(No Model.) 2 Sheets—Sheet 1.

J. HODGKINSON.

MECHANICAL STOKER.

No. 574,423. Patented Jan. 5, 1897.

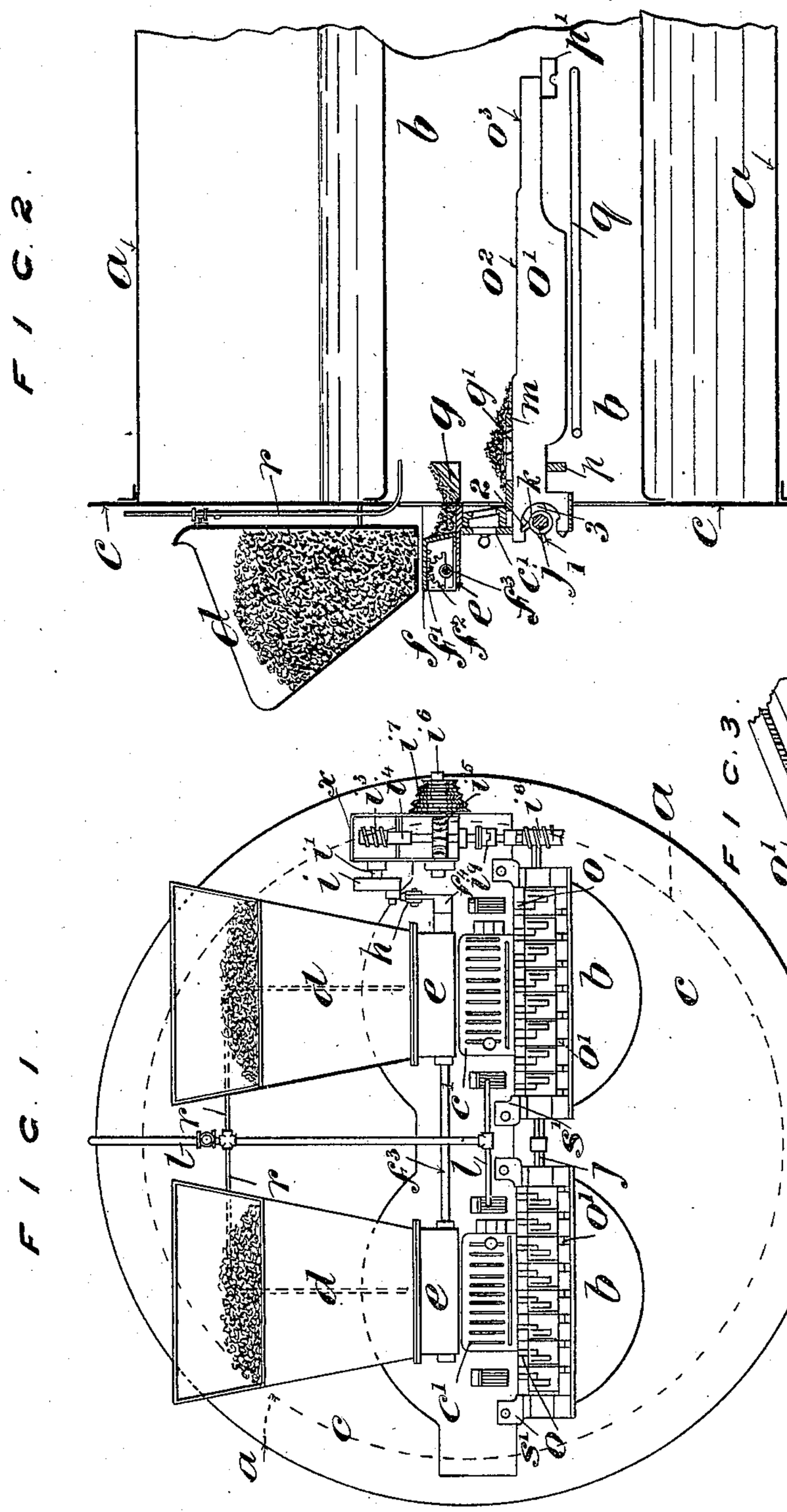


FIG. 1.

