(No Model.) 2 Sheets—Sheet 1.

T. HENDERSON.

GRATE FOR FURNACES.

No. 403,840. Patented May 21 1889.

Fig. 1.

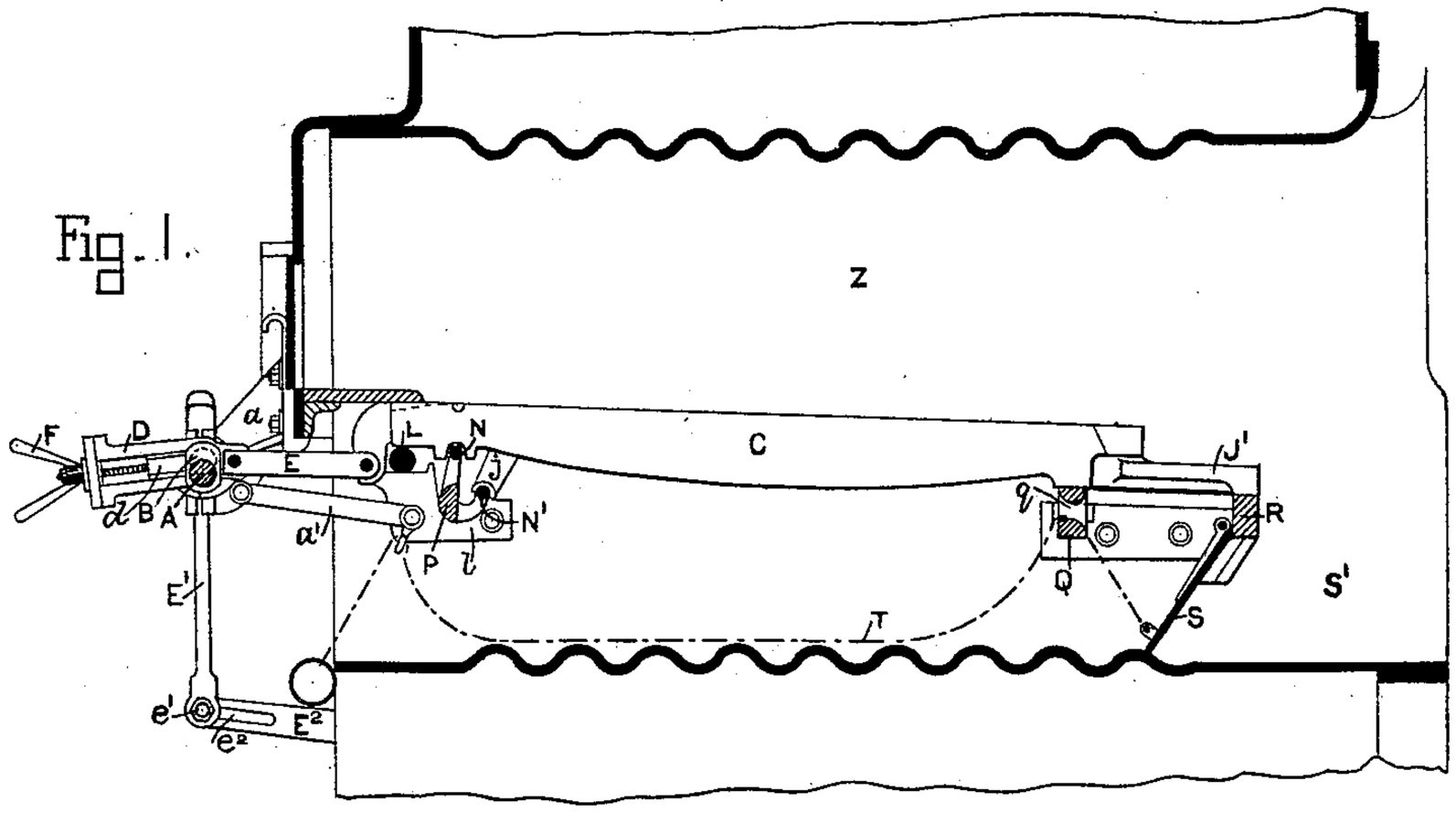
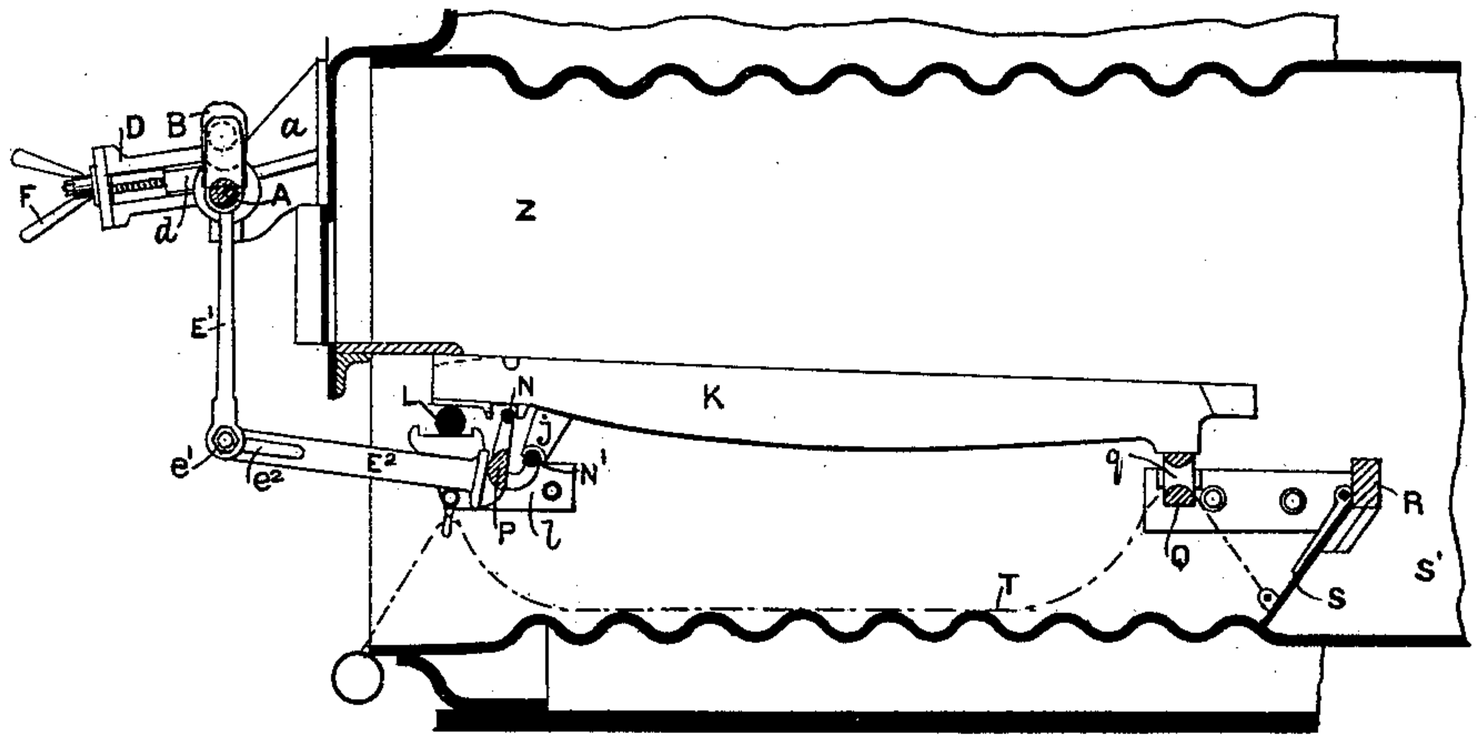


