No. 803,777. PATENTED NOV. 7, 1905.

E. McCONNELL.

MECHANICAL STOKER.

APPLICATION FILED DEC. 22, 1904

4 SHEETS—SHEET 1.

Fig. 1

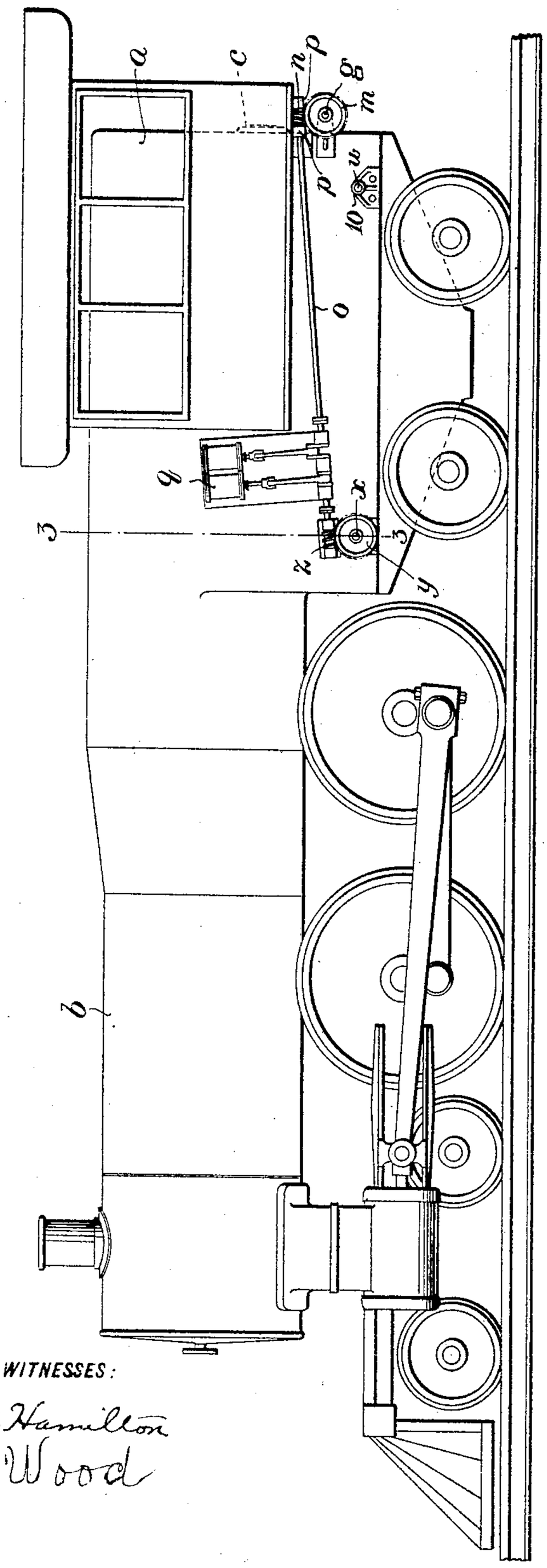
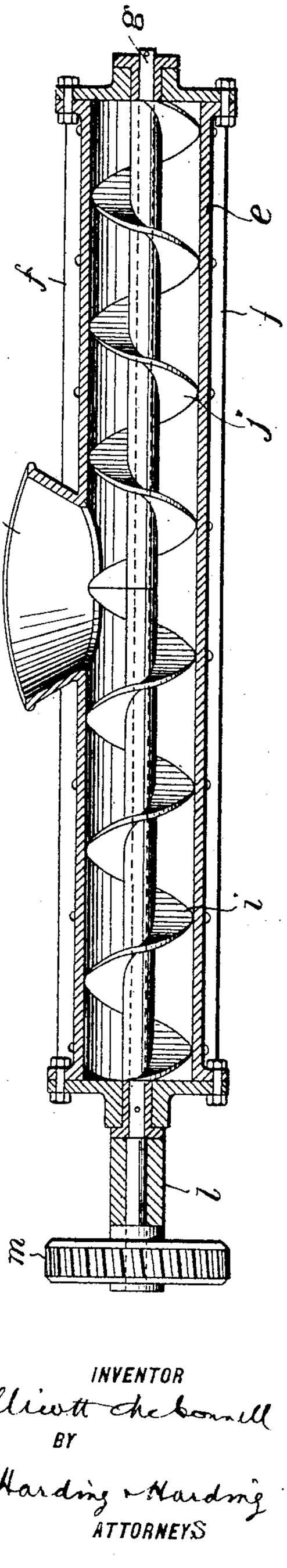


Fig. 2



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4 SHEETS—SHEET 2.

