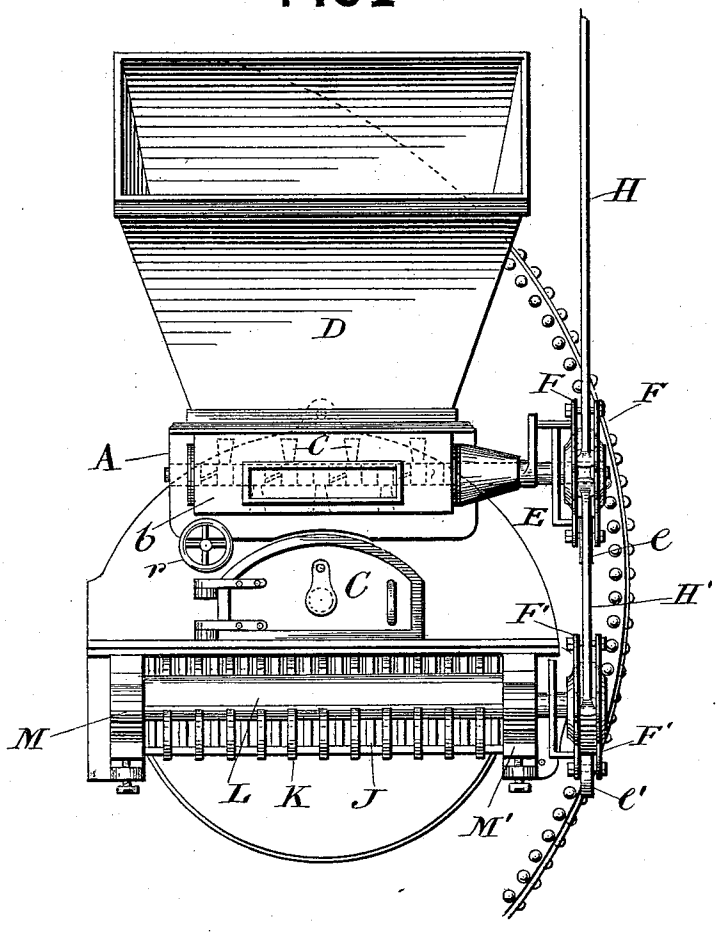
(No Model.) 3 Sheets—Sheet 1.

W. A. AYRES & H. P. RANGER.

MECHANICAL STOKER.

No. 565,253. Patented Aug. 4, 1896.

FIG 1



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 3 Sheets—Sheet 2.

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MECHANICAL STOKER.

