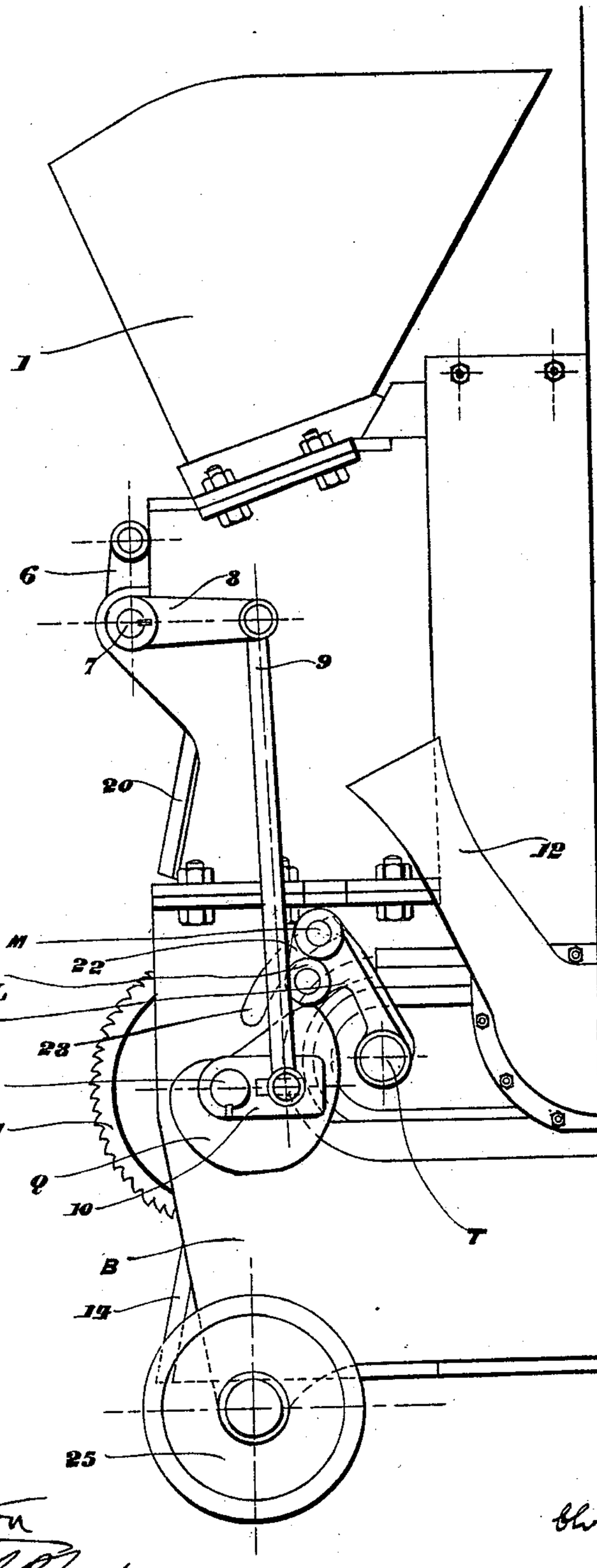
(No Model.) 5 Sheets—Sheet 1.

C. W. JAMES & G. WATSON.

MECHANICAL FURNACE OR GRATE.

No. 583,378. Patented May 25, 1897.

FIG 1.



Witnesses,
Thos. Dobson
Robert R. P. London

Inventors:
Christopher W. James.
George Watson.