Fig. 2

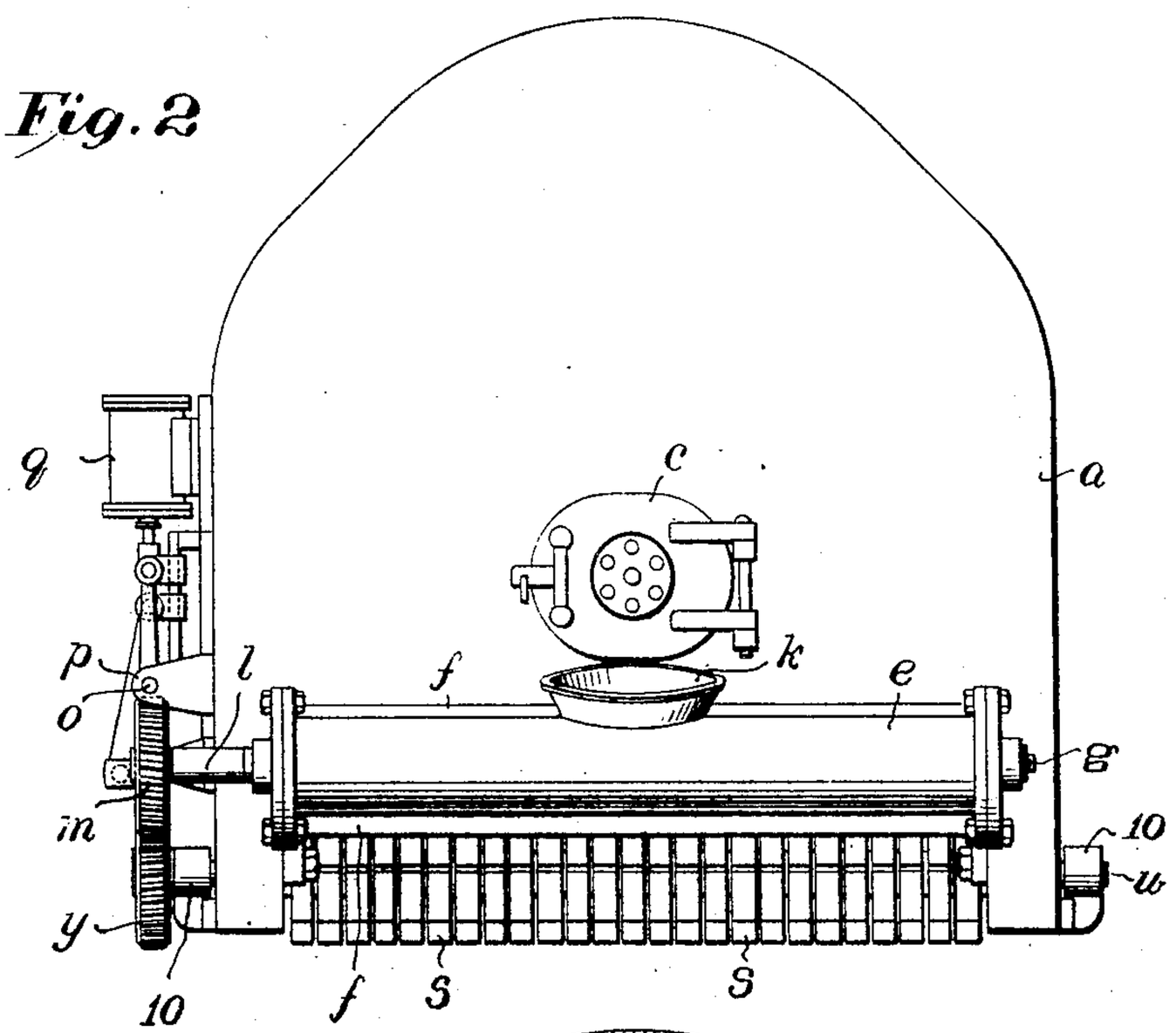
