

(No Model.)

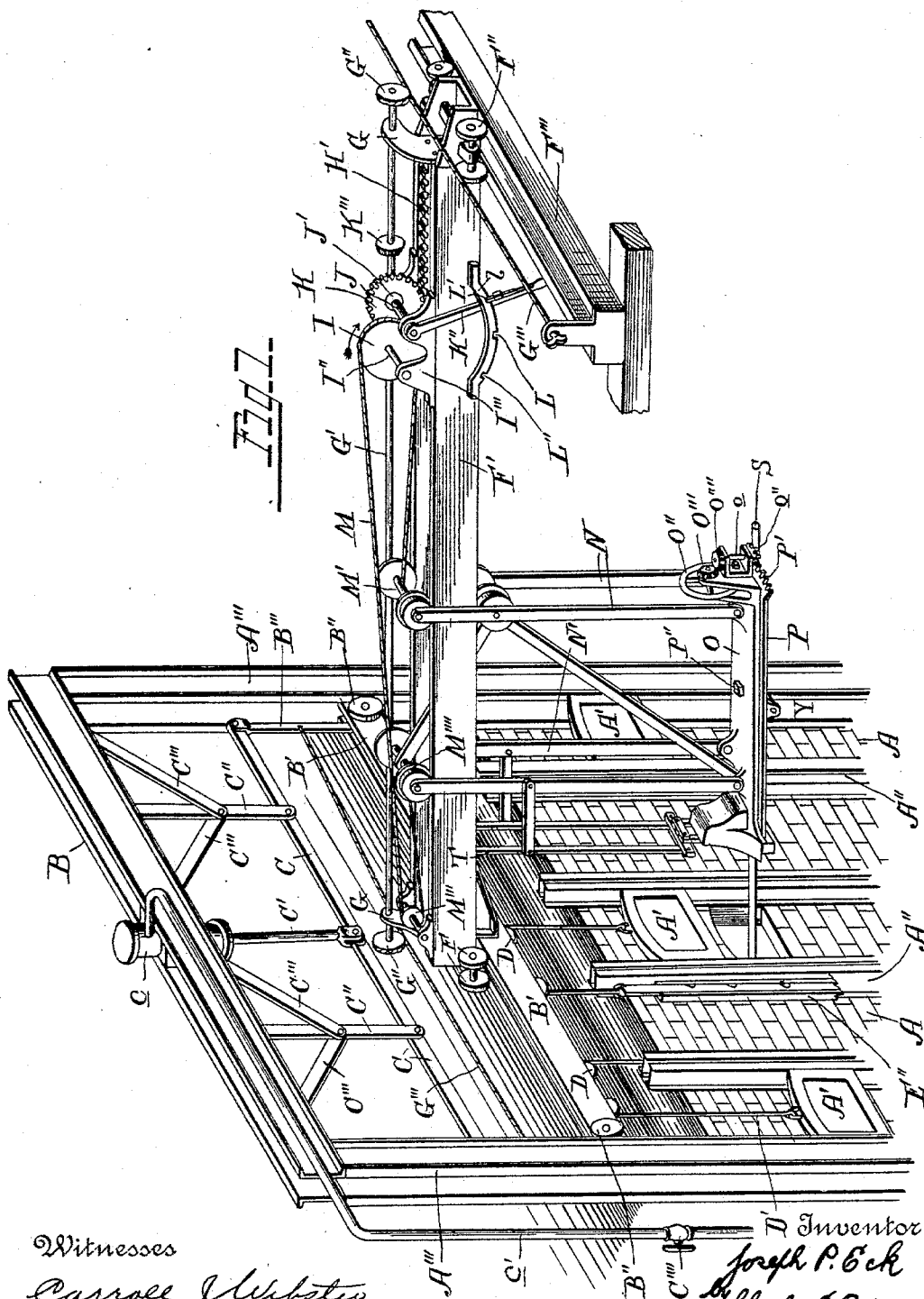
6 Sheets—Sheet 1.

J. P. ECK.

MACHINE FOR CHARGING OPEN HEARTH FURNACES.

No. 584,051.

Patented June 8, 1897.



Witnesses

Carroll J. Webster
Robertus Jackson

Inventor

Joseph P. Eck
Charles E. Adamson
his Attorney

(No Model.)