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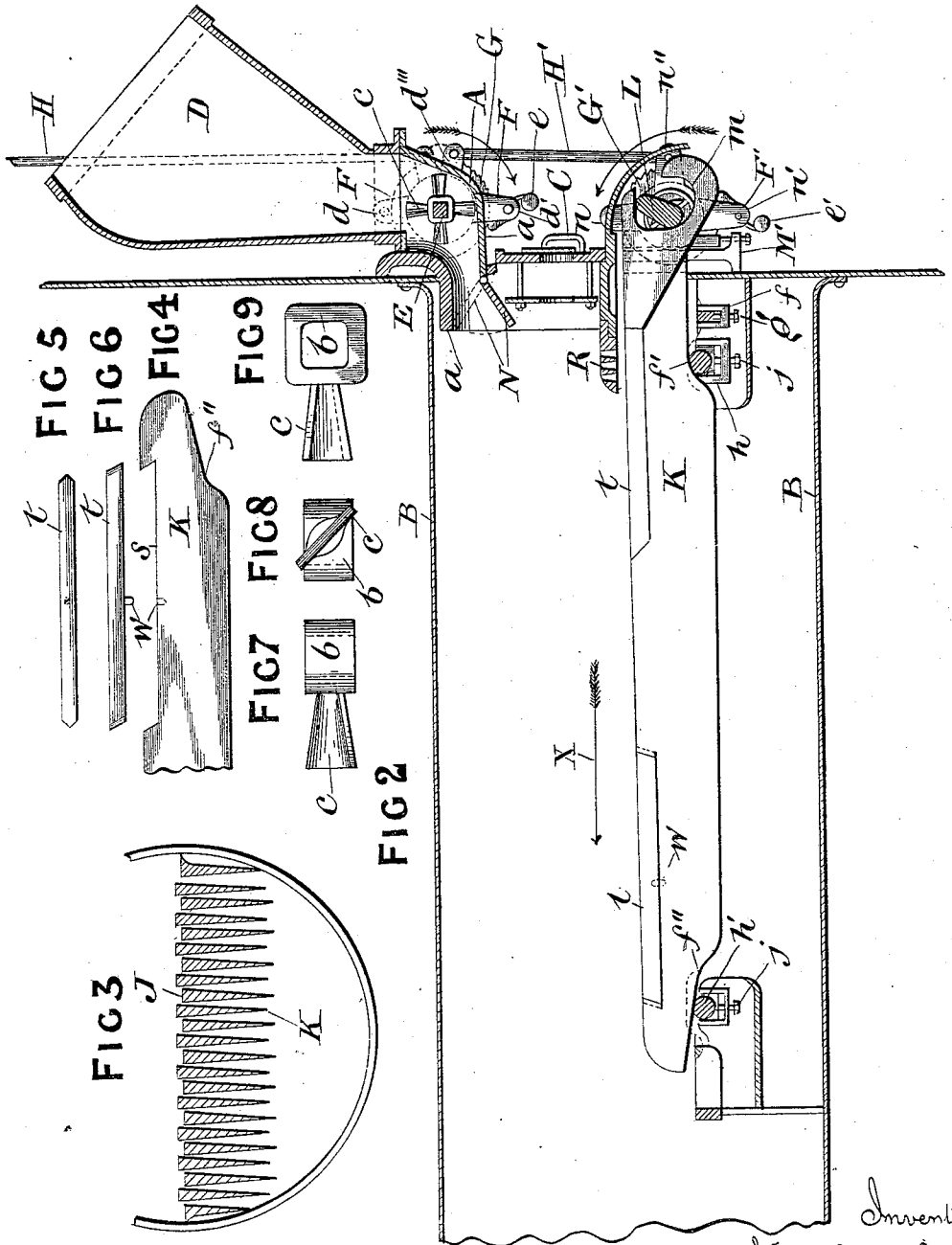

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(No Model.) 3 Sheets—Sheet 3.