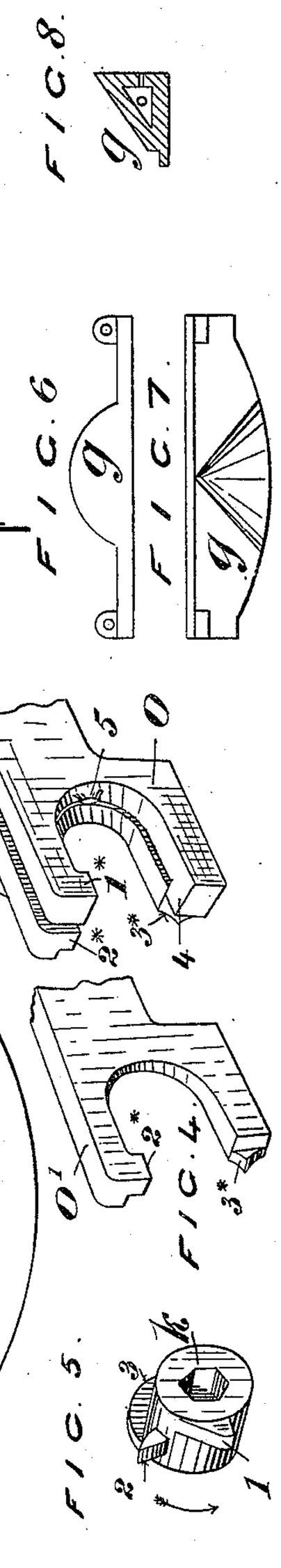


FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

Witnesses
H. Vaul Oldenweel
E. A. Scott

INVENTOR
James Hodgkinson
By his attys. Reicardt & R

(No Model.) 2 Sheets—Sheet 2.

J. HODGKINSON.
MECHANICAL STOKER.

No. 574,423. Patented Jan. 5, 1897.

FIG. 10.