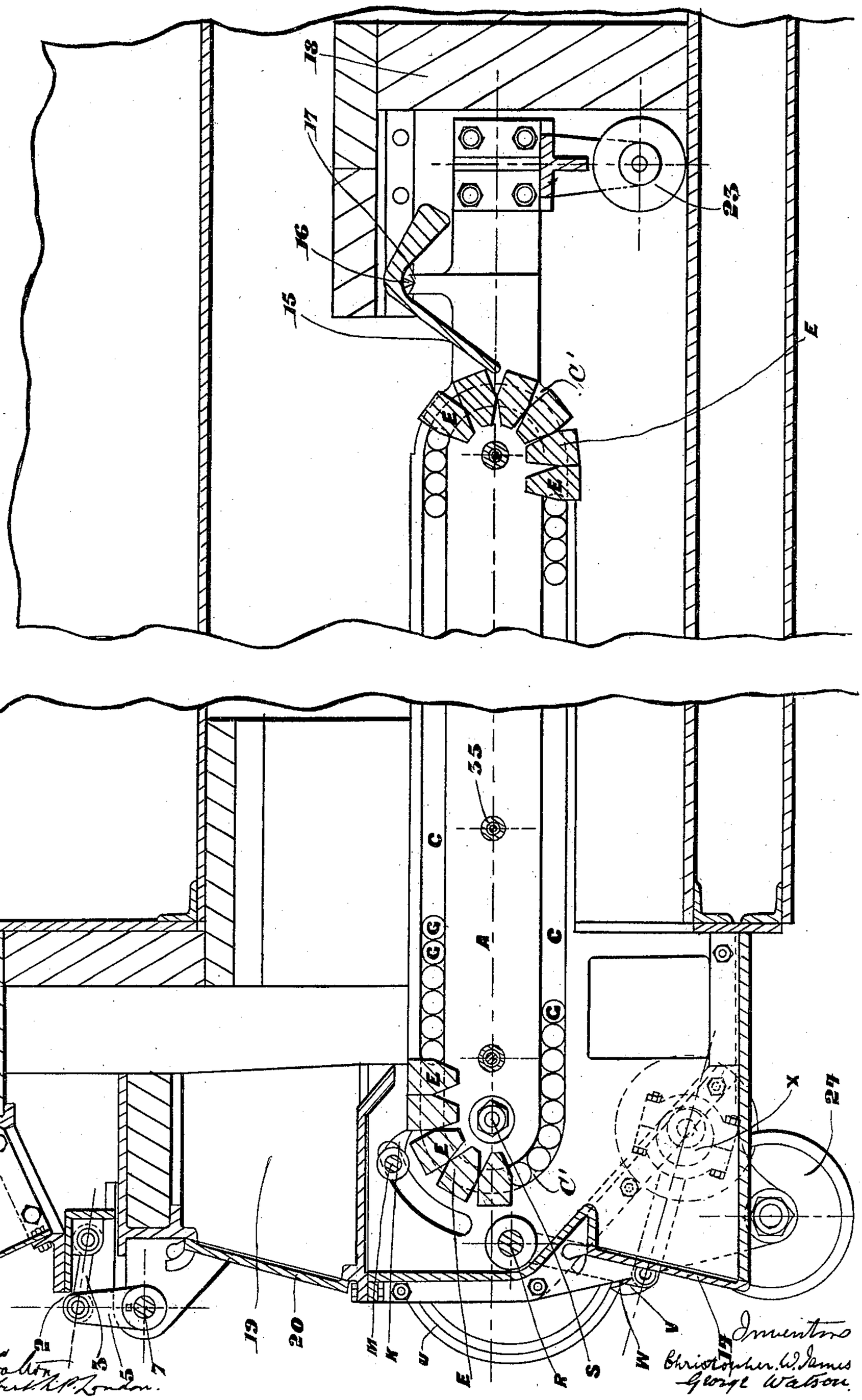
(No Model.) 5 Sheets—Sheet 2.

C. W. JAMES & G. WATSON.

MECHANICAL FURNACE OR GRATE.

No. 583,378. Patented May 25, 1897.

FIG 2.