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FIG 12

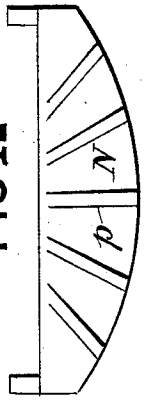


FIG 13

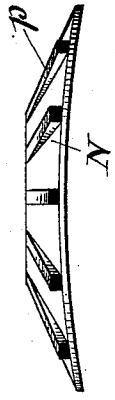


FIG 11

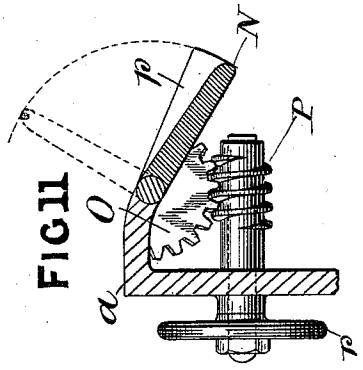


FIG 10½

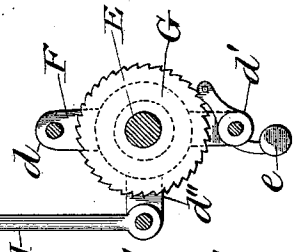


FIG 10

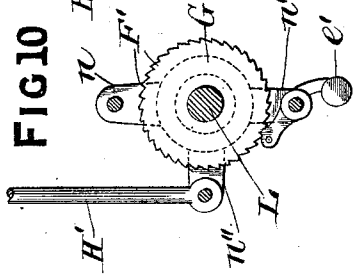
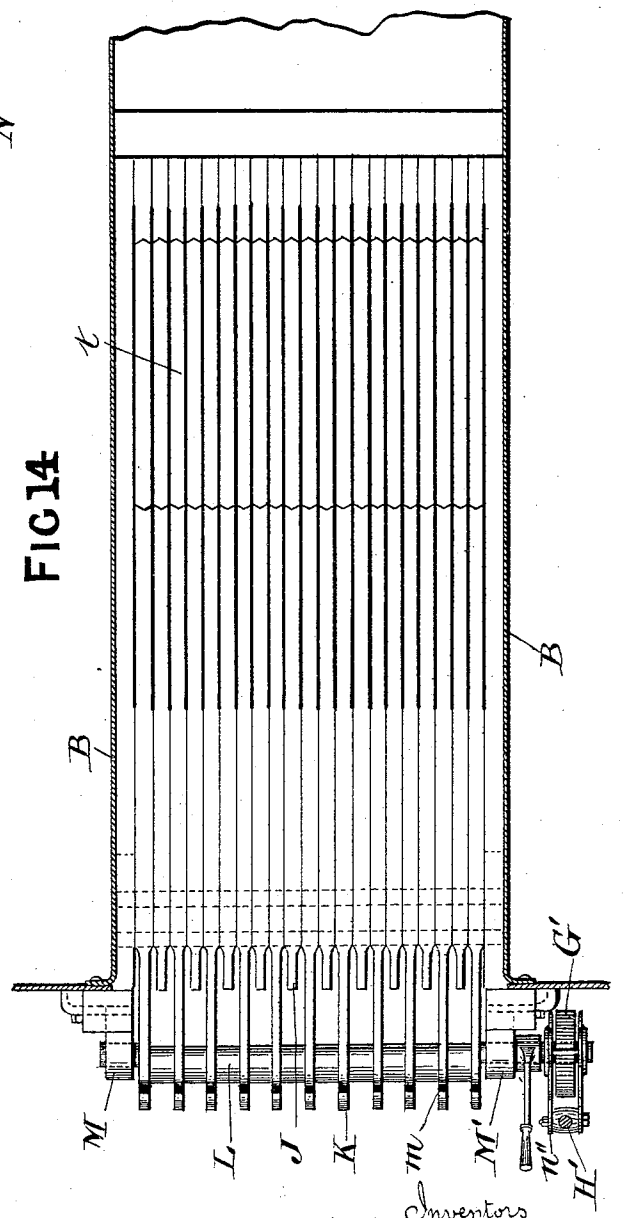


FIG 14



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UNITED STATES PATENT OFFICE.

WALTER ARTHUR AYRES AND HAROLD PELHAM RANGER, OF LONDON, ENGLAND.

MECHANICAL STOKER.

SPECIFICATION forming part of Letters Patent No. 565,253, dated August 4, 1896.

Application filed January 11, 1896. Serial No. 575,174. (No model.) Patented in England April 1, 1895, No. 6,683.

To all whom it may concern:

Be it known that we, WALTER ARTHUR AYRES, of Dace Road, Bow, London, in the county of Middlesex, and HAROLD PELHAM RANGER, of 56 St. George's Road, Leyton, London, in the county of Essex, England, engineers, subjects of Her Majesty the Queen of Great Britain and Ireland, have invented certain new and useful Improvements in and in Connection with Mechanical Stokers for Furnaces, (for which we have obtained a patent in Great Britain, No. 6,683, dated April 1, 1895,) of which the following is a specification.

Our invention relates, first, to improvements in the construction and arrangement of mechanical stokers for furnaces and known as "coking-stokers," and, secondly, to improvements in the bars of such furnaces, the objects of our said invention being to so construct a coking-stoker and arrange the said furnace-bars as to effectually feed and spread the coal continuously and in regular quantities across the whole width of the furnace, thus forming a bank or ridge of coal to be coked in the front of the furnace before being carried by moving fire-bars to the back of same, and we attain these objects by first feeding the coal into a suitable hopper or receiver, and through and from the said hopper the coal is fed by means of a series of propeller-shaped blades joined to and radiating from a sleeve or sleeves or collar or collars mounted upon a shaft or spindle, caused to rotate intermittently at any desired speed, and by these the coal is thus propelled, through an aperture or opening in the furnace, onto an inclined guide-plate, and from this directly upon a perforated dead-plate below, and by this means the coal is equally distributed across the front of the furnace, and by the before-mentioned movable fire-bars conveyed to the back end of same into the coke-pit.