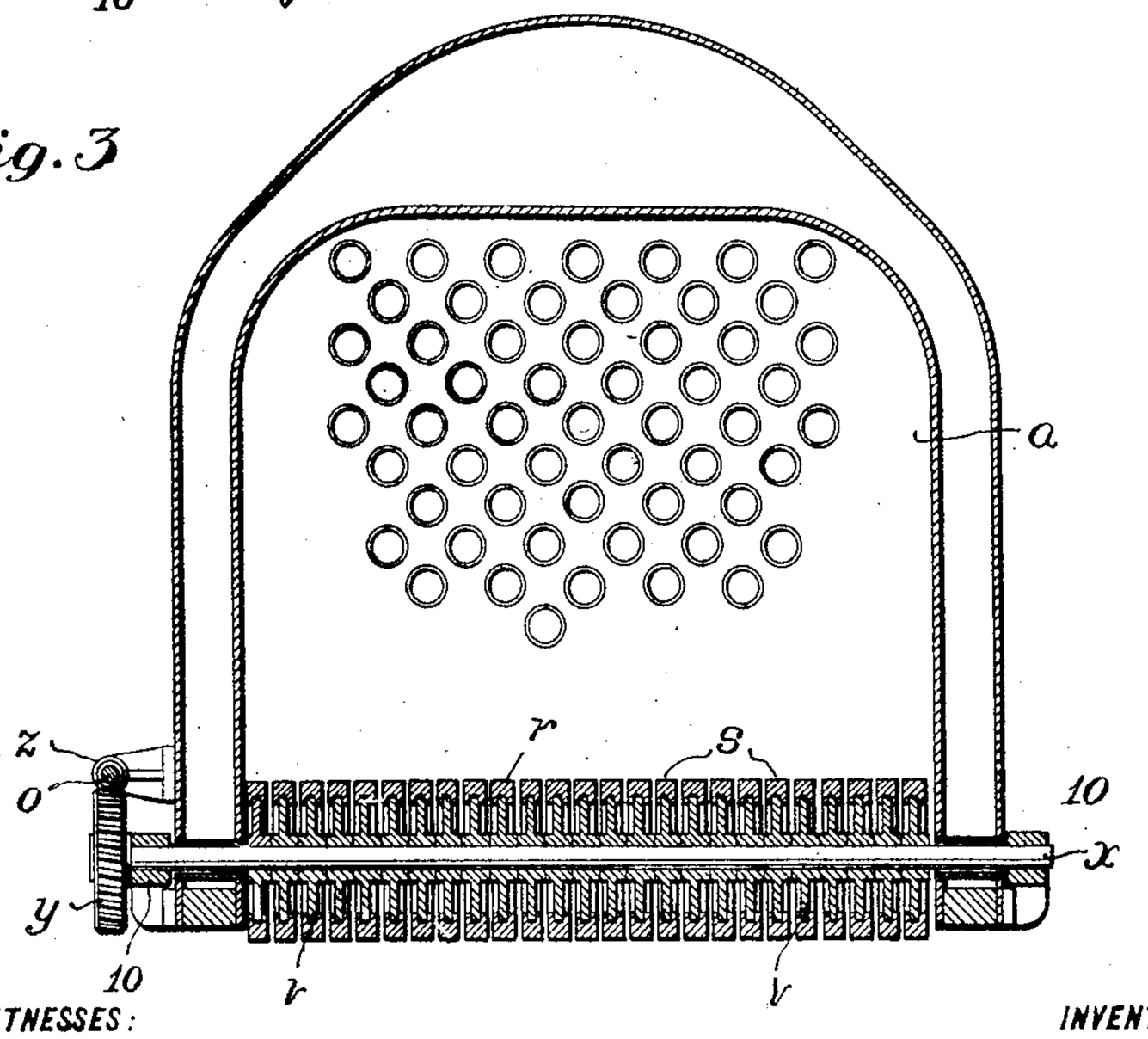