Fig. 2.



Witgesses.
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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

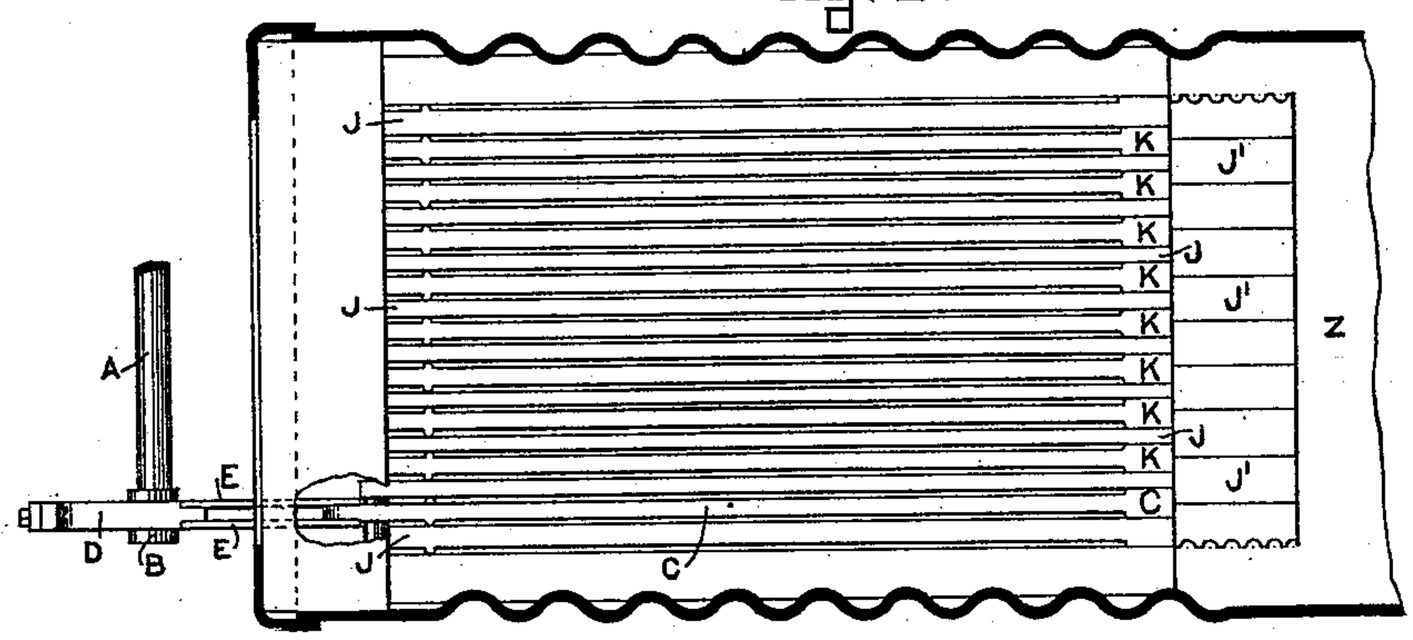


Fig. 4.

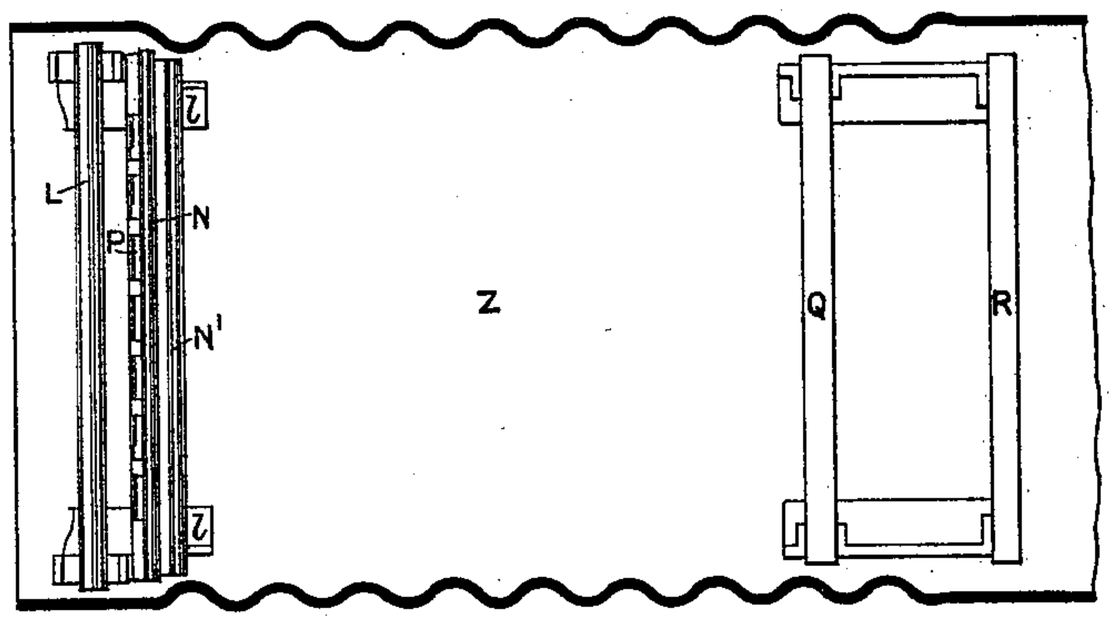


Fig. 5.

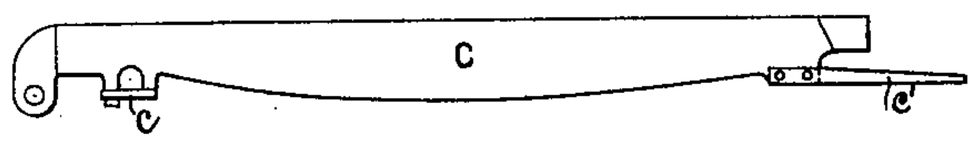


Fig. 6.