The improvements in furnace-bars forming part of our said invention consist in so constructing these that the parts most subjected to wear may be renewable.

In order that our invention and the manner of its application and operation may be fully and clearly understood, we have hereunto appended a sheet of drawings, in which we have chosen to illustrate its application to the right-hand furnace of a double-furnaced horizontal boiler.

Figure 1 is a front elevation of our improved mechanical stoker fixed in position. Fig. 2 is a horizontal vertical section taken centrally, or thereabout, of Fig. 1, between one of the fixed bars and one of the movable bars according to our invention. Fig. 3 is a vertical cross-section of the furnace and fire-bars, taken centrally of the length of the latter, or thereabout. Fig. 4 is a side elevation of the back end of the fire-bars, illustrating the manner in which we prefer to construct these with a removable and renewable portion at the part at which the greatest wear usually occurs, Figs. 5 and 6 being a plan and side elevation, respectively, of the said removable and renewable portion. Figs. 7, 8, and 9 are enlarged top, front, and side views, respectively, of one of the said propeller-like blades and its rectangular or polygonal sleeve or collar to which it is connected. Figs. 10 and 10½ are enlarged diagrams illustrating the method of operating the intermittent feed of the coal and the moving fire-bars, as hereinafter explained. Fig. 11 is an enlarged section of the lower surface of the feeding-aperture, illustrating the manner in which we prefer to pivotally connect thereto the distributing guide-plate and the mechanism employed for raising the same for closing the said aperture, as hereinafter explained. Figs. 12 and 13 are enlarged and detached plan and front views, respectively, of the said guide-plate. Fig. 14 is a plan view of the fire-bars of the furnace, showing, partly in section, the mechanism for operating such of these as are movable according to and for the purposes of our invention.

We carry our invention into effect by casting or otherwise constructing, of sheet-iron or other suitable metal, a casing A, preferably of the shape shown in Figs. 1 and 2, the lower mouth of which, *a*, is passed through and fits an aperture in the furnace B, just above the door C, whereat the said casing is bolted or otherwise fixed, the upper mouth of which is constructed to receive a hopper D, preferably shaped and provided with a sloping mouth, as at Figs. 1 and 2. Through the said casing

A passes a horizontal spindle or shaft E, preferably rectangular or polygonal in cross-section for so much of its length as is inclosed within A, and upon this portion is mounted a series of short sleeves or collars *b*, each having attached thereto or formed integrally therewith and extending outwardly therefrom a propeller-like blade *c*, (shown detailed by Figs. 7, 8, and 9,) the said sleeves or collars being arranged in such a manner upon the said shaft E that the said blades form a helix or spiral projection radiating therefrom; or in lieu of a series of said sleeves *b*, each carrying a blade *c*, we may employ one such sleeve of a length equal to the said series, from which the desired number of blades *c* may project in like order.

The shaft or spindle E being carried in suitable bearings (which may or may not be the ends of the casing A) has pivotally mounted upon one end thereof a pair of triple-eared plates, such as F, Fig. 10½, the upper and lower ears of which, *d* and *d'*, respectively, are bolted together in such a manner that a space exists between them, and in this space is mounted and keyed or otherwise fixed upon the shaft E a ratchet-toothed wheel, such as G, Fig. 10½, while a weighted pawl *e* is mounted upon the bolt connecting the lower ears *d'* and engages with the teeth of G. The third pair of ears *d''* of the plates F are at right angles or thereabout with the ears *d d'* and are bolted together in like manner, and upon this bolt is pivotally connected the lower end of a vertical rod H, the upper end of which is connected to a short crank, cam, or eccentric upon a power-shaft, or to any other suitable motion by which an up-and-down vertical movement may be imparted thereto, an adjustable joint in the upper end of which said rod may, if necessary, be employed to govern the extent of such movement.