Fig. 3



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4 SHEETS—SHEET 3.

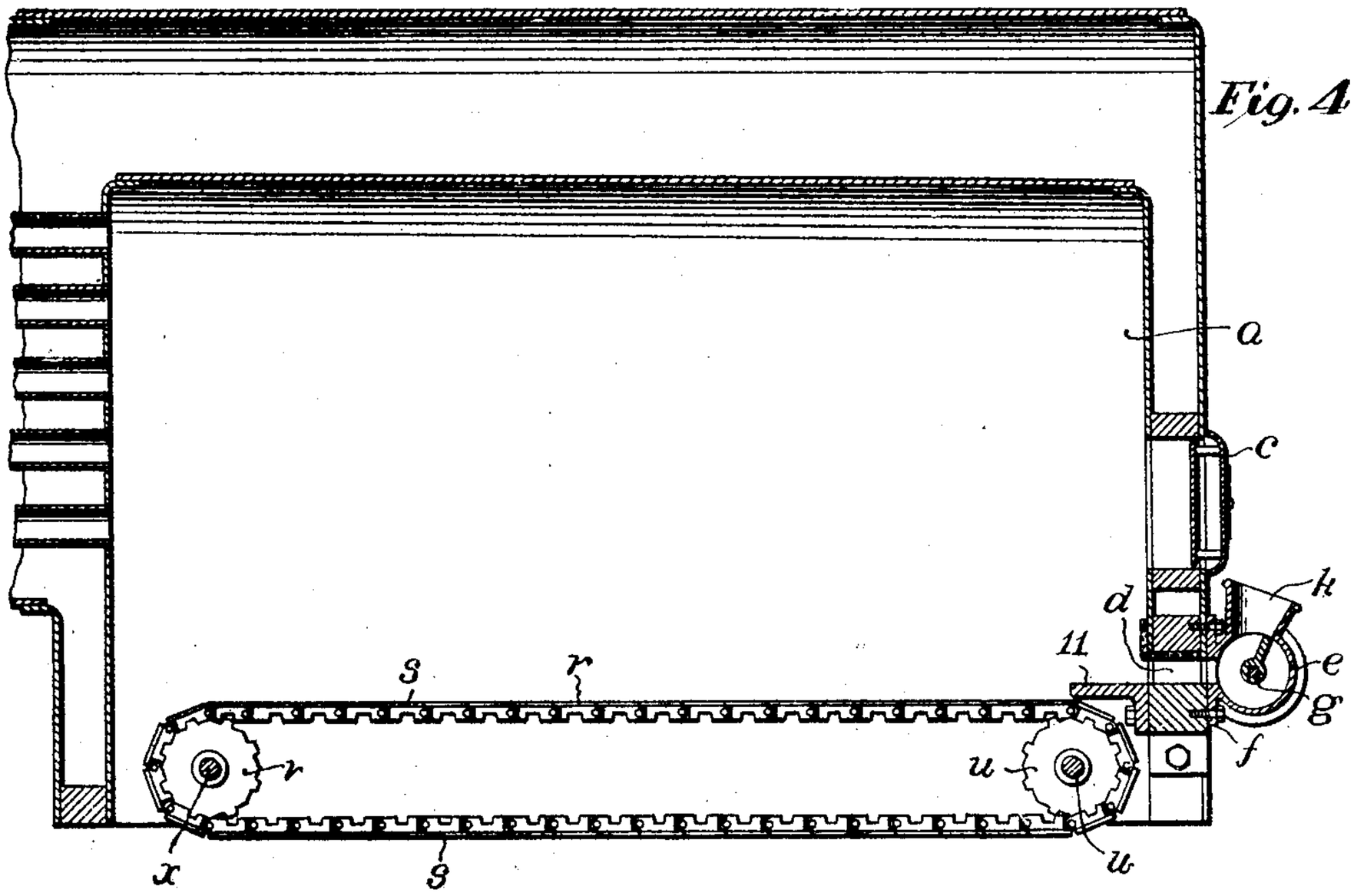

Fig. 4

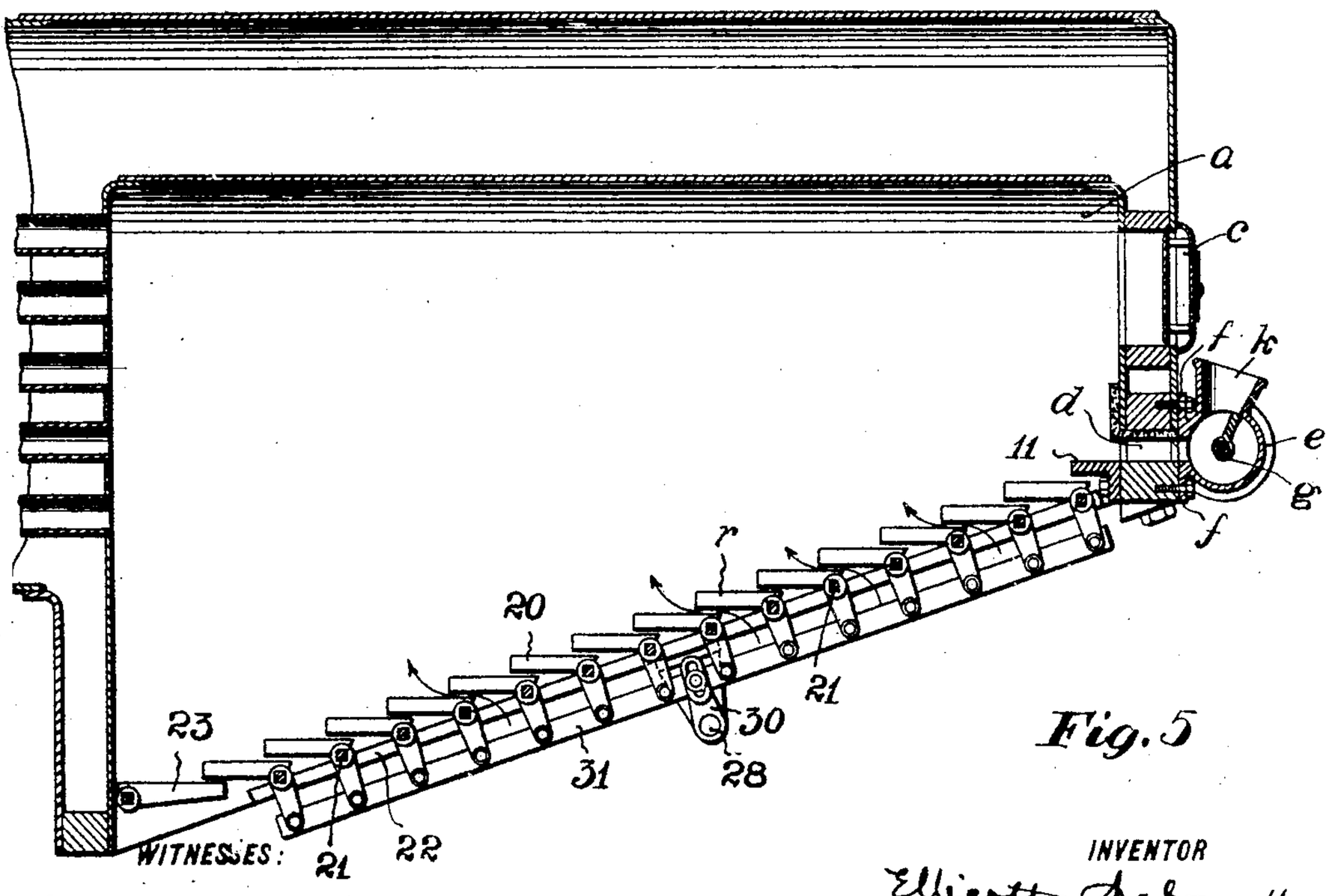

Fig. 5