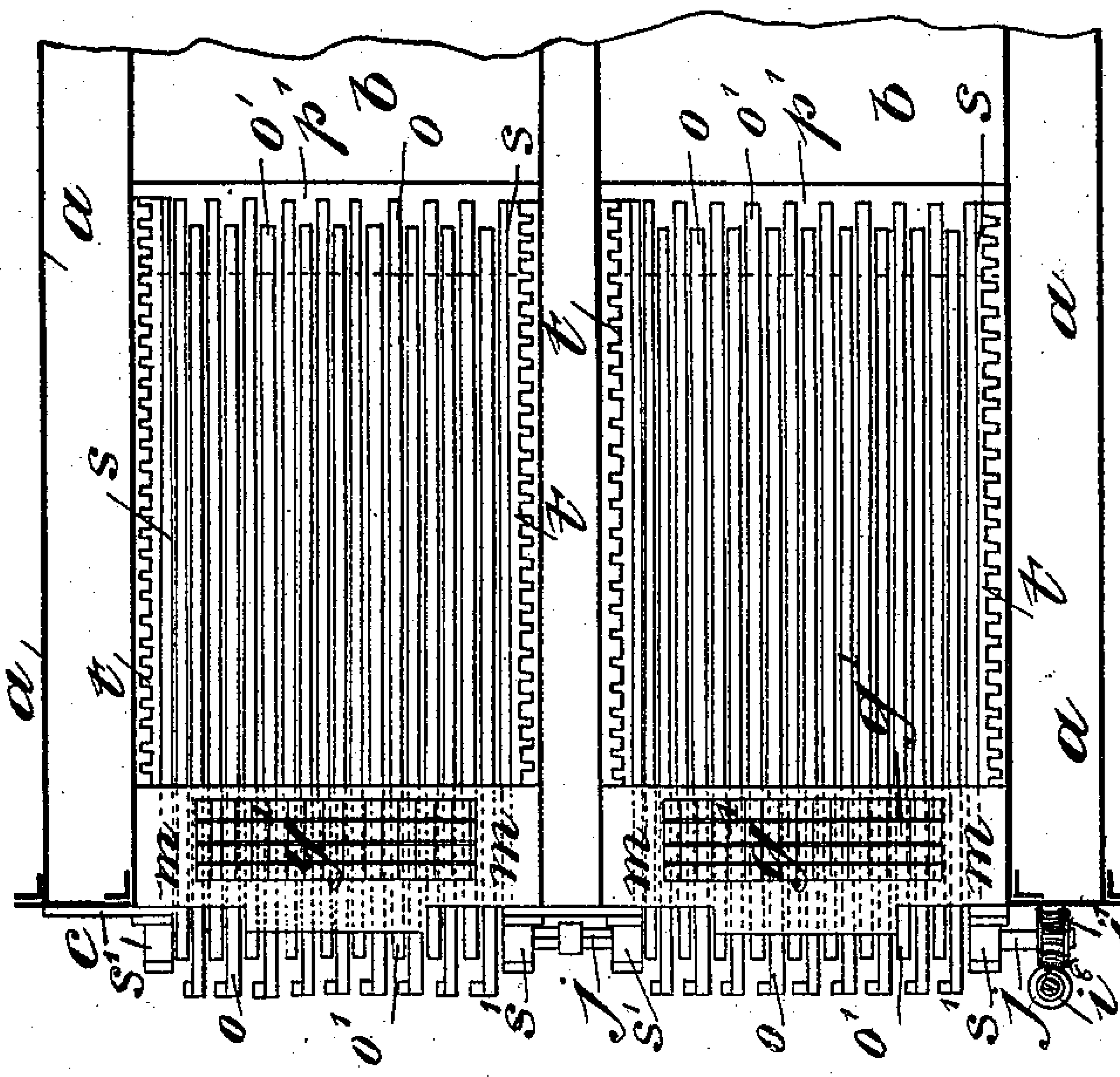


FIG. 12.

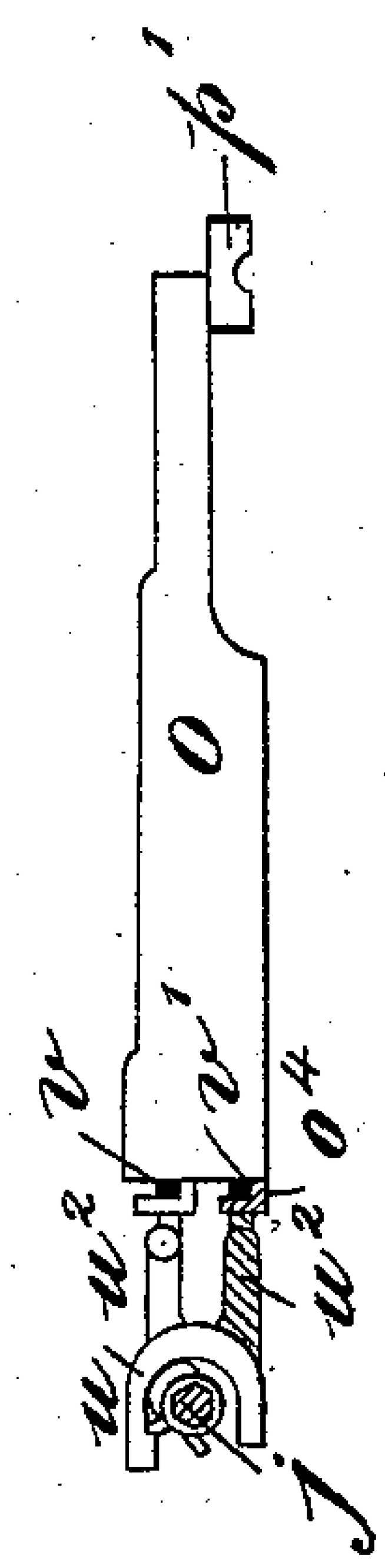


FIG. 9.