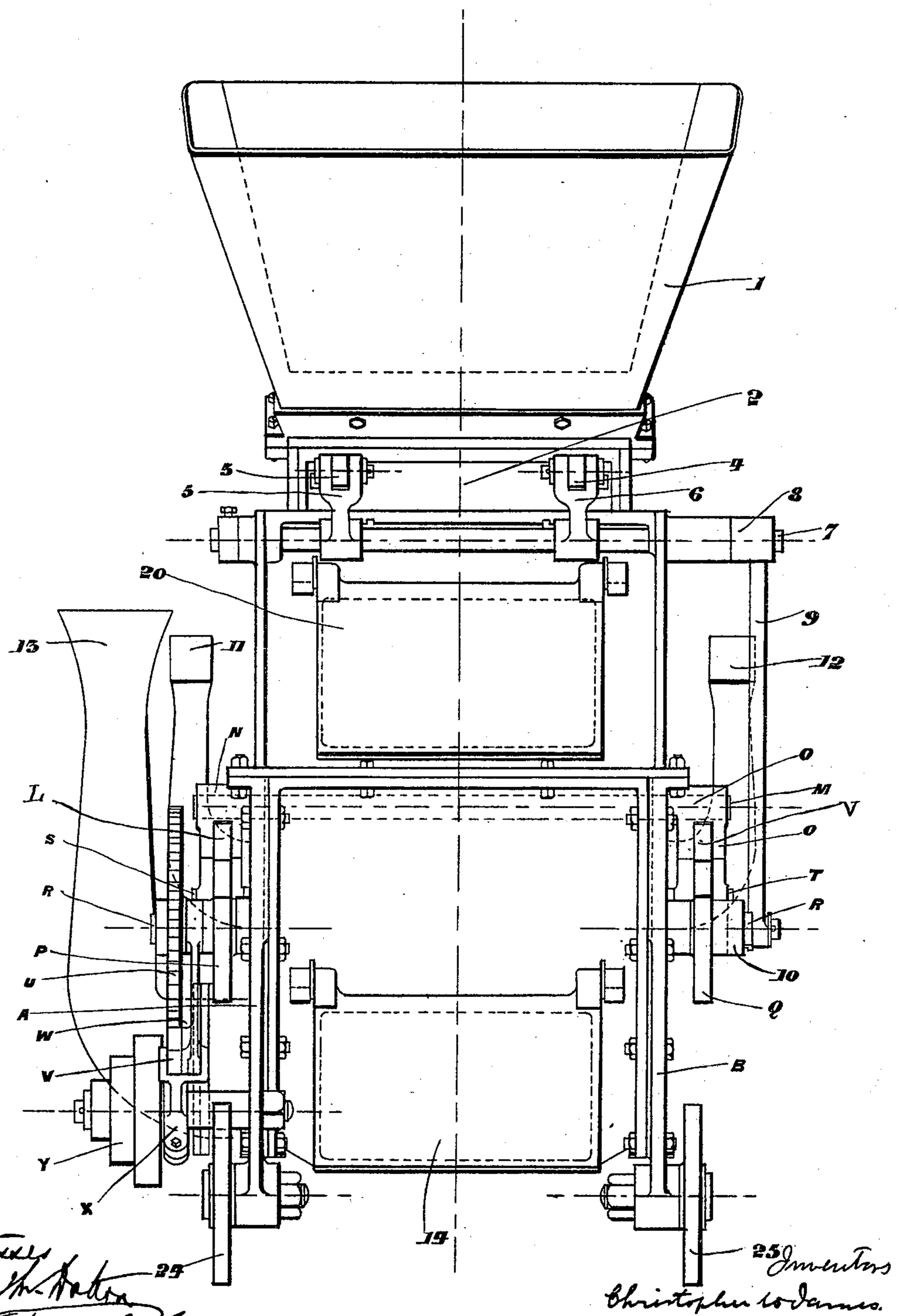
(No Model.) 5 Sheets—Sheet 3.

C. W. JAMES & G. WATSON.

MECHANICAL FURNACE OR GRATE.

No. 583,378. Patented May 25, 1897.