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4 SHEETS—SHEET 4.

Fig. 6

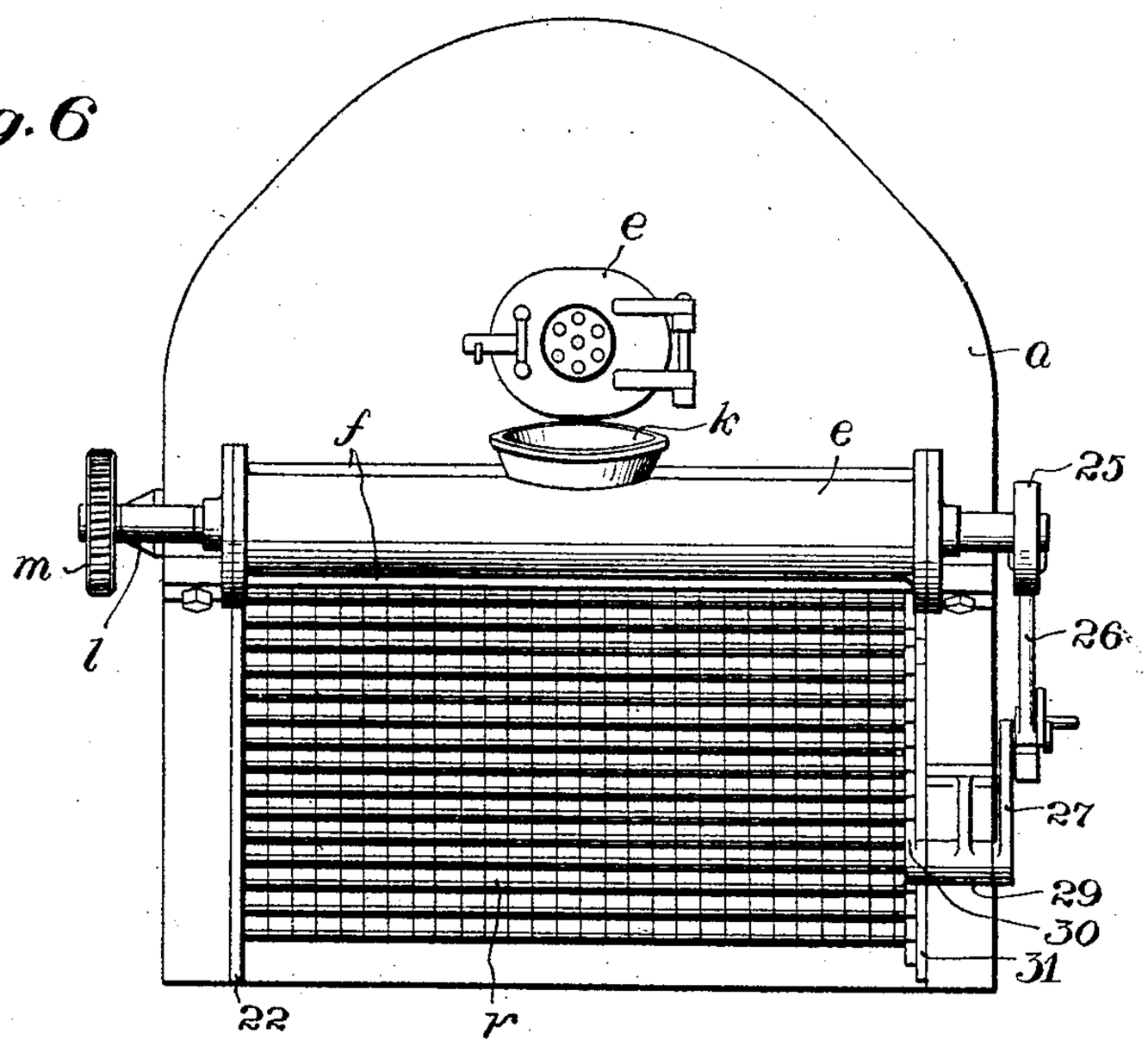

Fig. 7

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UNITED STATES PATENT OFFICE.