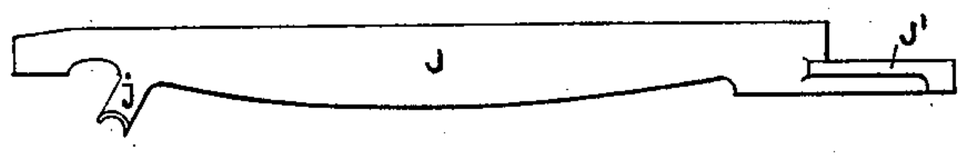
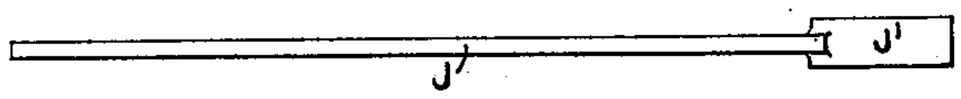


Fig. 7.



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UNITED STATES PATENT OFFICE.

THOMAS HENDERSON, OF LIVERPOOL, ENGLAND.

GRATE FOR FURNACES.

SPECIFICATION forming part of Letters Patent No. 403,840, dated May 21, 1889.

Application filed July 10, 1888. Serial No. 279,503. (No model.) Patented in England October 2, 1876, No. 3,812.

To all whom it may concern:

Be it known that I, THOMAS HENDERSON, engineer, a subject of the Queen of Great Britain, residing at Liverpool, in the county of Lancaster, in the Kingdom of England, have invented certain new and useful Improvements in Grates for Furnaces, (for which I have received Letters Patent in England, dated October 2, 1876, No. 3,812,) of which the following is a specification.

This invention relates to furnaces having vibratory bars and to mechanism for working the same.

The object of the invention is to produce a simple and economical grate for furnaces by means of which the fuel may be fed from one end of the furnace to the other, which can be adjusted acccording to the different sizes and qualities of fuel used, and which can be worked either with or without a mechanical stoker.

The invention may be described by reference to the accompanying drawings, which illustrate the invention as applied to a marine boiler, though it is equally applicable to other kinds of boilers.

Figures 1 and 2 are side views of my invention, the former showing the means for operating the bars C and J, and the latter the means for operating the bars K and J, the connections between the main shaft and the bars being slightly different. Fig. 3 is a central horizontal section of a furnace with the fire-bars in position and a portion broken away to show the actuating mechanism. Fig. 4 is a similar view, with the fire-bars and the greater part of the actuating mechanism removed. Fig. 5 is an elevation of the actuating-bar C. Figs. 6 and 7 are respectively an elevation and plan of the bar J, hereinafter described.

A horizontal shaft, A, runs along the front of the furnaces Z, being supported in suitable brackets, *a*. Upon the shaft A, and opposite each furnace, is a crank, B, or its equivalent, for working the actuating-shaft P. In the two upper furnaces each crank B is connected with the actuating-shaft P by means of a strap, D, link E, and actuating-bar C, Figs. 1 and 3. In the central or lower furnace the crank is connected with the actuating-shaft by means of the connecting-rod E′ and the lever E^2, which are attached to said shaft. (See Fig. 2.) *a′* is a stay for the bracket *a*.

The actuating-bar C, as well as the alternate horizontal reciprocating bars K, rest at each end upon horizontal supports, the support at the rear end being preferably a fixed bearer, Q, while that at the front end is by preference an anti-friction roller, L, which is supported at its ends on brackets *l*. The actuating-shaft P is flanged somewhat in the form of a bell-crank and is placed transversely below the front ends of the bars, being supported at its ends on the brackets *l* in such a manner as to be capable of oscillating thereon. The upper edge of the vertical flange N of the shaft P rests in a notch in the bars K and C. The notch in the actuating-bar C fits the flange N without appreciable play, and is preferably provided with a strap or cover, *c*, as in Fig. 5. The notches in the bars K have very considerable play, so that they can remain stationary while the flange N moves through a small arc of a circle, during which time the alternating bars J are raised vertically at their front ends for a short distance by the approximately-horizontal flange N′ of the shaft P. This latter flange rests in notches in the downward projections *j* of the vertically-oscillating bars J.