FIG 3



Witnesses
Herbert L. P. London.

Inventors
Christopher Jodamus.
George Watson.

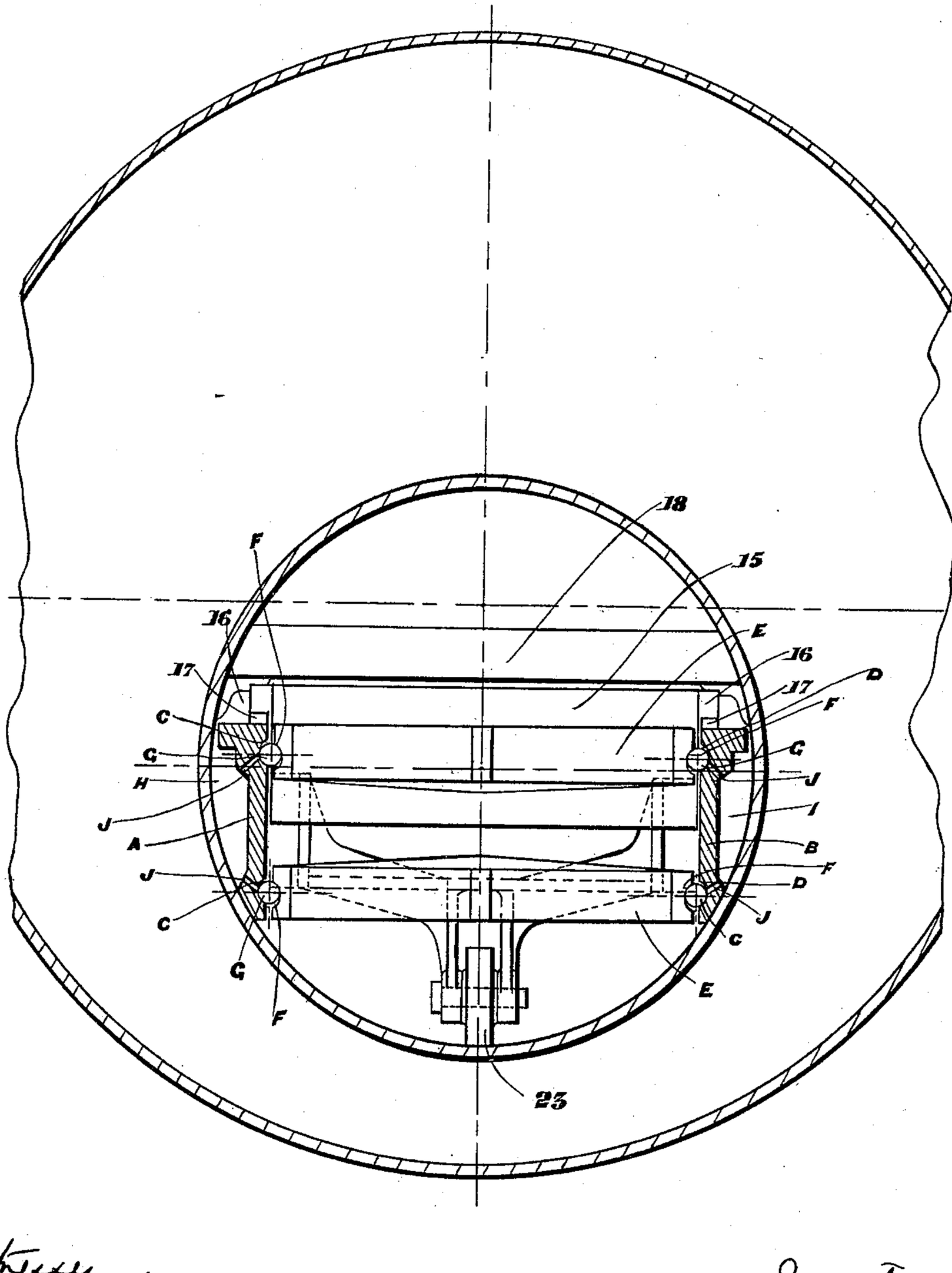
(No Model.) 5 Sheets—Sheet 4.