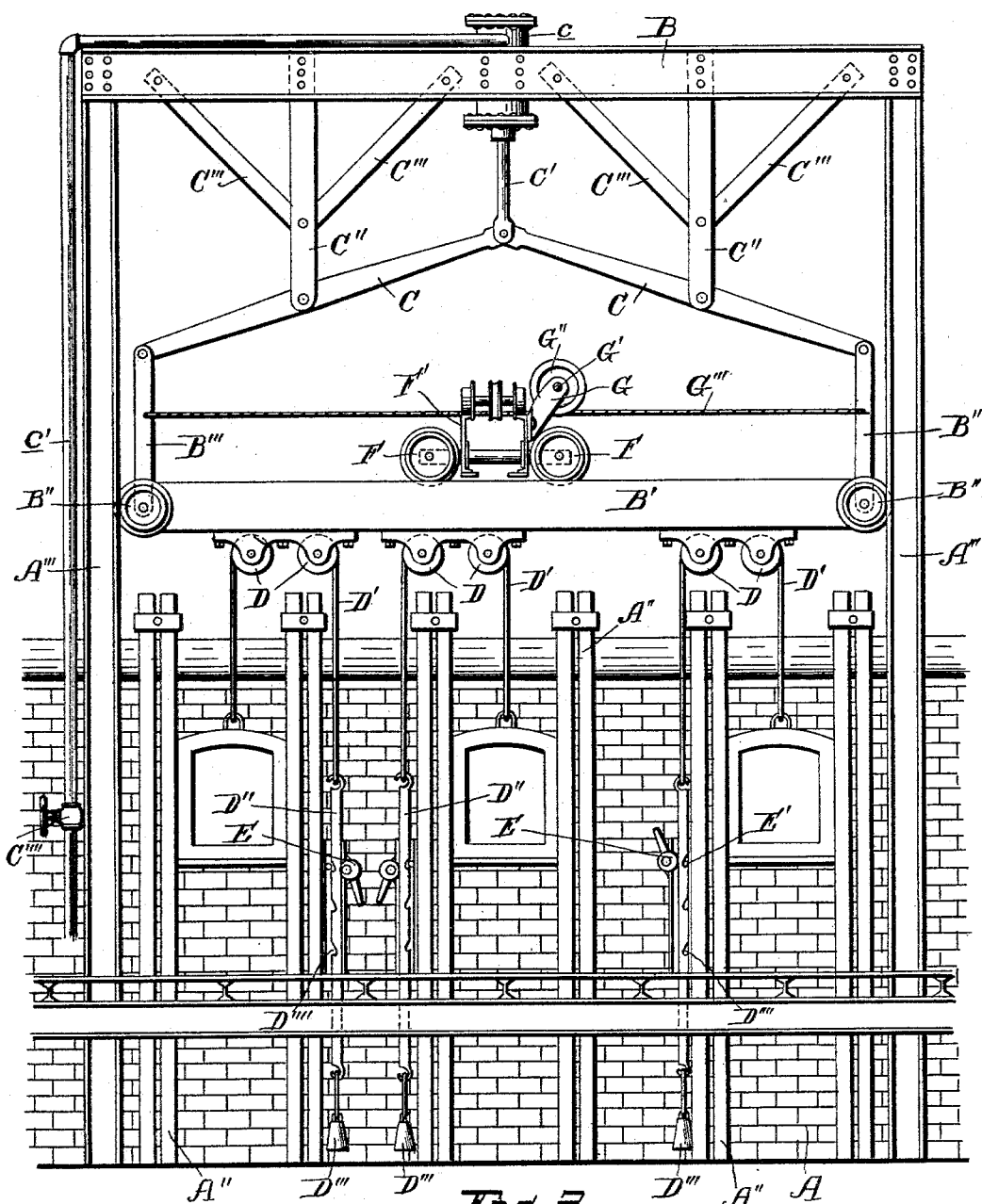
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Inventor
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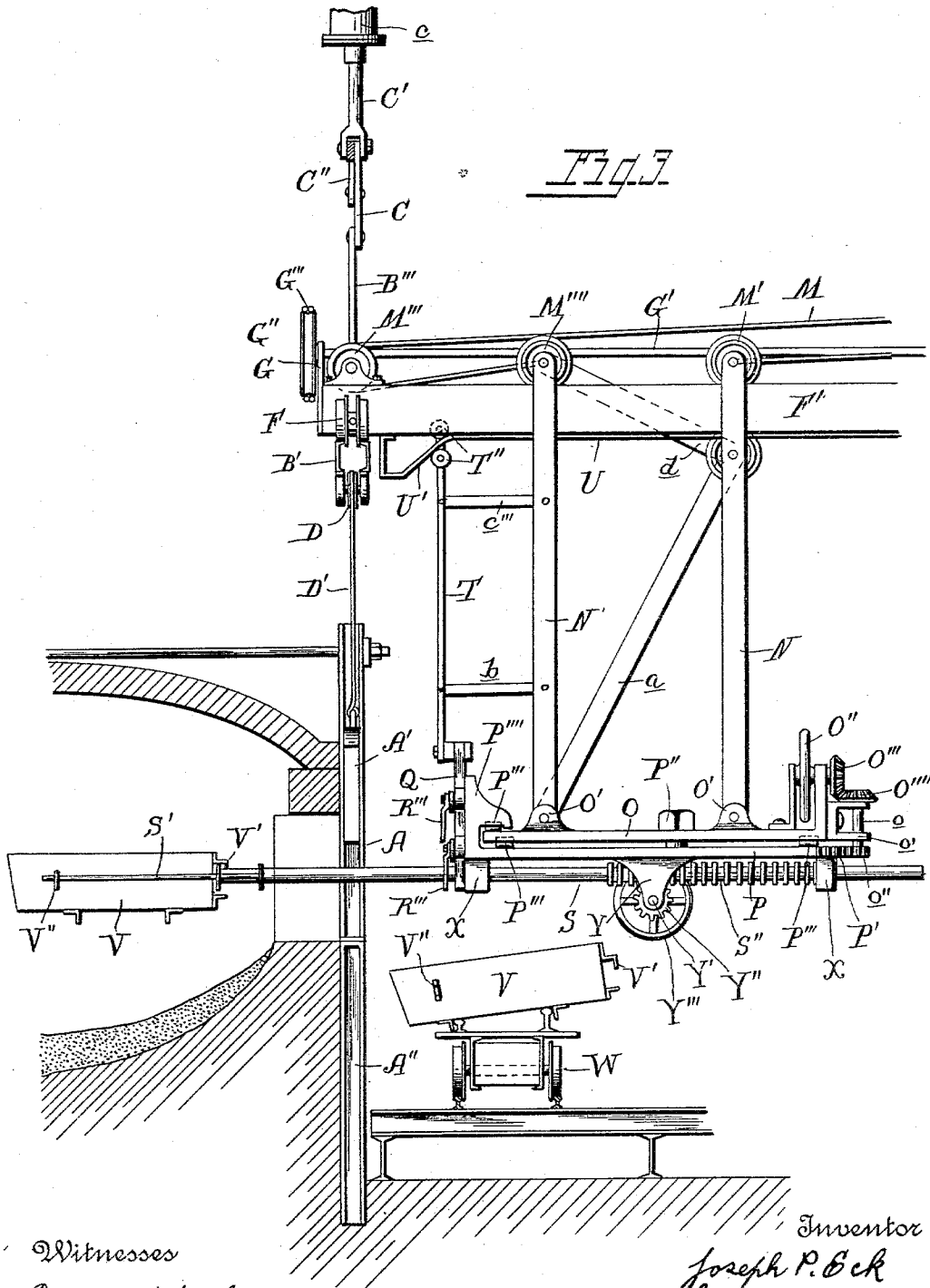
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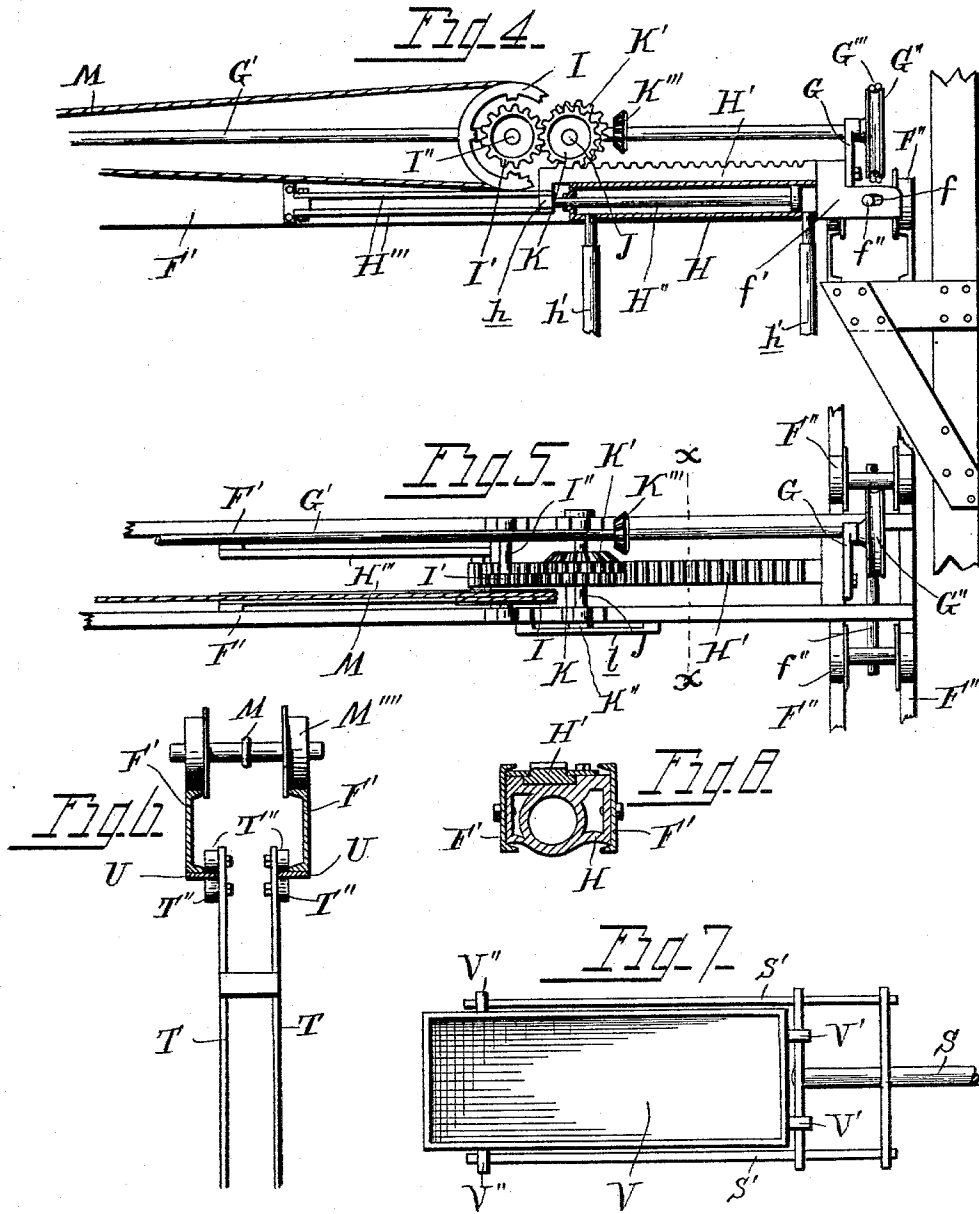
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B. Lamar Jackson