ELLICOTT McCONNELL, OF EASTON, MARYLAND.

MECHANICAL STOKER.

No. 803,777. Specification of Letters Patent. Patented Nov. 7, 1905.

Application filed December 22, 1904. Serial No. 237,877.

To all whom it may concern:

Be it known that I, ELLICOTT McCONNELL, a citizen of the United States, residing at Easton, county of Talbot, and State of Maryland, have invented a new and useful Improvement in Mechanical Stokers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to mechanical stokers, and particularly to mechanical stokers for locomotives.

The object of my invention is to design a stoker that may be successfully applied to locomotives. For some years mechanical stokers have been more or less successfully used in connection with stationary boilers, but stokers built on the same principle when applied to locomotives have utterly failed to do the work required of them.

My invention consists of the general construction and arrangement of fire-box, grate, and fuel-retort hereinafter set out, and also in certain details of construction and arrangement also fully disclosed.

While my invention is primarily intended for application to locomotives, it may be adapted to stationary boilers. The invention, therefore, is not restricted to any particular use nor to the specific details of construction in which I prefer to embody the invention.

In the drawings, Figure 1 is a side elevation, partly diagrammatic, of a locomotive with my invention applied. Fig. 2 is an end view of the same. Fig. 3 is a transverse section on the line 3 3 of Fig. 1. Fig. 4 is a longitudinal section through the fire-box. Fig. 5 is a longitudinal section similar to Fig. 4, showing a modified form of grate. Fig. 6 is an end view of the modified construction. Fig. 7 is a side elevation of the modified construction. Fig. 8 is a longitudinal section through the fuel-retort.

a is the fire-box of the locomotive; *b*, the boiler; *c*, the regular fire-door. Below the regular fire-door is a long narrow opening or fire-door *d*. This fire-door extends substantially along the whole width of the fire-box.

The fuel-retort may be composed of a shell or casing *e*, having flanges *f*, by means of which the retort is bolted to the fire-box above and below the fire-door *d*. The longitudinal opening between the flanged ends of the casing is of the same width as the fire-door, and when the retort is bolted to the fire-box the said opening registers with the fire-door *d*. The ends of the casing are closed.

g is a square shaft extending through the fuel-retort and whose center line is coincident with the axis of the retort. Upon this shaft is threaded a helical screw conveyer, having a right-hand thread *i* and a left-hand thread *j*. One end of the conveyer-shaft projects beyond the casing-head and beyond the end of the fire-box and is provided with a worm-wheel *m*.

l is a bearing on the side of the fire-box for the end of the shaft *g*.

k is a hopper of any suitable style—such, for instance, as that shown in my Patent No. 711,668, dated October 21, 1902—said hopper being secured to the top of the retort and communicating with an appropriate opening in the top of the retort.

o is a shaft turning in bearings *p p*, secured to one side of the fire-box, said shaft extending substantially the length of the fire-box.

n is a worm on the front end of the shaft *o*, said worm engaging the worm-wheel *m*.

q is a double engine secured to the forward part of the fire-box on the fireman's side thereof. The pistons of the engine actuate the shaft *o*, the latter through worm *n* and worm-wheel *m* driving the shaft *g*. Thereby the screw conveyer is rotated. Fuel fed into the hopper will be carried longitudinally within the conveyer toward one or the other end of the retort and be introduced into and distributed along the front of the fire-box over the grate *r*.

The grate *r* is of peculiar construction and operation, being formed of a number of series of grate-sections, the grate-sections of each series being hinged together and forming an endless sprocket-chain extending around sprocket-rollers *u v*, secured to shafts *w x*, respectively, at the rear and front of the fire-box, respectively. The shafts *w x* turn in bearings 10 on the outside of the fire-box. Secured to the shaft *x* is a worm-wheel *y*, meshing with a worm *z* on the rear end of the shaft *o*. As the shaft *o* is rotated by the engine *q*, worm *z* turns the worm-wheel *y* and shaft *x*, thereby causing the grate to travel within the fire-box and carry the fuel forwardly, the fuel being consumed as it travels forwardly and the spent fuel and ashes being discharged through the interstices of the grate and at the forward end of the fire-box at the point where the grate-bars turn about

the shaft *x* at the beginning of their return movement. It is evident that the depth of the fire depends upon the speed of grate travel as compared with the quantity of fuel delivered from the retort—*i. e.*, the faster the travel the thinner the fire, and conversely. As the conveyer and grate are driven from a common driving-shaft it is apparent that the relation between the speed of rotation of the conveyer and the speed of travel of grate will be constant. It is not, however, an essential feature of the invention that the grate and conveyer shall be driven in unison or from a common driving-shaft.