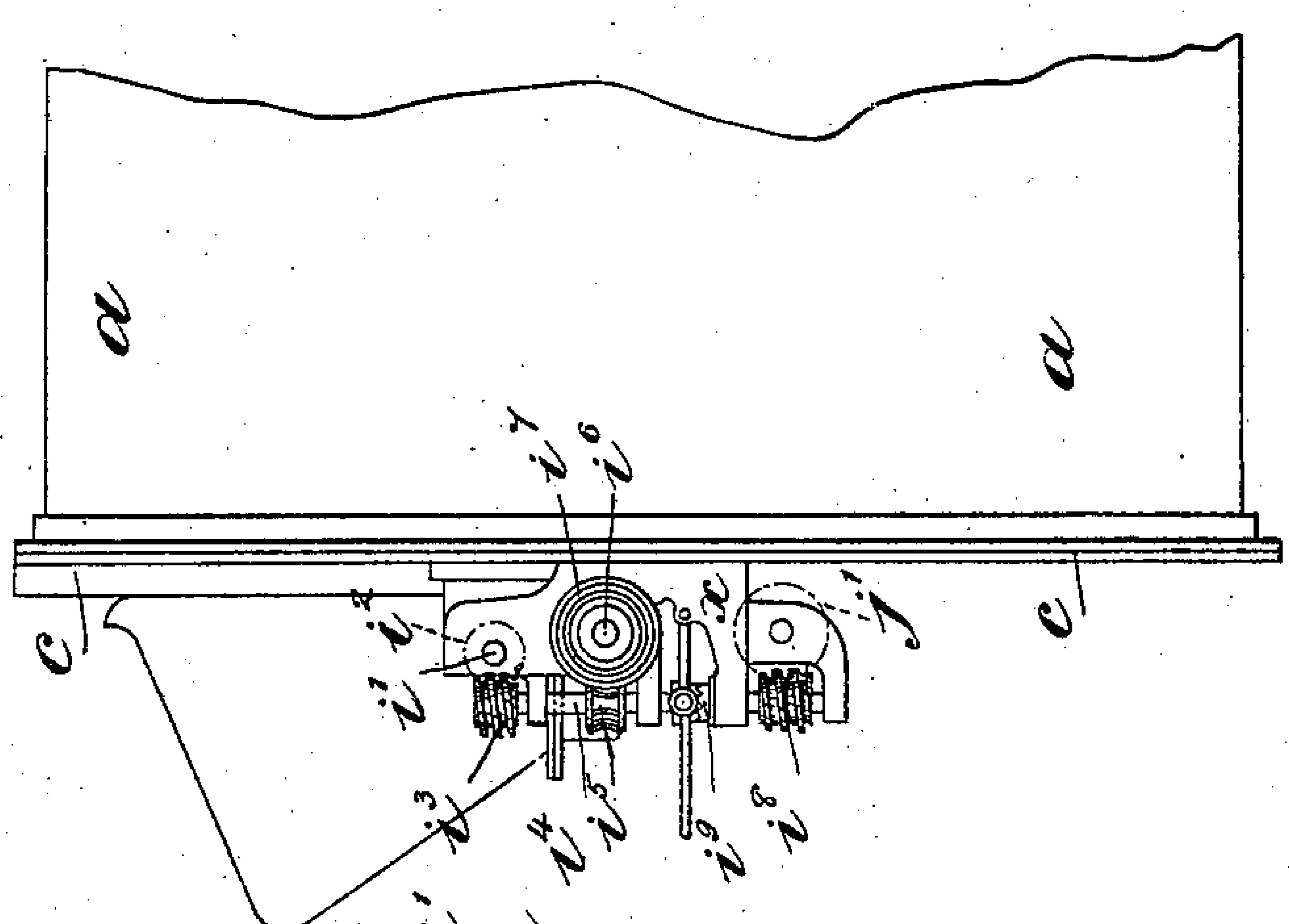


FIG. 11.