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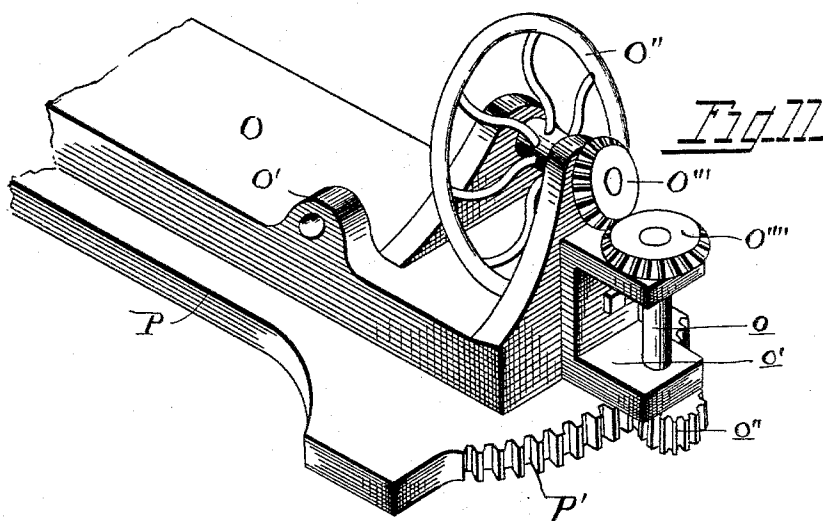
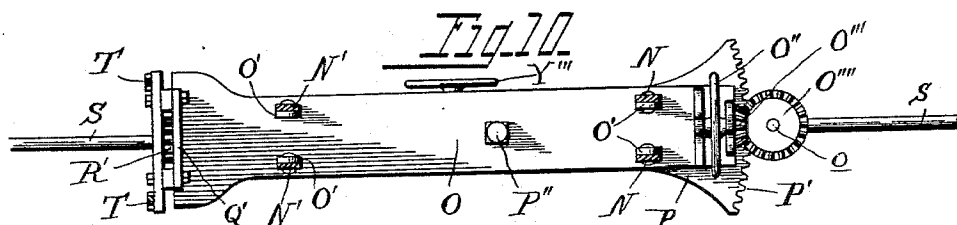
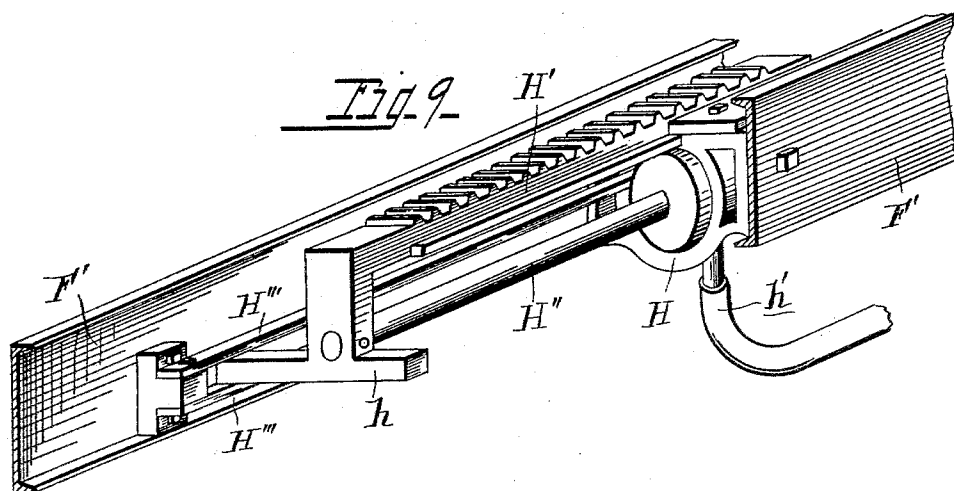
6 Sheets—Sheet 5.