The shaft *x* for driving the traveling grate is preferably square in cross-section, this being the simplest way of securing the sprocket-rollers *v* thereon so as to rotate therewith while permitting the shaft to be simply withdrawn longitudinally to enable the entire machinery to be dismantled.

11 is an L-shaped coking-plate secured to the inside of the fire-box immediately beneath the fire-door *d* and overhanging the sprocket-roller *u* and the space between the sprocket-roller *u* and the front of the fire-box.

The advantages of the foregoing construction are the perfect lateral distribution of the fuel along the rear of the fire-box due to the arrangement and construction of the fuel-retort and conveyer and the perfect distribution of the fuel longitudinally due to the travel of the grate forwardly from the point of introduction. The means for accurately regulating the amount of fuel used, the length of time it remains on the grate, and the depth of the fire also constitute valuable features of the invention.

In Figs. 5, 6, and 7 I have shown a modification in which instead of a traveling grate an inclined grate is provided. This grate is inclined downwardly from the fire-door to the rear of the grate. It is not necessary that the grate should be inclined as much to the horizontal as therein shown. A much less degree of slant may be found efficient; but it may be found advisable in certain cases to give the grates a considerable slant, in which event I prefer to employ horizontally-disposed grate-bars 20, arranged one below the other in step fashion, each grate-bar overhanging the one below it. The grate-bars are secured to shafts 21, supported in racks or bearing-bars 22, secured to the inner side walls of the fire-box. 23 is a dump-grate at the extreme front of the fire-box. I prefer to use in connection with the inclined conveyer precisely the same arrangement and construction of fire-door, fuel-retort, screw conveyer, and driving mechanism that I employ in connection with the traveling grate. The shaft *g*, however, projects beyond the side of the fire-box opposite the side to which the driving mechanism is secured. To this end of the shaft *g* is secured an eccentric 24, embraced by a strap 25, to which is secured a rod 26, pivotally connected with lever 27, secured to a shaft 28, held in bearing 29 on the mud-ring of the fire-box. Secured to a shaft 28 is an arm 30, engaging a shaker-bar 31, similar to those ordinarily used. As coal is fed into the hopper and thence through the retort to the fire-box, as hereinbefore described, the coal is distributed evenly along the rear of the fire-box. The inclination of the grates effects the desired longitudinal distribution of the fuel. The stepped arrangement of grate-bars also facilitates the forward feed of the fuel, as the induced blast enters laterally between the grates, as shown by the arrows in Fig. 5, tending to blow the fuel forwardly toward the front of the grate. The grate-shaking mechanism also assists in the forward feed of the fuel, besides keeping the fire clean.

In both forms of the present invention the following advantages may be enumerated: A perfect longitudinal as well as lateral distribution of the fuel is effected. The entire apparatus is outside the cab. It is accessible for examination and repair. The regular fire-door is left undisturbed and unobstructed, enabling the slice-bar and clinker-hook to be used when desired and leaving the regular door always available in emergencies for hand-firing. The fire-door being normally closed, the well-known deleterious effects produced by an open fire-door upon flues, flue-sheets, and all fire-box fittings are entirely avoided. It should be added that the modern type of locomotive is so large that the labor of manually firing them almost exceeds human strength and endurance, and a successful power-stoker is almost indispensable.

While I have shown and ordinarily prefer a fuel-retort comprising a helical screw conveyer, my invention is not limited to the use of this form of feeding mechanism, as it may be desirable under certain conditions, particularly when a small size of anthracite is employed as fuel, to use some other known type of feeding mechanism.

Having now fully described my invention, what I claim, and desire to protect by Letters Patent, is—

1. The combination, with the boiler, the fire-box having a fire-door along the rear of the fire-box, of a fuel-retort along the rear of and outside the fire-box and communicating along its length with the fire-door, means to introduce fuel to the retort, and a right-hand feed-screw and a left-hand feed-screw within the retort to distribute the fuel along the rear of the grate, substantially as described.

2. The combination, with the boiler, the fire-box having the fire-door along the rear of the fire-box, of a fuel-retort along the rear of and outside the fire-box and communicating along its length with the fire-door, means for introducing fuel to the central portion of the retort, a right-hand feed-screw within the re-

tort at one end thereof and a left-hand feed-screw within the retort at the other end thereof, whereby the fuel is conveyed from the central portion of the retort toward the opposite ends thereof and distributed along the rear of the grate, substantially as described.

3. The combination, with the boiler and the fire-box, a grate within the fire-box, means to cause said grate to travel longitudinally of the fire-box, a fuel-retort at the rear of and extending transversely of the fire-box and grate and above the level of the grate, means to introduce fuel to the retort, a right-hand feed-screw and a left-hand feed-screw within the retort for distributing the fuel along the rear portion of the grate, substantially as described.