C. W. JAMES & G. WATSON.

MECHANICAL FURNACE OR GRATE.

No. 583,378. Patented May 25, 1897.

FIG 4



Witnesses,
Thos. Dalton
Herbert P. London.

Inventors.
Christopher W. James
George Watson.

(No Model.) 5 Sheets—Sheet 5.

C. W. JAMES & G. WATSON.

MECHANICAL FURNACE OR GRATE.

No. 583,378. Patented May 25, 1897.

FIG 7

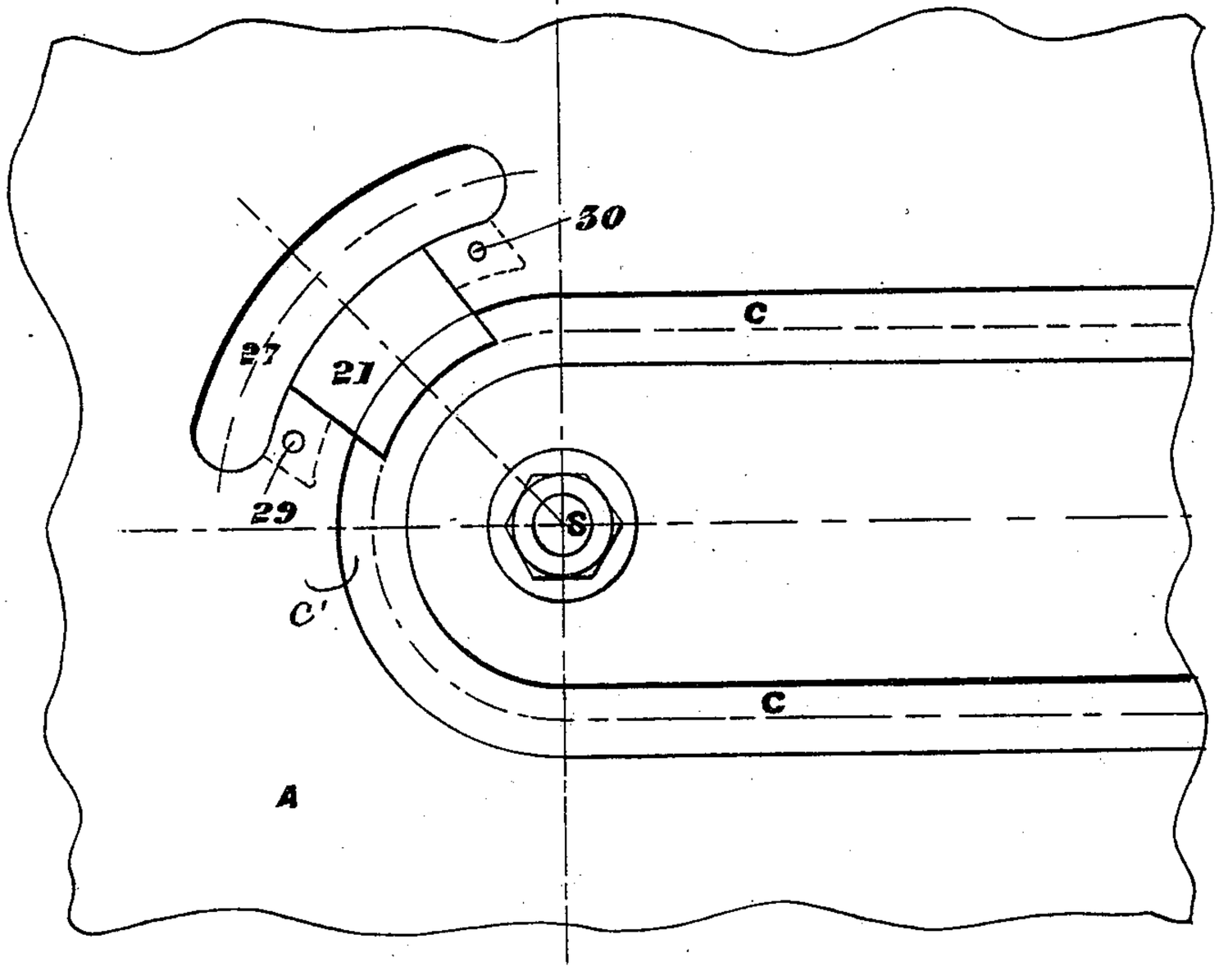


FIG.5.

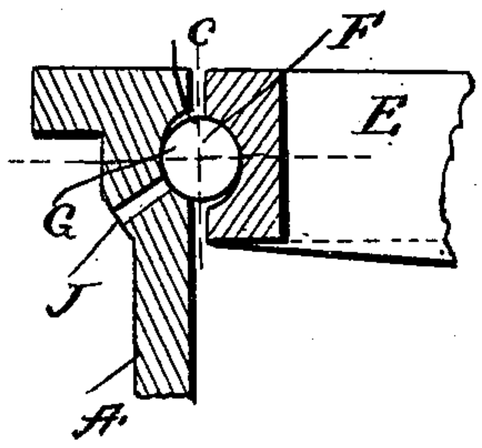


FIG.8.

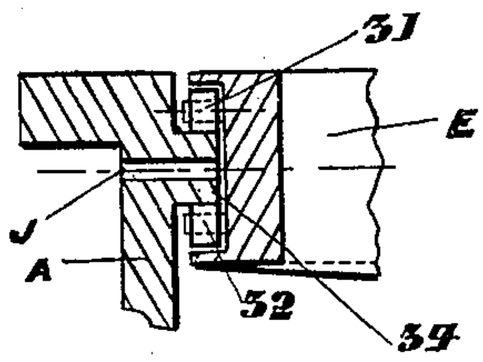


FIG.6.

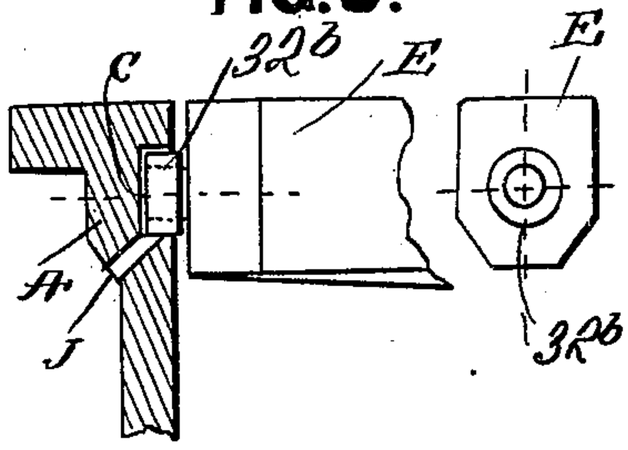
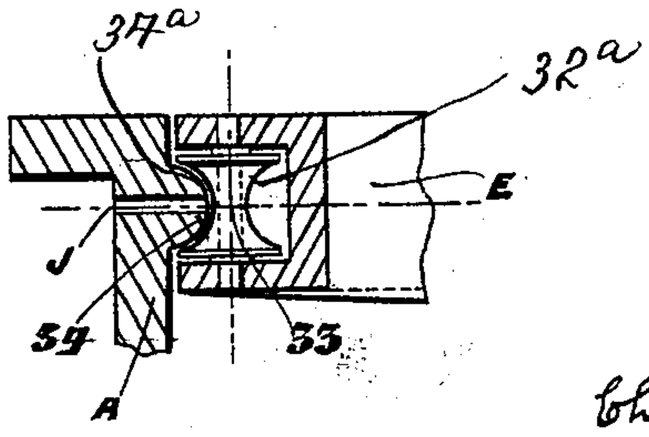


FIG.9.