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Witnesses

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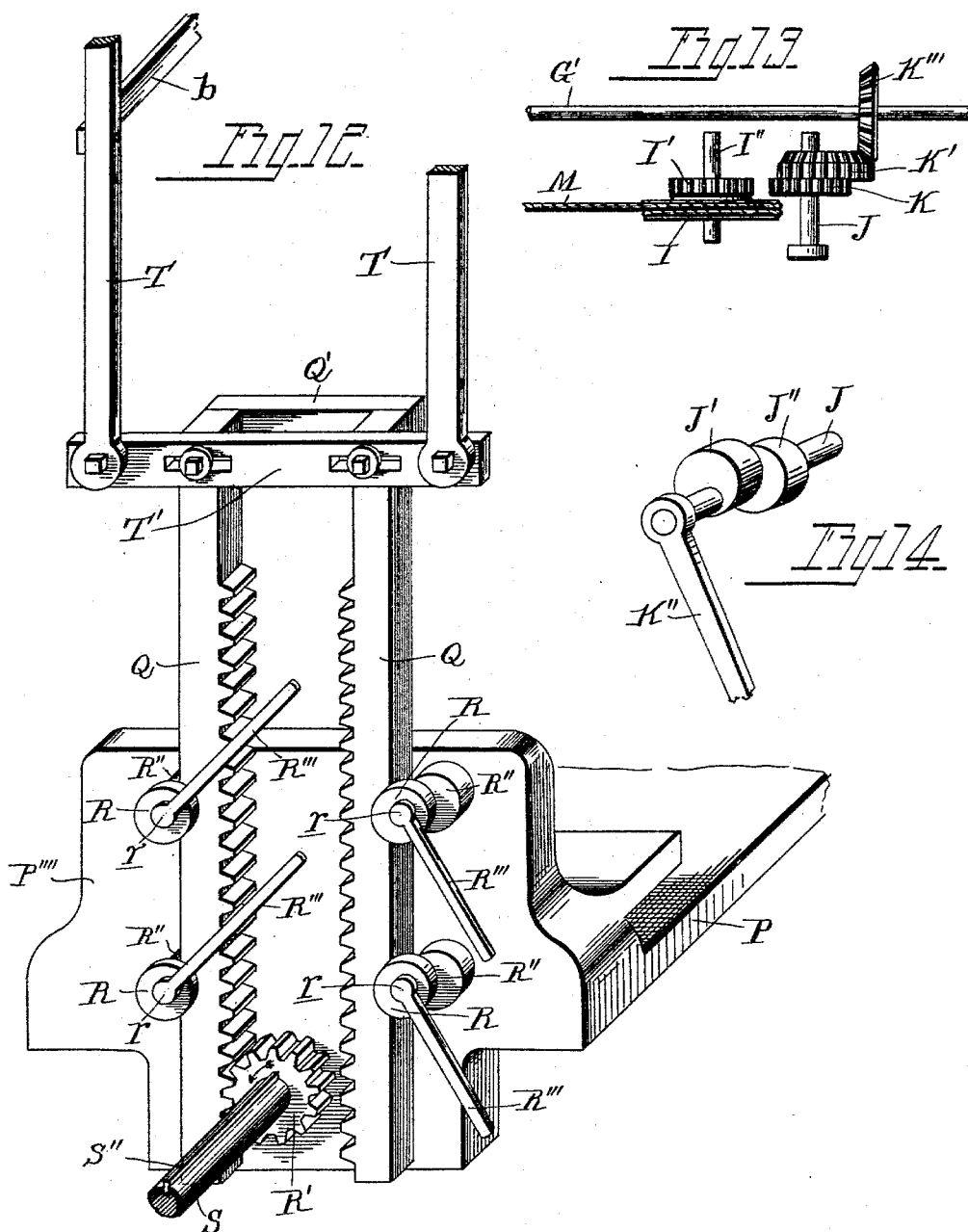
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UNITED STATES PATENT OFFICE.