The fixed fire-bars J of the furnace are preferably borne at the front or both ends upon a transverse bar or bars, plate or plates *f*, rendered adjustable vertically by a set-screw, such as *g*, Fig. 2, while the movable bars K are preferably recessed upon their under surfaces at *f'* and *f''* and when in their normal positions rest upon transverse bars or plates *h* and *h'*, rendered adjustable vertically by set-screws, such as *j*, the said movable bars K extending at their front ends beyond the fixed bars J, whereat they are each provided with an aperture *m*, preferably but not imperatively formed as shown in Fig. 2, but which may vary according to the motion desired to be imparted to these bars, as hereinafter explained, but for the purposes of description we assume that they are so formed, and passing through these recesses is a cam shaft or spindle L, the bearing ends of which are journaled in suitable brackets, such as M M', and that extending through the latter has keyed or otherwise fixed thereon a ratchet-wheel G', and pivotally triple-ear plates F', Fig. 10, the upper and lower ears of which, *n* and *n'*, are bolted together in the same manner as the plates F, before described, with the lower one *n'* carrying a pawl *e'*, Fig. 1, substantially as at Fig. 10. To the central or horizontal ears *n''* of the plates F' is pivotally connected the lower end of a rod H', the upper end of which is connected to the lower end of the rod H, before described, such connection between H and H' being either by a link or by forming two eyes in the ears *d''* of the plates F, the upper eyes of which may be connected to the lower end of the rod H, while the lower eyes of same may be connected to the upper end of the rod H', as suggested by *d'''* in Fig. 2, the object of this being that the vertical movements of H and H' may be identical and both receiving motion from the same source.

Referring again to the casing A and the views Figs. 11, 12, and 13, the lower surface of the mouth *a* of this has pivotally connected thereto a guide-plate N, upon the upper surface of which are radial ridges *p*, and the said plate is arranged to be raised and lowered by a worm-wheel O, fixed upon one of its pivoted ends, engaging with a worm P, operated by a wheel or handle, such as *r*, and when the plate N is lowered, as shown by the full lines in Fig. 2, this and its ridges *p* serve to distribute the coal fed through *a*, which would be spread by this onto a perforated plate R, Fig. 2, and from this onto the initial end of the fire-bars, but when (as shown by dotted lines in Fig. 2) the plate N is raised this closes the mouth of *a* and prevents the coal in A from becoming ignited by the flames from the furnace.

Referring again to the fire-bars J and K, it is found in practice that these burn and wear out at their back ends more quickly than elsewhere, and to accommodate such wear we construct this end of these renewable by forming in that part of their upper surfaces a recess, such as *s*, Fig. 4, and to occupy such recesses we provide portable pieces, such as *t*, Figs. 5 and 6, which may be of chilled iron or steel, which are retained in position by forming the ends of these V-shaped, as shown by the plan view, Fig. 5, and by providing like-shaped apertures in the fire-bars at each end of the recesses *s*, with which the ends of *t* engage, as shown in Fig. 14, and, further, by suitable pins or dowels *w* upon *t*, which engage with like holes in the fire-bars.

The manner of operation is as follows: The coal being deposited in the hopper D, and intermittent motion imparted to the rods H and H', the former of these rods, by oscillating the plates F, would, by the pawl *e*, impart an intermittent rotary motion to the ratchet G, and consequently the shaft E and the propeller-like blades *c* thereon, in the direction of the upper arrow, Fig. 2, the said blades regularly and evenly breaking the coal and pushing it through the open mouth of *a* onto the guide-plate N, and by reason of the convex formation of this and the ridges *p* thereon