Witnesses
W. Baker
Herbert P. London.

Inventors
Christopher W James.
George Watson.

UNITED STATES PATENT OFFICE.

CHRISTOPHER WILLIAM JAMES AND GEORGE WATSON, OF LEEDS, ENGLAND.

MECHANICAL FURNACE OR GRATE.

SPECIFICATION forming part of Letters Patent No. 583,378, dated May 25, 1897.

Application filed February 12, 1896. Serial No. 579,080. (No model.) Patented in England December 20, 1894, No. 24,752; in France December 3, 1895, No. 252,168; in Belgium December 16, 1895, No. 118,669, and in Germany November 21, 1896, No. 89,332.

To all whom it may concern:

Be it known that we, CHRISTOPHER WILLIAM JAMES, of South View, Potternewton Lane, Chapel Allerton, and GEORGE WATSON, formerly of 2 Woodsley Terrace, but now of 21 Springfield Mount, in the city of Leeds, England, subjects of the Queen of Great Britain, have invented certain new and useful Improvements in Mechanical Furnaces, (for which we have obtained Letters Patent in Great Britain, No. 24,752, dated December 20, 1894; in Belgium, No. 118,669, dated December 16, 1895; in France December 3, 1895, No. 252,168, and in Germany November 21, 1896, No. 89,332,) of which the following is a specification.

This invention relates to what are known as "mechanical furnaces," particularly boilers, evaporators, and refuse-furnaces, wherein traveling grate-bars are set transversely in the furnace structure.

The chief object of the present invention is to provide a new and improved construction of traveling grate and to facilitate the motion of the grate-bars.

To accomplish this object, our invention consists in the features of construction and in the combination or arrangement of parts hereinafter described and claimed, reference being made to the accompanying drawings, in which—

Figure 1 is a partial side elevation of a mechanical furnace embodying our invention. Fig. 2 is a longitudinal central sectional view taken vertically through the same. Fig. 3 is a front elevation of the same. Fig. 4 is a transverse sectional view. Fig. 5 is a detail sectional view showing a portion of one side of the furnace structure and one end portion of a grate-bar with a roller-bearing interposed between the parts. Fig. 6 is a similar view showing a modification of the invention. Fig. 7 is a detail elevation showing a portion of one of the continuous or endless guideways, and Figs. 8 and 9 are detail views of modifications hereinafter explained.

In order to enable those skilled in the art to make and use our invention, we will now describe the same in detail, referring to the drawings, wherein—

The letters A and B indicate the sides of a furnace structure constructed, respectively, with upper and lower horizontal grooves C C and D D, which are connected at their ends by semicircular or rounded grooves, as at C′, (best seen in Figs. 2 and 7,) for the purpose of producing in each side of the furnace a continuous or endless guideway.

The traveling endless grate of our invention is composed of a plurality of independent and disconnected grate-bars E, arranged transversely in the furnace structure between the sides A and B thereof. As best seen in Figs. 4 and 5, the horizontal grooves C C and D D and the semicircular or rounded grooves, as at C′, are semicircular in cross-section, and the ends of each independent grate-bar are constructed with semicircular horizontal grooves or cavities in which balls or spheres G are arranged in such manner that the balls or spheres lie partly in the semicircular horizontal grooves or cavities in the ends of the grate-bars and partly in the grooves C C and D D. The balls or spheres enable the grate-bars to travel easily and smoothly and greatly facilitate the motion of the grate.

As best seen in Figs. 2, 4, and 5, the grate-bars are supported by the balls or spheres, and it is possible for the entire set of independent grate-bars to travel horizontally along the horizontal grooves C C and D D and around the semicircular or rounded connecting-grooves, as at C′.

Instead of making the grooves in the sides of the furnace structure semicircular in cross-section, as best seen in Fig. 5, the grooves may be made approximately square in cross-section, as at C, Fig. 6, and in this event the ends of the independent and disconnected grate-bars, as at A, will be provided at their ends with journals carrying rollers or roller-bearings in the form of disks or wheels, as at 32^b; or, as shown in Fig. 8, the continuous or endless guideways at the sides of the furnace structure may be in the form of laterally-projecting ribs, as at 34, Fig. 8, approximately square in cross-section. In this event the independent and disconnected grate-bars, as at E, will be provided at their ends with upper and lower rollers or roller-bearings 31 and 32, which bear against the upper and lower sides of the rib 34; or, as shown in Fig.