JOSEPH P. ECK, OF MUNCIE, INDIANA, ASSIGNOR OF ONE-HALF TO JOHN H. McGRATH, OF SAME PLACE.

MACHINE FOR CHARGING OPEN-HEARTH FURNACES.

SPECIFICATION forming part of Letters Patent No. 584,051, dated June 8, 1897.

Application filed October 28, 1896. Serial No 610,296. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH P. ECK, a citizen of the United States, residing at Muncie, in the county of Delaware and State of Indiana, have invented certain new and useful Improvements in Machines for Charging Open-Hearth Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in machines for charging open-hearth steel-making furnaces; and the object of my invention is to construct a mechanism that will handle and feed all kinds of scrap metal into the furnace and one that will be rapid in its operation and easily handled and managed by the operator; and a further object is to provide a machine that will perform the work so that the operator is not compelled to come into close contact with the heated furnace or feeding-doors while it is in operation. I attain these objects by the mechanism illustrated by the accompanying drawings, in which—

Figure 1 is a perspective view of an open-hearth furnace, showing my machine attached and in operation. Fig. 2 is a front elevation of a furnace, showing a part of my invention. Fig. 3 is a cross-section of a furnace, showing a side elevation of the forward part of my charging-machine. Fig. 4 is a side elevation with one side rail removed, showing the rack-gear and pressure-cylinder. Fig. 5 is a top plan of the same. Fig. 6 is a front elevation of the dumping mechanism. Fig. 7 is a top view of a scrap-pan and forward end of the pan-fork. Fig. 8 is an end view or cross-section taken on line X X of Fig. 5. Fig. 9 is a perspective interior view of the rack and water-cylinder for operating the cable-driving gear. Fig. 10 is a top plan of the pan-operating mechanism. Fig. 11 is a detailed view of the gear and mechanism for giving the pan a side movement. Fig. 12 is a detail of the front end of a part of the pan-dumping mechanism, and Figs. 13 and 14 are detailed views of the gear-wheels and eccentric-shaft for operating the driving-cables.

Similar letters refer to similar parts throughout the several views.

A represents the front of an open-hearth furnace, such as used in the manufacture of steel. This furnace is provided with a series of vertically-sliding doors A' and upright posts A'' for preventing the furnace from spreading or for holding the furnace rigidly in position. At the two front corners of the furnace are two tall parallel posts or supports A''', secured together at their upper ends by two beams B, all of which is fully shown in Fig. 1. Suspended from the upper beams B are two track-beams B' B', the ends of which are supplied with friction-pulleys B'', which allow the ends of the said track to rest close to the upright posts A''' and move freely up and down when in operation. This set of track-beams are connected to the upper beams by a set of arms B''', one at each end of the track, the arms connecting to the outer ends of two levers C, and the levers are connected to and suspended from the top beams by bar C'' and braces C''', all as shown in Figs. 1 and 2. The inner ends of the arms C are connected to the lower end of the piston-rod C', which works into the water-cylinder c, all of which operate when the pressure is admitted in the said cylinder.

The water-cylinder c is secured in the center of the two cross-beams B, and it is suitably connected with water or steam pressure by a pipe c' and controlled by a valve C''', located conveniently for the operator of the machine. To the under side of the track B' are secured cable-pulleys D, over which the cable D' works, one end of the cable being secured to the hearth-door A' and the other end to a sliding bar D'', the lower end of the said bar having a weight D''' secured to it, all as shown in Figs. 1 and 2. The bar D'' is provided with notches D''', so that by the eccentric E the bar D'' may be moved over, bringing one of the notches against stop E', which is rigidly secured in the casing E'', thereby preventing the bar from being moved up and down. The eccentric E is secured to the casing E'', in which the bar D'' is located, all as shown in Figs. 1 and 2.