the coal would slide from this and be deposited evenly and in all directions onto the plate R, and from this onto the front or initial end of the fire-bars J and K. The intermittent vertical motion of the rod H would impart a like motion to the rod H', and this by oscillating the plates F' would, by the agency of their pawl *e'*, impart an intermittent rotary motion to the ratchet-wheel G', and consequently the cam-shaft L, in the direction of the lower arrow, Fig. 2, and this in its course of rotation would by colliding with the upper portion of the aperture *m* first raise the front end of all the bars K above the fixed bars J, and continuing on would push the same bars backward in the direction of the arrow X, Fig. 2, and as the wider portion of these adjacent to the recess *f''* rose upon the bar or plate *h'* the back ends of the bars K would be also raised, and by the return motion of the cam L the said bars K would be again returned to their normal position, as shown in Fig. 2. By this means the whole of the alternate bars K are caused to first rise above the fixed bars J and then travel horizontally between them, lower and return to their original position once to every revolution of the cam-shaft L, the adjustment of the screws *h h'* serving to regulate the distance that the bars K may in their return motion fall below the level of the fixed bars J, and by this continued horizontal motion of the bars K the fuel would be gradually carried from the front to the back end of the bars in short and regular stages, the rise and fall of these above and below the bars J serving to break up the clinkers, clear

The combination may be varied as desired the air-spaces, and effect perfect combustion of the fuel, ultimately depositing the exhausted portion of the fuel into the ash or clinker pit at the end of the bars in the usual way.

We may find it convenient or desirable that certain of the bars K may have a motion differing from or to a greater or lesser extent than the others, and it is obvious that this may be easily effected by altering the shape, length, or height of the apertures *m* in such bars.

The method of and means for raising the guide-plate N for closing the mouth *a* will be fully understood and the necessity for doing so fully conceived by all person conversant with stoking without further explanations.

We may find it desirable to provide more than one recess, such as *s*, in the upper surface of the fire-bars for the reception of renewable portions, such as *t*, an example of which is shown by *t'* in Fig. 2, and it is obvious that the same method of providing renewable portions is applicable to the fire-bars of all furnaces whether the said fire-bars be fixed or otherwise.

Having now particularly described our said invention, we declare that what we claim is—

1. In combination with a furnace, the casing having a horizontally-extending mouth projecting into the furnace, the ribbed distributing-plate hinged to the bottom of said casing, means for raising and lowering said plate, a spiral feeder horizontally arranged in said casing with means for imparting a step-by-step rotation thereto, and a hopper mounted above said casing, substantially as described.

2. In an improved mechanical stoker for furnaces, the combination of a casing such as A, carrying a hopper or receiver such as D, and having a mouth such as *a* entering the furnace B, and carrying a guide-plate such as N, arranged for closing the mouth of *a* by suitable gearing such as O, P, *r*, the shaft E carrying propeller-like blades such as *c*, arranged in helical form, and the means for imparting intermittent motion to such shaft by a ratchet-wheel such as G, operated by a pawl such as *e* carried upon a double plate such as F mounted upon E, and caused to oscillate by the means of a rod H receiving intermittent motion from a cam, crank, eccentric or the like, operated by a power-shaft, substantially as and for the purposes herein described and shown by the appended drawings.

3. In combination with the mechanical stoker a cam-shaft such as L, intermittently rotated by a ratchet-wheel such as G', operated by a pawl such as *e'* upon a double plate such as F', caused to oscillate by the means of a rod H', connected by a link or otherwise to and receiving motion from the rod H, the movable fire-bars K arranged alternately with fixed bars J and having apertures such as *m* operated by the cam-shaft L and mounted upon adjustable bars *h h'*, the said bars K and J having removable and renewable portions such as *t*, substantially as and for the purposes herein described and shown by the appended drawings.

4. A grate-bar for boiler-furnaces having a cut-away portion terminating in inclined walls combined with a removable reinforcing-piece having beveled ends corresponding to said inclines and having a pin projecting from its bottom face and entering a recess in the grate-bar, substantially as described.

In witness whereof we have hereunto set our hands in presence of two witnesses.

WALTER ARTHUR AYRES.
HAROLD PELHAM RANGER.

Witnesses:
GEORGE THOMAS HYDE,
SAMUEL JOHN EARL.