9, the laterally-projecting rib, as at 34ª, may be semicircular in cross-section and the grate-bars, as at E, provided with rollers or roller-bearings, as at 32ª, constructed with concaved peripheries to fit the semicircular rib.

It should be understood that where the laterally-projecting ribs 34 or 34ª are employed they will be arranged in substantially the same manner as the grooves C C D D and semicircular or rounded portions C′ for the purpose of producing continuous or endless guideways in or on the inner surfaces of the sides A and B of the furnace structure.

The sides of the furnace structure are provided with channels, orifices, or passages J, leading to the roller-bearings, so that air may be blown through the channels, orifices, or passages, as will hereinafter appear, for the purpose of blowing away any dust or ashes which may fall into the path of the roller-bearings to prevent any clinkers adhering to the roller-bearings and, further, to cool the parts and aid in combustion of the fuel upon the traveling endless grate. This is accomplished by providing the spaces H and I between the surface of the boiler-flue and the sides A and B of the furnace structure, as best seen in Fig. 4. The spaces H and I may be in the form of a hollow casing attached to the sides A and B, and into these spaces air may be blown, so that such air will pass through the channels, orifices, or passages J for the purposes before stated.

The mechanism preferably used to actuate the grate-bars and cause them to travel forward consists of two pawls K, (see Fig. 2,) mounted upon the shaft M, (also shown in Figs. 1 and 3,) which engage the bars at or near the the curve at the outer end of the furnace. The shaft M passes through both pawls and through slots 27 and 28, Figs. 1, 2, and 7, provided in the sides A and B to allow of its proper movement, and is secured at its ends to the free ends of the two levers or radius-arms N O, which cause it, and therewith the pawls K, to oscillate in the arc of a circle. The levers or radius-arms N O are provided with rollers L, Figs. 2 and 3, by which they bear upon and are actuated by the two cams P Q, Fig. 1, keyed or otherwise fastened on a shaft R, the cams being of such a size and shape as to move the ends of the levers N O through a certain distance, which may preferably be about or a little more than the width of one grate-bar, so that when the cams operate the levers, and through them the pawls K, all the grate-bars are driven forward through the distance aforesaid. When this has been done, the cams in the course of their rotation allow the levers N O and the pawls K to drop back to the bottom of their stroke and engage with the next grate-bar, ready for the above action to be repeated. The arms or levers N O are attached to studs S T, Figs. 1, 2, 3, and 7, fixed upon the sides A and B, preferably concentrically with the curve traversed by the grate-bars in passing the semicircular portions, as at C′, so that the pawls K follow the same curve as the grate-bars.

As the speed at which the fire-bars, and consequently the cams P Q, are required to move is comparatively slow, it is convenient to drive the cam-shaft R by some form of reducing-gear, and we have shown for this purpose in Figs. 1, 2, and 3 a ratchet-wheel U, driven by a ratchet V, which ratchet V is attached to a radius-link W and is driven by an eccentric X, attached to or forming part of the speed-cone Y.

The feeding-gear which we prefer to use consists, as in Figs. 1, 2, and 3, of a hopper 1, at the bottom of which is a broad pusher or plunger 2. This plunger is driven backward and forward through a suitable distance and at a suitable speed to give the requisite rate of feed. The fuel is placed in the hopper 1 and pushed out at the bottom as required by the action of the plunger 2, when it falls onto the grate and is carried forward and burned, as in other traveling furnaces. The plunger 2 may be driven by means of connecting-rods 3 4 and levers 5 6, keyed or otherwise fastened upon a shaft 7, to which is secured a lever 8, which is in turn driven by a connecting-rod 9 and a lever 10, attached to the cam Q or otherwise secured to and rotating with the cam-shaft R, which drives the grate, as before described. The rate of action of the plunger 2 is thus proportioned to the speed of travel imparted to the grate, but the length of stroke of the plunger 2 may be varied by altering the position of the connecting-rod 9 upon the lever 10, which is provided for that purpose with a slotted hole, Fig. 1, so that the connecting-rod 9 may be clamped to the lever 10 in any desired position within the limits of the slotted hole, and thus the thickness of fire upon the bars may be varied at will.