Resting on the track B' are four truck-

wheels F, which are secured to the forward end of the longitudinally-moving track or carrier F', and at the rear end of the said track are four similar track-wheels F'', which rest on a stationary track F''', similar to the one at the forward end of the carrier. The two bars F' forming the traveling carrier are secured a few inches apart and parallel to each other, as shown in Fig. 1. At each end is secured a bracket G, in which is journaled the cable-driving shaft G', on each end of which is secured a cable-wheel G'', around which the cable G''' is wound for propelling the traveling carrier sidewise or from one furnace-door to another. Near the rear end of the carrier F' and between the side bars of the same is located a water or pressure cylinder H, fed by the pipes h', and fitted in a recess-groove on the upper side of the said cylinder is a cog-rack H', one end of which is formed with a T-shaped head h, and in which the outer end of the piston-rod H'' is secured, all as shown in Figs. 4, 9, and 8. The projecting points of the T-head of the rack rest or slide between two parallel guide-bars H''', which are secured to the inner sides of the carrier F', as shown in Figs. 4 and 9, which compel the rack H' to move on a direct line with the cylinder. Directly above the inner end of the cylinder is the cable-driving wheel I. The cable-wheel I and cog-pinion I' are journaled rigidly to the shaft I'', the said shaft resting in the pillar-block I'''. Parallel with the said shaft is a double-eccentric shaft J, carrying differently-set eccentrics J' and J'', the cog-gear K being journaled on the eccentric J' and the cog and beveled gear K' being journaled on the eccentric J'', and the last two wheels are made solid together. The wheels K and K' are on different centers, so as to throw them into and out of gear by a slight move of the lever K'', which is set rigid to the shaft J. When the lever is set in the center notch L in the notched segment l, all the wheels on the shaft J are out of contact with the wheel I', rack H', and bevel-pinion K''' on the shaft G', so that any movement of the rack H' would not move any of the wheels, but when the lever K'' is moved over in the notch L' the wheel K is in contact with the wheel I' and also the rack H', so that by an outward movement of the rack the cable-wheel I is moved, as indicated by the arrow in Fig. 1, which moves the pan-carrying mechanism or charger up toward the furnace-doors.

When the lever is moved to the notch L'', the rack-pinion K' is resting on the rack H' and the beveled-gear side of the wheel K' and the beveled gear K''' are meshing together. Therefore when they are in this position an outward movement of the rack H' will not move the wheels I and cable M, but will revolve the shaft G' and thereby revolve the cable-wheels G'', which will cause the traveling carriage F' to move sidewise one way or the other, according to the direction

the rack is moved. The cables G''' are each wound once or oftener around their respective drive-wheels G'', and the ends of the cable are secured at each end of the tracks B' and F'''. One end of the cable M is secured to one of the trucks M', then, winding twice around the wheel I, it passes rearward to a loose pulley M'', then back to the truck M''', to which it is secured, and by this arrangement the trucks can be moved backward or forward on the track F' as desired.

Suspended from the trucks M' M''' are a backward and forward set of parallel bars N N', which suspend or carry the charging or pan-operating mechanism, as shown in Figs. 1 and 3. The said mechanism consists mainly of two heavy plates O and P. The upper plate is provided with four lugs O', to which the bars N N' are secured. The rear portion of the plate O is supplied with a hand-wheel O'', which is connected by the beveled gear O''', to operate the gear O''', which is secured to the upright shaft o, journaled on the plate o'. To the lower end of the shaft o is secured the cog o'', which meshes with the curved rack P', all as shown in Figs. 1, 3, and 11. The plates O and P are pivoted together near their center by a large bolt P'', and they are prevented from resting on each other by friction-roller P''', so that by the gearing at the rear end of the plates the lower one P may be given a slight circular side motion. To the forward end of the under plate P is fixed a vertical face-plate P''', to which are movably secured the racks Q. The said racks are rigidly secured together at their upper ends by a block Q', and they are prevented from leaving the plate by the flanges R on the eccentric-bolts r, all as shown in Fig. 12. The racks Q are set so that they remain the same distance apart at all times, and between them is a cog-pinion R', which is secured to the shaft S by a key-way or feather S'', so that the shaft can move through the pinion, but it cannot revolve except directly with the movement of the said pinion. In Fig. 12 two of the eccentrics R'' are pressed against one of the racks, making the cogs mesh with the pinion R', so that a downward movement of the said rack will revolve the pinion and shaft in a direction indicated by the arrows in the said figure. Then by moving the levers R''' outward their two eccentrics will be drawn away from the rack, freeing the pinion, and by moving the opposite lever over the opposite rack will be brought to bear on the said pinion, and from a downward movement of the rack the pinion and shaft will revolve in an opposite direction from that shown by the arrow.

The racks are connected at their upper ends by two bars T, the said bars being bolted at their lower ends to a slotted cross-bar T', and to their upper ends are secured two small track-rollers T'', which serve to move the said bars up and down when the machine is charging or dumping a load into the furnace. The

rollers T'' are set so as to travel one under and one over a flat thin track U, which is bolted to the forward ends and under sides of the beams F'. (Most clearly shown in Figs. 3 and 6.) The forward end of the said truck U drops down on an incline U', so that when the charger is moved up against the furnace the rollers T'' run down the incline, forcing down on the racks Q, one of which is engaged with the cog-pinion R', causing it to turn the fork S', tipping the pan V over and unloading the scrap metal into the furnace. The pans V are made with catches V' and V'', and they are placed on a suitable truck W, which is run on a track along in front of the furnace. When the pans are loaded up with metal to be melted, they are run along in front of the furnace where the machine can pick them up. When any article too large for the pan is to be fed into the furnace, it is placed on the truck W in a suitable manner, so the fork will raise and carry it into the furnace. As to the shape or design of the pan or fork, it may be made suitable for any special use.

Under the plate P are cast two lugs X, through which the long fork-shaft runs, and a portion of the said shaft located between the said lugs is provided with a circular rack S''. This rack is solid, and near the center of the said plate P are two lugs Y, which support a cross-shaft Y', which carries a rack-pinion Y'' for engaging the rack S'', all as indicated and shown in Figs. 1 and 3. One end of the shaft Y' is provided with a hand-wheel Y''', which is used by the operator to move the fork-shaft endwise. In loading or unloading a pan V it is often necessary to move the fork on an angle to one side or the other, which is done by moving the wheel O'', causing the under plate to move sidewise.