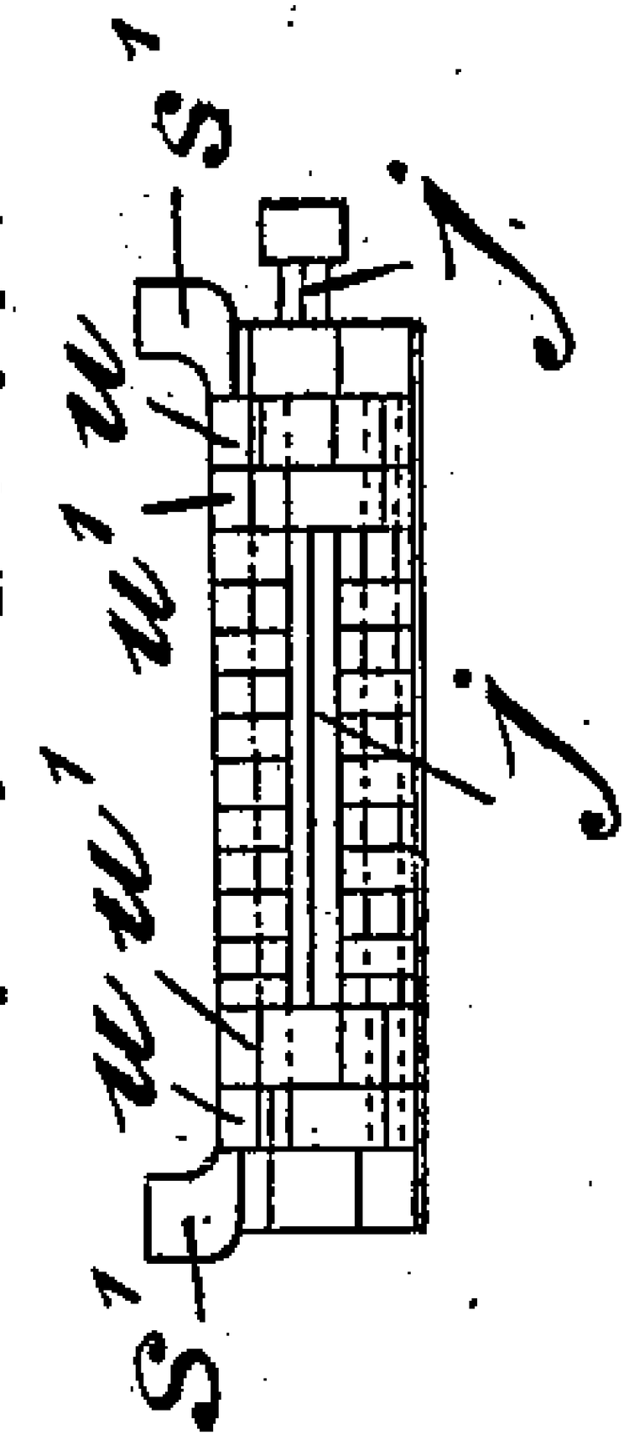
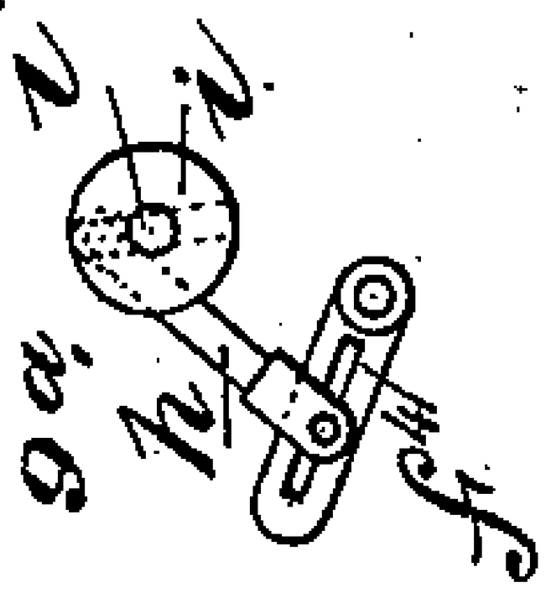


FIG. 9a.