Air may be blown or forced into the spaces H I between the frame sides and the inner surface of the flue by means of a fan or blowing-engine or by one or more steam-jets or other common means, if any. We prefer to make use of steam-jets for this purpose, and when we do so two trumpets 11 12, Figs. 1 and 3, may be provided, attached to the frame sides, a steam-jet being preferably placed to blow into each trumpet. We also prefer to use one or more steam-jets for a like purpose when using our traveling grate with forced draft, and in the drawings we have shown the place of introduction of the blast by the trumpet 13 at one side of the frame; but one common source of air-supply may be used both for forcing the fire and for blowing into the spaces H I for the purposes hereinbefore mentioned. For example, one or more steam-jets may be placed close together and blowing into one trumpet and the stream of air be afterward divided by suitable pipes as required. A door 14, Figs. 1, 2, and 3, is used to close the ash-pit when the furnace is being used with forced

draft. It may be opened when required for the removal of ashes and clinker. A trap-door 15 at the back or inner end of the furnace prevents the escape of air, while at the same time allowing the clinker to drop over the end of the grate. The door 15 swings upon knife-edges 16, resting upon bearers 17.

The trap-door is so balanced that the weight of the clinker will readily cause it to open downward, and afterward, when the clinker drops off, it will return to its proper position. We have not shown the alternative or additional common method of a door under the fire-bars.

18 is the bridge, which we prefer to construct of fire-brick quarries, or bricks so disposed as to protect the trap-door 15 as far as possible from the direct action of the flames.

19 is the combustion-chamber, which we also prefer to line partly or wholly with fire-brick and to provide with a fire-brick arch over the first or outermost portion of the grate to protect the boiler-plates at that part from the intense heat and to maintain a high temperature for the ready ignition of fresh fuel and the consumption of smoke.

20, Figs. 1, 2, and 3, is a fire-door, of good size, so that access to the fire may be readily had, if required.

For the removal of any or all of the bars, when required, we provide two loose pieces 21 and 22, one on each side, (see Figs. 1 and 7,) in the frame sides, which may be retained in place by screws or bolts 29 and 30; and the position in which we prefer to place these loose pieces is that shown clearly in Fig. 7, Sheet 6.

We prefer to carry the whole mechanism, including the feeding-gear according to the common method, upon wheels, one, 23, at the inner end within the flue and two, 24 and 25, at the outer end, resting upon the firing-floor, Figs. 1, 2, 3, and 4. By these means the whole mechanism can be readily removed from the flue.

Having thus described our invention, what we claim is—

1. The combination in a furnace structure, of side pieces each having a continuous guideway composed of upper and lower horizontal guide portions and circular guide portions connecting the extremities of the upper and lower horizontal portions, an endless chain of loose balls or spheres lying in the continuous guideway of each side piece, and a grate composed of disconnected grate-bars having recessed ends which engage and are supported by the loose balls or spheres, said balls or spheres being retained in operative position and guided in their travel from the upper to the lower horizontal guide portions and conversely through the medium of said circular guide portions of the continuous guideway, substantially as shown and described.

2. The combination in a furnace structure, of side pieces each having continuous guideways composed of upper and lower horizontal guide-grooves and circular guide-grooves connecting the extremities of said upper and lower horizontal grooves, independent, disconnected grate-bars having cavities in their ends, and balls or spheres lying partly in the cavities and partly in said horizontal and circular grooves, said grate-bars being retained in operative position and guided in their travel from the upper to the lower horizontal guide portions and conversely through the medium of said circular guide portions of the continuous guideway, substantially as and for the purposes described.

3. The combination in a furnace structure, of side pieces having continuous guideways composed of upper and lower horizontal portions and circular portions connecting the extremities of said upper and lower horizontal portions, traveling grate-bars, roller-bearings located at the ends of the said grate-bars and engaging said continuous guideways, air channels or passages leading through the side pieces of the furnace structure for delivering a fluid upon the roller-bearings and guideways, and means for driving or propelling a fluid through said channels or passages, substantially as and for the purposes described.

4. The combination with a furnace structure provided with chambers at its side portions, and an endless traveling grate arranged between the sides of the furnace structure, of means for driving or propelling a fluid through said chambers in the side portions of the furnace structure, substantially as described.

5. The combination with the endless traveling grate of a furnace structure, of a shaft having pawls which engage the grate-bars to move the same, pivoted radius arms or levers supporting said shaft and serving to carry the latter in the arc of a circle, and mechanism for swinging the radius-arms, substantially as and for the purposes described.

CHRISTOPHER WILLIAM JAMES.
GEORGE WATSON.

Witnesses:
THOS. DALTON,
HERBERT L. P. LONDON.