The horizontally-moving bars K and C end abruptly a little beyond the bearer Q. The alternate vertically-oscillating bars J do not end abruptly at the same point as the bars K and C, but are at that point stepped down vertically an inch or more, sometimes, perhaps, six or seven inches. Beyond this point the bars J are provided with a horizontal flange, which is extended both in a lateral and rearward direction, as seen at J′ in Figs. 1, 3, 6, and 7. Each part J′ touches or almost touches the part J′ on the next similar bar, so that a flat dead-surface is formed with very small or no air-intervening spaces, this surface being also extended in a forward direction for a short distance below the bars K. The rear ends, J′, of the bars J rest upon a bearer, R, which may be a water-tube, though shown solid in the drawings. The bearer R acts as a pivot, upon which the bars J may turn when moved vertically at their

front ends; or, instead of the bearers Q and R, a flanged shaft similar to P might also be placed below the rear ends of the bars, so that the bars J would be actuated throughout instead of mainly at their front ends.

A roller may be substituted for the bearer Q; but a fixed bearer is preferable, as, if a roller were used, the bars K would be apt to move during the entire stroke of the shaft P instead of during a portion of it only, as before described.

The rear end of the actuating-bar C is preferably provided with a rearwardly-projecting tongue, *c'*, Fig. 6, which serves as an additional guide thereto and prevents any possibility of it being drawn off the bearer Q during its reciprocation.

The movement of the bars may be adjusted to suit different qualities of fuel, as follows: In the upper furnaces the strap D carries a block, *d*, forming one-half of the crank-pin bearing. This block slides within the strap, and its position therein may be adjusted by the winged regulating-nut F or other similar device, so that the crank moves the strap during the whole or during only a regulated portion of its revolution. In the lower furnace the movement of the bars is adjusted by the slot e^2 in the lever E^2 and the adjustable pin *e'* in the connecting-rod E'. A hanging door, S, Fig. 1, is usually hinged to the bearer R and protected by fire-resisting material. A chain, T, attached to this door passes through an eye, *q*, in the bearer Q, and is brought to the front of the furnace, so that the door may be opened when desired.

The action of the apparatus is as follows: The crank B oscillates the flanged shaft P either by means of the strap D, link E, and actuating-bar C, or by means of the connecting-rod E' and lever E^2. During one portion of the oscillation the front ends of the bars J are raised slightly above the level of the alternate bars K, and the latter are drawn forward. During the remaining part of the oscillation the bars J are depressed, and the bars K, with the fuel, are pushed toward the rear of the furnace. The fuel and clinker are thus fed continuously rearward and the bars are kept clean. The fuel is mostly consumed by the time it reaches the rear end of the bars proper, but the clinker falls off the latter onto the dead-surface J', aforesaid, whence it is pushed back by the ends of the bars K and falls down into the space S' behind the door S. This door may be opened when desired and the clinker drawn out at the front of the boiler. The bars may be actuated by any suitable means.

Where a mechanical stoker is used with the furnaces, the shaft A may be driven from it.

I claim as my invention—

1. In combination, the horizontally-reciprocating bars K, a fixed bearer supporting the rear ends, an anti-friction roller supporting their front ends, the alternate bars J, having projections located near the forward end and supported at their rear ends upon a fixed bearing, an actuating-shaft having flanges formed thereon, and means for actuating said shaft, one of said flanges engaging the bars K for reciprocating them back and forth and the other flanges engaging the projections on the bars J, whereby they are tilted, substantially as described.

2. The combination of the shaft P, having vertical and horizontal flanges N N', a bar, C, having a notch formed therein and adapted to engage the vertical flange N, grate-bars K, having notches formed therein also adapted to engage said vertical flange, alternate bars J, having projections formed on their lower surface near the forward end and engaging the horizontal flange N', and means for actuating said bar C, whereby horizontal reciprocation is given the bars K and the bars J are tilted, substantially as described.

3. The combination of the alternate bars K with the alternate bars J, having horizontal flanges J' located below the level of the grate-surface and extended laterally and longitudinally beyond and for a short distance below the rear ends of the alternate bars K, whereby a flat dead-surface is formed with small or no air-spaces, substantially as described.

4. In combination with the shaft P, having vertical and horizontal flanges N N', bars J, having notched projections near their forward end adapted to engage the horizontal flange N', alternate bars K, having notches therein adapted to engage the vertical flange N, said notches being wider relatively to the flange N than the notches in the projections on the bars J, and means for actuating the shaft P, whereby in the movement thereof the bars J will be tilted before the bars K are reciprocated, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

THOS. HENDERSON.

Witnesses:

GEO. C. DYMOND,

H. P. SHOOBRIDGE.