From the foregoing description the operation of my machine will be well understood, the movements being but few and simple, as follows: When the furnace-doors are closed, the pressure is not on the cylinder c, and the first thing is to move the charging mechanism forward and pick up a pan of scrap. This is done by moving the lever K'' over in the notch L'. At this time the rack H' is supposed to be already out as far as it will go. Then by admitting pressure in at the outer end of the cylinder the rack will be drawn back, revolving the cable-wheel I in the direction indicated by the arrow in Fig. 1. Then by admitting pressure in the cylinder c the piston C' is moved down, causing the levers C to raise the track and front end of the charging-machine and at the same time to open a furnace-door, which is the one on which eccentrics E have been locked. Then by admitting more pressure into the cylinder II the charging mechanism moves the pan into the furnace through the open door, and when the charge has moved to the extreme end of the track F' the wheels T'' drop down the incline, pressing the racks Q down, one of which causes the shaft S to revolve, up-

setting or turning over the pan V and dumping the load. A reverse operation of the cylinder and movements will bring the machine back for another load. In the drawings I show some braces, such as a, b, c'', and d, which, as well as other minor points, may be varied in the construction according to the size and special purpose for which the machine is built.

The outer end of the carrier F' is pivotally supported on the truck F'' by means of the slot f in the casting f', through which the rod f'', which is connected to the axles of the truck, passes. The casting f' is secured to the outer end of the carrier. By this construction when the inner end of the carrier is lowered the truck F'' will still remain on the tracks F'''.

Having thus described my invention, I claim the following and desire to secure the same by Letters Patent:

1. In a machine for charging furnaces, the combination with the furnace-doors, of a track arranged over the front of the furnace for supporting one end of the charging mechanism, means for elevating and lowering the track, and means connecting the doors of the furnace and track whereby the doors will be raised and lowered by the movement of the track, substantially as described.

2. In a machine for charging furnaces, the combination with the furnace-doors, of a movable track arranged above the doors for supporting one end of the charging mechanism, means for raising and lowering the track, and connections consisting of cables and pulleys between the doors and track whereby the doors will be opened and closed by the movement of the track, substantially as described.

3. In a machine for charging furnaces, the combination with the furnace-doors, of a movable track arranged above the doors for supporting one end of the charging mechanism, connections between the doors and track, a pressure-cylinder supported above the track, and means for connecting the pressure-cylinder and track for moving the track, substantially as described.

4. In a machine for charging furnaces, the combination with the furnace-doors, of a movable track arranged above the doors for supporting one end of the charging mechanism, connections between the doors and track, a pressure-cylinder supported above the track, a piston-rod extending from the cylinder, and levers connected to the piston-rod and track, substantially as described.

5. In a machine for charging furnaces, the combination with the furnace-doors, of a frame located in front of the furnace, a track for supporting one end of the charging mechanism arranged within and adapted to have a vertical movement on the frame, means for elevating and lowering the track, and means connecting the doors of the furnace and track whereby the doors will be raised and lowered by the movement of the track, substantially as described.

6. In a machine for charging furnaces, the combination with a frame located in front of the furnace, of a track for supporting one end of the charging mechanism arranged within and adapted to have a vertical movement on the frame, a pressure-cylinder supported on the frame above the track, a piston-rod extending from the cylinder, and levers pivoted to the frame and having their opposite ends pivoted to the rod and track, substantially as described.

7. In a machine for charging furnaces, the combination with a frame located in front of the furnace, of a track for supporting one end of the charging mechanism arranged within and adapted to have a vertical movement on the frame, a pressure-cylinder supported on the frame above the track, a piston-rod extending from the cylinder, and oppositely-extending levers pivoted intermediate their ends to the frame and having their opposite ends pivoted to the rod and track, substantially as described.

8. In a machine for charging furnaces, the combination with a vertically-movable track arranged over the front of the furnace, of a stationary track arranged in front of the vertically-movable track, a longitudinally-movable carrier supported on the tracks, a movable truck supported on the carrier, charging mechanism suspended from the truck, and means for operating the movable parts, substantially as described.

9. In a machine for charging furnaces, the combination with a vertically-movable track arranged over the front of the furnace, of a stationary track arranged in front of the vertically-movable track, a longitudinally-movable carrier having one end supported on the vertically-movable track and the opposite end pivotally supported on the stationary track, charging mechanism suspended from the carrier, and means for actuating the movable parts, substantially as described.

10. In a machine for charging furnaces, the combination with a vertically-movable track arranged over the front of the furnace, of a stationary track arranged in front of the vertically-movable track, a longitudinally-movable carrier, supported on the tracks, a movable truck supported on the carrier, charging mechanism suspended from the truck, and a pressure-cylinder carried by the carrier for operating the carrier, truck and charging mechanism, substantially as described.

11. In a machine for charging furnaces, the combination with a vertically-movable track arranged over the front of the furnace, of a stationary track arranged in front of the vertically-movable track, a longitudinally-movable carrier supported on the tracks, charging mechanism suspended from the carrier, a pressure-cylinder carried by the carrier, gearing adapted to be actuated by the pressure-cylinder for moving the carrier and actuating the charging mechanism respectively and

means for alternately connecting the gearing with the cylinder, substantially as described.

12. In a machine for charging furnaces, the combination with tracks arranged in front of the furnace, of a longitudinally-movable carrier supported on the tracks, charging mechanism supported by the carrier, a pressure-cylinder on the carrier, a rack-bar actuated by the pressure-cylinder, pinions journaled on the carrier, adapted to be brought into mesh with the rack-bar for actuating the carrier and charging mechanism respectively, and means for alternately bringing each pinion into mesh with the rack-bar, substantially as described.

13. In a machine for charging furnaces, the combination with tracks arranged in front of the furnace, of a longitudinally-movable carrier supported on the tracks, charging mechanism supported by the carrier, a pressure-cylinder on the carrier, a rack-bar actuated by the pressure-cylinder, a shaft journaled on the carrier, pinions eccentrically mounted on the shaft for actuating the carrier and charging mechanism respectively, and a lever for rotating the shaft to bring each pinion alternately into mesh with the rack-bar, substantially as described.