4. The combination, with the boiler and the fire-box, a grate within the fire-box, means to cause said grate to travel longitudinally of the fire-box, a fuel-retort at the rear of and extending transversely of the fire-box and grate and above the level of the grate, means to introduce fuel to the central portion of the retort, a right-hand feed-screw within the retort at one end thereof and a left-hand feed-screw within the retort at the other end thereof, whereby the fuel is conveyed from the central portion of the retort toward the opposite ends thereof and distributed along the rear portion of the grate, substantially as described.

5. The combination, with the boiler, the fire-box having the fire-door along the rear of the fire-box, of a fuel-retort along the rear of and outside the fire-box and communicating along its length with the fire-door, means for introducing fuel to the retort, a shaft within the retort, a right-hand feed-screw and a left-hand feed-screw on the shaft, and means to turn the shaft, substantially as described.

6. The combination, with the boiler, the fire-box having the fire-door along the rear of the fire-box, of a fuel-retort along the rear of and outside of the fire-box and communicating along its length with the fire-door, means for introducing fuel to the central portion of the retort, a shaft within the retort, a right-hand feed-screw on one end of the shaft, a left-hand feed-screw on the other end of the shaft, and means to turn the shaft.

7. The combination, with the boiler, the fire-box having the fire-door along the rear of the fire-box, of a fuel-retort along the rear of and outside the fire-box and communicating along its length with the fire-door, means for introducing fuel to the retort, a right-hand feed-screw and a left-hand feed-screw on the shaft, whereby, when the shaft turns, the screws feed and distribute the fuel along the rear end of the fire-box, means to turn the shaft and means to distribute the fuel longitudinally within the fire-box, substantially as described.

8. The combination, with the boiler, the fire-box having the fire-door along the rear of the fire-box, of a fuel-retort along the rear of and outside the fire-box and communicating along its length with the fire-door, means for introducing fuel to the retort, a right-hand feed-screw and a left-hand feed-screw within the retort, a traveling grate within the fire-box, and means to turn the feed-screws and move the grate, substantially as described.

9. The combination, with the boiler, the traveling grate, and the fire-box having a fire-door along the rear of the fire-box and above the level of and of substantially the width of the grate, a fuel-retort extending along the fire-door, means for introducing fuel to the central portion of the retort, a right-hand feed-screw within the retort at one end thereof, a left-hand feed-screw within the retort at the other end thereof, and means to turn the feed-screws and move the grate longitudinally of the fire-box.

10. The combination, with the boiler, the fire-box having the fire-door along the rear of the fire-box, of a fuel-retort along the rear of and outside the fire-box and communicating along its length with the fire-door, means for introducing fuel to the retort, a shaft within the retort, a right-hand feed-screw and a left-hand feed-screw on the shaft, shafts extending laterally of the fire-box, an endless grate extending about the last-named shafts, and means to drive one of the grate-shafts and the screw-shaft substantially as described.

11. The combination, with the boiler, the fire-box having the fire-door along the rear of the fire-box, of a fuel-retort along the rear of and outside of the fire-box and communicating along its length with the fire-door, means for introducing fuel to the central portion of the retort, a shaft within the retort, a right-hand feed-screw on one end of the shaft, a left-hand feed-screw on the other end of the shaft, shafts extending laterally of the fire-box, one at the front end, and the other at the rear end thereof, an endless grate extending about the last-named shafts, a main driving-shaft, a motor for actuating the main driving-shaft, driving connections from the main driving-shaft to the screw-shaft, and driving connections from the main driving-shaft to one of the grate-shafts, substantially as described.

12. The combination, with the boiler, the fire-box having a fire-door back of the grate, and a grate within the fire-box, of means to cause the grate to travel longitudinally of the fire-box, the fire-door extending longitudinally of the rear wall of the fire-box and of substantially the width of the grate, a fuel-retort on the exterior of the fire-box extending alongside of and communicating with the fire-door, means to introduce fuel to the central portion of the retort, and mechanism within the retort adapted to convey the fuel in opposite directions from the central portion of the retort and distribute it laterally

along the rear end of the grate, substantially as described.

13. The combination, with the boiler, the fire-box having a fire-door back of the grate, and a grate within the fire-box, of means to cause the grate to travel longitudinally of the fire-box, the fire-door extending longitudinally of the rear wall of the fire-box and of substantially the width of the grate, a fuel-retort on the exterior of the fire-box extending alongside of and communicating with the fire-door, means to transfer the fuel from the retort through the fire-door to the fire-box and distribute it laterally along the rear end of the grate, substantially as described.

In testimony of which invention I have hereunto set my hand, at Des Moines, on this 12th day of December, 1904.

ELLICOTT McCONNELL.

Witnesses:

F. T. VAN LIEW,

BLANCHE BICE.