Witnesses.
H. van Oldenneel
E. A. Scott

Inventor.
James Hodgkinson
By his Attorneys Richards & Co.

UNITED STATES PATENT OFFICE.

JAMES HODGKINSON, OF MANCHESTER, ENGLAND.

MECHANICAL STOKER.

SPECIFICATION forming part of Letters Patent No. 574,423, dated January 5, 1897.

Application filed July 8, 1896. Serial No. 598,468. (No model.) Patented in England July 20, 1894, No. 13,984, and in Germany August 2, 1895, No. 86,930.

To all whom it may concern:

Be it known that I, JAMES HODGKINSON, a subject of the Queen of Great Britain, and a resident of Manchester, Lancaster county, England, have invented certain new and useful Improvements in Mechanical Stokers, (which have been patented in Great Britain, No. 13,984, dated July 20, 1894, and in Germany, No. 86,930, dated August 2, 1895,) of which the following is a specification.

My invention relates to mechanical stokers for steam-boiler furnaces, and relates to certain improvements whereby such stokers are simplified in construction and made more reliable and economical in action, while the steam-producing powers of the boiler are largely increased.

In describing my invention I will refer to the annexed two sheets of drawings.

On Sheet 1, Figure 1 is a front view of a double-flued boiler fitted with my improved automatic stoker. Fig. 2 is a longitudinal vertical section of the boiler and stoking apparatus. Figs. 3 and 4 are perspective views of the front ends of the movable fire-bars composing the grate. Fig. 5 is a view of one of the cams which move the fire-bars. Figs. 6, 7, and 8 are views of the distributing throat-plate or shelf in front of the pusher of the stoker. On Sheet 2, Fig. 9 is a side view of the end of the boiler and stoking apparatus. Fig. 9^a shows the crank-disk and lever for moving the pusher. Fig. 10 is a plan view of the furnace-grates and coking-plates of the boiler. Figs. 11 and 12 are views of a slight modification of the mode of working the fire-bars.

Referring to the said drawings, the boiler-shell is marked *a* and the flues *b*. The cast-iron front plate *c* carries the doors *c'* and the stoking and fire-bar-actuating mechanism. The fuel-hoppers *d* are mounted upon the pusher-boxes *e*, and within the said boxes *e* I place pushers *f*, which move in and out toward and from the throat-plate or shelf *g*. The interior of each pusher is furnished with teeth f', gearing with segments f^2, which are fixed on a rocking shaft f^3, extending through both pusher-boxes, as shown in Fig. 1. The shaft f^3 carries a lever f^4, as shown most clearly at Fig. 9^a, which is connected by a link *h* with a revolving crank-disk *i*, both lever and disk being slotted, so as to give facilities for adjusting the stroke of the lever f^4.

The disk *i* is carried on a spindle i', which spindle has a worm-wheel i^2, which gears with a worm i^3 on the upright spindle i^4. A worm-wheel i^5 on the spindle i^4 gears with a worm on the driving-spindle i^6, and this spindle is rotated by a band engaging with a pulley-cone i^7. The lower end of the spindle i^4 carries another worm i^8, which gears with a worm-wheel j' on the end of the shaft *j*, which carries the cams *k* to operate the fire-bars. Upon the upright spindle i^4 I place a clutch i^9, operated by a handle i^{10}. If it is wished to stop the operation of the cams *k*, it is only necessary to shift this clutch, when the cams come to rest, while the action of the pushers is maintained. The foregoing description will show how all of the working parts of the stoker are operated from the pulley-cone i^7.

The spindles and parts just described are all supported in a casing or frame *x*, bolted to the boiler-front *c* and appearing most clearly in Fig. 9.

