of said bar being provided with corrugations, while the opposite side is provided with bearings, slots extending from said bearings to the top of the bar, shafts mounted in said bearings, and choppers attached to said shafts, in combination with filling-pieces adapted to be placed in said slots and to bear on said shafts, substantially as described.

8. In a grate for marine and other boilers, supporting devices for the front, rear and intermediate portions of the grate, having front and rear cross-bars mounted thereon, a bridge-bar and blocks supported on said cross-bars, in combination with stationary bars supported on said bridge-bar and blocks, and side grate-bars serving also as bearing-bars, and supporting rock-shafts, choppers mounted on the latter, means for placing said shafts in position after the side bearing-bars have been assembled, and means for actuating said choppers, substantially as described.

9. A grate-bar having a raised crown, a longitudinally-extending web, wings depending from either side of said web, ports through said crown arranged in staggered order, a boss attached to said web and having a passage therethrough adapted to serve as a bearing, and a slot extending from the latter to the top of the bar, substantially as described.

10. In a grate for marine and other boilers, feet adapted to support the front, rear and intermediate portion of the grate, cross-bars supported on said front and rear feet, a bridge-bar supported on the intermediate foot, and blocks mounted on the front and rear cross-bars, in combination with stationary bars supported on said bridge-bar and blocks, side grate-bars serving also as bearing-bars, shafts supported in said latter bars, choppers mounted on said shaft, and means for actuating said choppers, substantially as described.

11. In a grate of the character described, front, rear and intermediate supports, cross-bars mounted on said front and rear supports, blocks attached to said cross-bars, and having ledges and lugs thereon, a bridge-bar having also ledges and lugs thereon and mounted on the intermediate support, and stationary bars and choppers intermediate said bridge-bar and blocks, substantially as described.

12. In a grate of the character described, supporting devices adapted to rest upon a boiler-shell, cross-bars attached to said devices, blocks attached to said cross-bars, a bridge-bar, stationary grate-bars supported by said blocks and bridge-bar, interlocking devices common to said grate-bars, blocks and bridge-bar, and side bearing-bars, in combination with rock-shafts seated in the latter, choppers supported thereupon, and means for actuating the same, substantially as described.

13. In a grate of the character described, a pair of side bars, each having a longitudinal web, a raised crown, ports therethrough arranged in staggered order, bosses attached to said side bars and having a bearing therein, and a shaft having choppers thereon having its journals mounted in said bosses, the choppers nearest to said side bars being provided with an offset, substantially as described.

14. In a grate of the character described, a side bearing-bar having a longitudinally-extending web, a raised crown, ports therethrough arranged in staggered order, wings depending from said crown on either side of said web, a boss attached to said web and having a hole therethrough serving as a bearing, and a slot in said bar extending from said bearing to the top of the bar, a portion of said slot being T-shaped, substantially as described.

15. In a grate, side bearing-bars, serving also as grate-bars, a shaft having choppers thereon, removably supported in said side bars, stationary bars removably supported intermediate said choppers, front, rear and intermediate supports for said side and stationary bars, and means for holding said bars in position so as to prevent lateral and longitudinal shifting, substantially as described.

16. In a grate for marine and other boilers, a side bar having a longitudinal web, wings depending from either side thereof, one side of said bar being provided with corrugations,

while the opposite side is provided with bearings and slots extending from said bearings to the top of said bar, substantially as described.

17. In a grate for marine and other boilers, a side bar having the double function of a grate-bar and a bearing-bar, said bar being provided with a curved raised crown having ports therethrough, a longitudinally-extending depending web, and wings depending from either side of the latter, one of said wings having bearings formed therein, substantially as described.

18. In a grate for marine or other boilers, a supporting-block having a body portion, ears projecting therefrom, a recess in said body portion adapted to interlock with the end of an adjacent grate-bar, said block being provided with a ledge having a curved under portion and a supporting-ledge adjacent thereto, substantially as described.

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