14. In a machine for charging furnaces, the combination with tracks arranged in front of the furnace, of a cable arranged over each track, a longitudinally-movable carrier supported on the track, a rod supported on the carrier and arranged parallel therewith, a pulley on the opposite ends of the rod around which the cables are wrapped, and means for rotating the rod whereby the carrier is moved longitudinally on the tracks, substantially as described.

15. In a machine for charging furnaces, the combination with tracks arranged in front of the furnace, of a longitudinally-movable carrier on the tracks, a truck movably supported on the carrier, a rotatable charging-pan holder supported by and swiveled to the truck, and means for moving the pan-holder from and toward the furnace independent of the movement of the truck, substantially as described.

16. In a machine for charging furnaces, the combination with tracks arranged in front of the furnace, of a longitudinally-movable carrier on the tracks, a truck movably supported on the carrier, and a rotatable charging-pan holder supported by the truck and adapted to be rotated by the movement thereof, substantially as described.

17. In a machine for charging furnaces, the combination with the tracks arranged in front of the furnace, of a longitudinally-movable carrier on the tracks, a truck movably supported on the carrier, a charging-pan holder carried by the truck, and means for moving the pan-holder from and toward the furnace independent of the movement of the truck, substantially as described.

18. In a machine for charging furnaces, the

combination with tracks arranged in front of the furnace, of a longitudinally-movable carrier on the tracks, a truck movably supported on the carrier, a platform carried by the truck, a plate swiveled to the platform, a charging-pan holder carried by the plate, and means connecting the plate and platform for moving the plate, substantially as described.

19. In a machine for charging furnaces, the combination with tracks arranged in front of the furnace, of a carrier on the tracks, a truck supported on the carrier, a platform carried by the truck, a plate swiveled to the platform, a charging-pan holder carried by the plate, and gearing connected to the plate and platform for actuating the plate, substantially as described.

20. In a machine for charging furnaces, the combination with tracks arranged in front of the furnace, of a carrier on the tracks, a truck supported on the carrier, a platform carried by the truck, a plate swiveled to the platform, a charging-pan holder carried by the plate, a curved rack on one end of the plate, gearing supported by the platform engaging the rack, and means on the platform for operating the gearing, substantially as described.

21. In a charging-machine for furnaces, the combination with tracks arranged in front of the furnace, of a carrier on the tracks, a truck supported on the carrier, a platform carried by the truck, a plate swiveled to the platform, a charging-pan holder carried by the plate, means for actuating the plate, and rollers interposed between the plate and platform, substantially as described.

22. In a charging-machine for furnaces, the combination with tracks arranged in front of the furnace, of a carrier on the tracks, a movable truck supported on the carrier, a shaft carried by the truck adapted to carry a charging-pan, and means connected to the shaft and carrier for rotating the shaft upon the movement of the truck, substantially as described.

23. In a charging device for furnaces, the combination with tracks arranged in front of the furnace, of a carrier on the tracks, a movable truck supported on the carrier, a shaft carried by the truck, adapted to carry a charging-pan, a pinion on the shaft, and a rack adapted to engage the pinion for rotating the shaft upon the movement of the truck, substantially as described.

24. In a charging device for furnaces, the combination with tracks arranged in front of the furnace, of a carrier on the tracks, a movable truck on the carrier, a shaft carried by the truck adapted to carry a charging-pan, a pinion on the shaft, oppositely-arranged racks adapted to engage the pinion, means for engaging either rack with the pinion, and means for actuating the racks upon the movement of the truck, substantially as described.

25. In a charging device for furnaces, the

combination with a carrier supported in front of the furnace, of a movable truck supported on the carrier, a shaft carried by the truck adapted to carry a charging-pan, a pinion on the shaft, a rack adapted to engage the pinion, a guide-rail on the carrier, and a rod connecting the guide-rail and rack whereby the rack will be moved by the movement of the truck, substantially as described.

26. In a charging device for furnaces, the combination with a carrier supported in front of the furnace, of a movable truck supported on the carrier, a plate carried by the truck, a shaft carried by the plate adapted to carry a charging-pan, a pinion on the shaft, a rack engaging the pinion adapted to be actuated by the movement of the truck and means on the plate for engaging the rack with the pinion, substantially as described.

27. In a charging device for furnaces, the combination with a carrier supported in front of the furnace, of a movable truck supported on the carrier, a shaft carried by the truck adapted to carry a charging-pan, a pinion on the shaft, a rack adapted to engage the pinion, a guide-rail on the carrier, a rod connected to the rack, and a roller on the opposite end of the rod engaging the guide-rail, substantially as described.

28. In a charging device for furnaces, the combination with a carrier supported in front of the furnace, of a movable truck supported on the carrier, a shaft carried by the truck adapted to carry a charging-pan, a rack on the shaft and a pinion engaging the shaft for moving the shaft independent of the truck, substantially as described.

29. In a machine for charging furnaces, the combination with the furnace-doors, of a track arranged over the front of the furnace for supporting one end of the charging mechanism, means for elevating and lowering the track, pulleys on the track, a cable secured to the doors and passing around the pulleys, a weight secured to the opposite end of the cable, and means for securing the cable to the furnace, substantially as described.

30. In a machine for charging furnaces, the combination with the furnace-doors, of a track arranged over the front of the furnace for supporting one end of the charging mechanism, means for elevating and lowering the track, pulleys on the track, a cable secured to the doors and passing around the pulleys, a notched bar secured to the opposite end of the cable, a weight secured to the bar, and means for engaging the notch on the bar with a fixed projection on the furnace, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JOSEPH P. ECK.

Witnesses:

JOHN H. MCGRATH,
G. A. UMBARGER.