Returning to the pusher *f*, it will be seen that there is an opening in the foot of the hoppers *d*, and as the pusher slides back this opening is uncovered, so that some of the fuel in the hopper falls down in front of the pusher. (See Fig. 2.) At the next advance of the pusher the opening in the front of the hopper is closed and the fuel in front is pushed forward upon the throat-plate or shelf *g*. This throat-plate or shelf *g* is shown in Figs. 6 to 8 and is mainly a bar bolted at each end to the boiler-front *c* and having a semiconical lump in the center, which has the effect of spreading and equally distributing the fuel as it is pushed upon and over the shelf. The shelf may either be a simple solid bar, as shown in section in Fig. 2, or it may be made hollow, as shown in Figs. 6 to 8, in which case I blow steam into it from the steam-pipes *l*, appearing in Fig. 1. This keeps the plate or shelf *g* cool and prevents it from burning away. The fuel as it passes over the shelf *g* becomes heated and partially coked, and as it is pushed over the edge of the shelf *g* it falls upon the coking-plate *m*, situated beneath the shelf. The coking-plate *m* may be a plain plate or

it might be made with a number of pockets g', which are filled with refractory material, with a small hole in the center to admit air.

The pockets of refractory material keep the plate from cracking or burning away. The fuel when resting on this plate becomes wholly or partially coked, and the gases driven off in the process pass forward into the furnace and are consumed without the production of smoke. The continuous creeping movements of the fire-bars O O′ draw the coked fuel from the fixed coking-plate m and pass it forward over the furnace-grate. The furnace-doors c' are made with air-slits, as shown, and may be packed with refractory material.

I will now describe the arrangement and action of the fire-bars O O′. It will be seen on referring to Fig. 10 that these fire-bars are divided into two sets, one set being marked O and the other set O′. The bars are arranged alternately and rest upon front bearers p and back bearers p'. (See Figs. 2 and 10.) To keep the bars and bearers cool, I arrange a steam-pipe q beneath, as shown in Fig. 2. The front ends of the fire-bars are fashioned in a manner which will be most clearly understood by a reference to Figs. 3 and 4. In Fig. 3 I show the front ends of two alternate bars O and O′ side by side. In Fig. 4 I show the front end of the bar O′ alone.

I have already referred to the cam-shaft j and the cams k and have indicated how these are rotated from the pulley-cone. There is one cam k for each two bars O and O′, and I will now describe how cam k in revolving draws out first the bars O, then the bars O′, and then carries both series of bars back at once. As seen at Fig. 2, the cams k occupy the jawed spaces in the front ends of the bars O O′. Supposing that both series of bars have been pushed in, I will trace the operation of the cams in bringing them out and returning them.

One of the cams k is shown separately at Fig. 5, and it will be seen that it carries three different projections in three different planes. The said three projections are marked 1, 2, and 3. The duty of projection 1 is to draw the bar O out. The duty of projection 2 is to draw the bar O′ out. The duty of projection 3 is to prevent the bar O′ from coming out with the bar O before its time. Now suppose that the cam k is revolving in the direction of the arrow and that projection 1 is approaching the toe 1* on the bar O, the bars lying together, as in Fig. 3. When the projection 1 strikes the toe 1*, the bar O is drawn forward in advance of the bar O′. While the cam is drawing this the rounded projection 3 of the cam bears upon the concave face of the step 3*, and thus the bar O′ is prevented from accompanying the bar O, which otherwise it might easily do by frictional contact or by the binding effect of clinkered fuel or the like between the bars. The bars O having been thus drawn out and the bars O′ left behind, the general plan of the bars would show as in Fig. 10. The continued rotation of the cam k causes the projection 1 to revolve clear of the toe 1*, and at the same time the part 3 revolves clear of the step 3*. The projection 2 of the cam now comes against the toe 2* of the bar O′, and the obstruction to its advance having now been removed the bar O′ is drawn forward level with the bar O.

A portion of the toe 2* is cut away, as shown at Figs. 3 and 4, so as to permit the part 3 of the cam to pass. In Fig. 2 the bar O′ is represented as being drawn out by the projection 2 of the cam k.

A small pap 5 on the inner curved face of the jawed end of the bar O abuts against the revolving circular boss of the cam k, so that the bar O is prevented from being further advanced by the frictional or binding effect of the advancing bar O′.

If the reader will now look at Fig. 3, it will be seen that the lower member of the jawed front end of the bar O has a sidewardly-extending heel 4, which rests against and half overlaps the lower member of the jawed front of the bar O′. This is for the purpose that when the projection 1 of the cam k in its continued revolution strikes upon the lower end of the bar O and pushes it in the said overlapping heel 4 causes the bar O to take the bar O′ back with it. The bars are thus returned to the position from which they started and the cam recommences the operation just described. It will thus be seen that the fire-bars are drawn out in two alternate and successive series or sections, and are all returned at the same time. The result is that the united inward stroke of all the bars at once has the effect of drawing the fuel from the coking-plate m and advancing it through the furnace, while the progressive and divided advance of the bars enables the fuel to be left behind. In addition to this, the front edge of the coking-plate m and the successive steps O^2 O^3 on the bars all tend to the forward feeding of the fuel. Besides, by the differential movements of the bars clinkers are broken up and more perfect combustion of the fuel and smoke is effected.

To assist combustion, I might introduce a jet of steam into the front of the furnace by means of the pipes r, which are connected to the steam-pipes l. As shown in the plan view, Fig. 10, there are fixed side bars s on each side of the sets of movable bars O O′, the said fixed side bars being bolted to blocks s', which are attached to the boiler-front c. These blocks s' serve as bearing-blocks to support the cam-shaft j, the said blocks s' appearing in Figs. 1 and 10. To fill up the spaces between the said fixed side bars s and the sides of the flues, I employ finger-bars t, which may be loosely connected in any suitable manner to the said side fixed bars. For example, they might be dropped into hooks projecting from the fixed bars. An ordinary bridge may be arranged behind the back bearer p'.

Instead of providing a cam *k* for every two bars, as described, I might arrange say two cams at each end of the cam-shaft and work the bars by rods extending across in front of the grate. Such an arrangement is indicated at Figs. 11 and 12, Fig. 11 being a front view and Fig. 12 a side view. Jaw-pieces *u u'* are arranged at each end of the cam-shaft *j*, and are connected by extensions u^2 to cross-rods *v v'*, which drop into hooks O^4 at the front ends of the bars. Each rod *v v'* works its own alternate set of bars. For instance, the rod *v*, operated by the jaw-pieces *u*, works the bars O, while the rod *v'*, operated by the jaw-pieces *u'*, works the bars *o'*. By this means I am enabled to dispense with a number of the cams *k*.

I claim as my invention—

1. In combination, the hopper, the pushers for feeding the material, the coking-plate *m* for receiving the same and arranged directly over the grate-bars, the grate-bars and the shelf *g* having a projection on its upper surface adapted to distribute the material said shelf being interposed between the coking-plate and the pushers, substantially as described.

2. In combination the hopper, the hollow pushers having the racks within the same, the segments within the boxes engaging the racks, the rocking shaft carrying the segments and the power connections for driving the rock-shaft, including the disk and the link *i*, substantially as described.

3. In combination, the reciprocating grate-bars having recessed heads connected thereto, with projections and the reciprocating cams having projections to operate the bars in succession one way and for returning them in unison, said cams having a projection to lock one bar against movement while the other bar is moved, substantially as described.

4. In combination, a pair of grate-bars having heads connected therewith, the head of one bar having an opening with an inwardly-extending projection and a laterally-extending projection, the head of the other bar having an inwardly-extending projection and a locking projection or step, and the cam having projections to engage the inwardly-extending projection of the grate-bar heads and having also a locking projection to engage the locking projection on one of the heads, one of the teeth of the cam being arranged to engage the lateral projection on the grate-bar head for moving both of them to the rear, substantially as described.

5. In combination, the two series of grate-bars, the heads *u'* common to the two series and the cams for operating the heads and the series of bars, substantially as described.

6. In combination with the pusher *f* or its equivalent, the distributing-shelf *g* formed with a semiconcave hump substantially as described and shown.

In witness whereof I have hereunto set my hand in presence of two witnesses.

JAMES HODGKINSON.

Witnesses:

JOSHUA ENTWISLE,

RICHARD IBBERSON.