

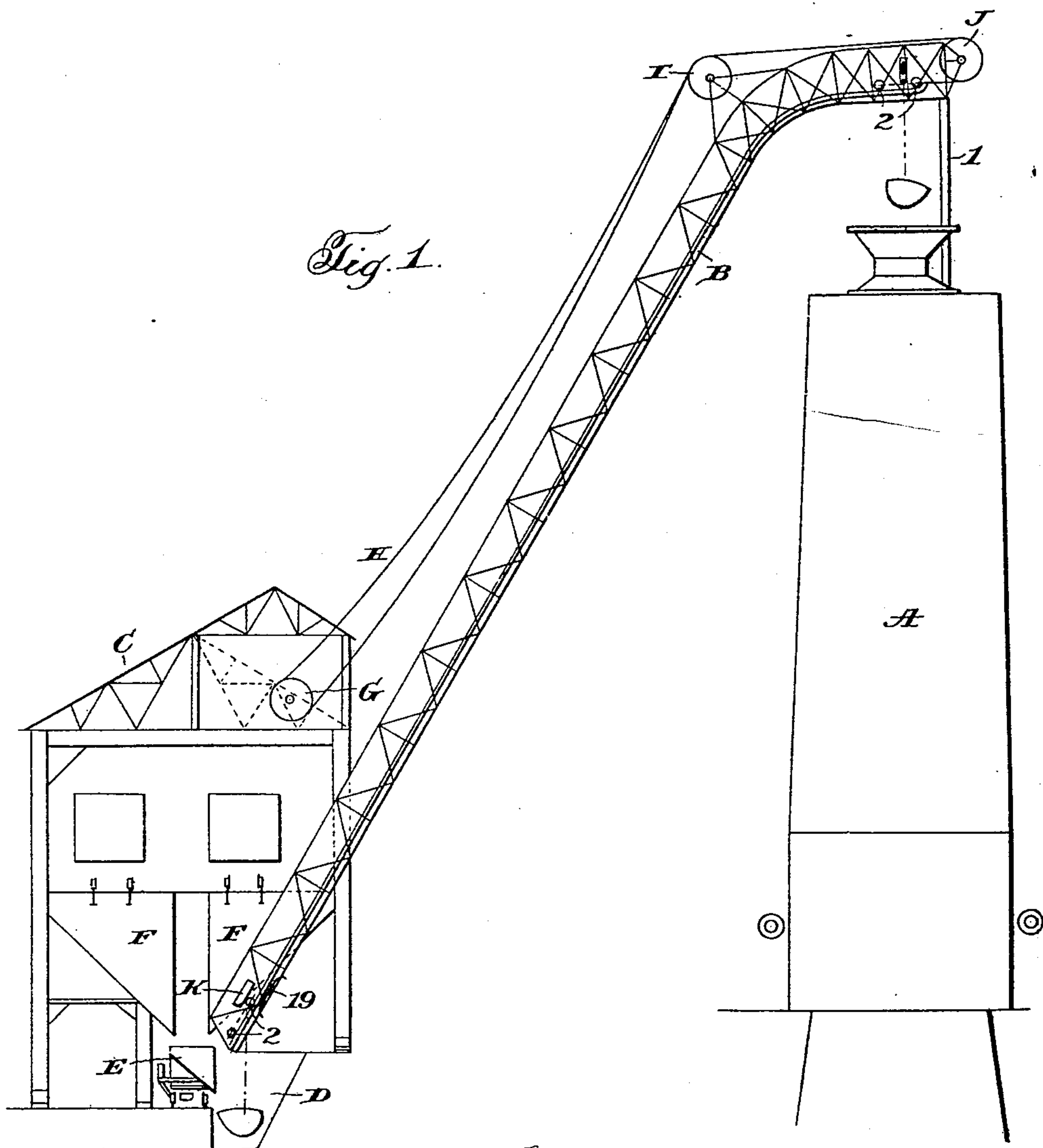
No. 868,507.

PATENTED OCT. 15, 1907.

C. P. TURNER, J. W. DOUGHERTY & J. E. LITTLE.  
BLAST FURNACE CHARGING DEVICE.

APPLICATION FILED FEB. 14, 1907.

5 SHEETS—SHEET 1.



Witnesses:

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*B. Mommers*

Inventors:

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by *Henry O. O'Leary* Attorney:

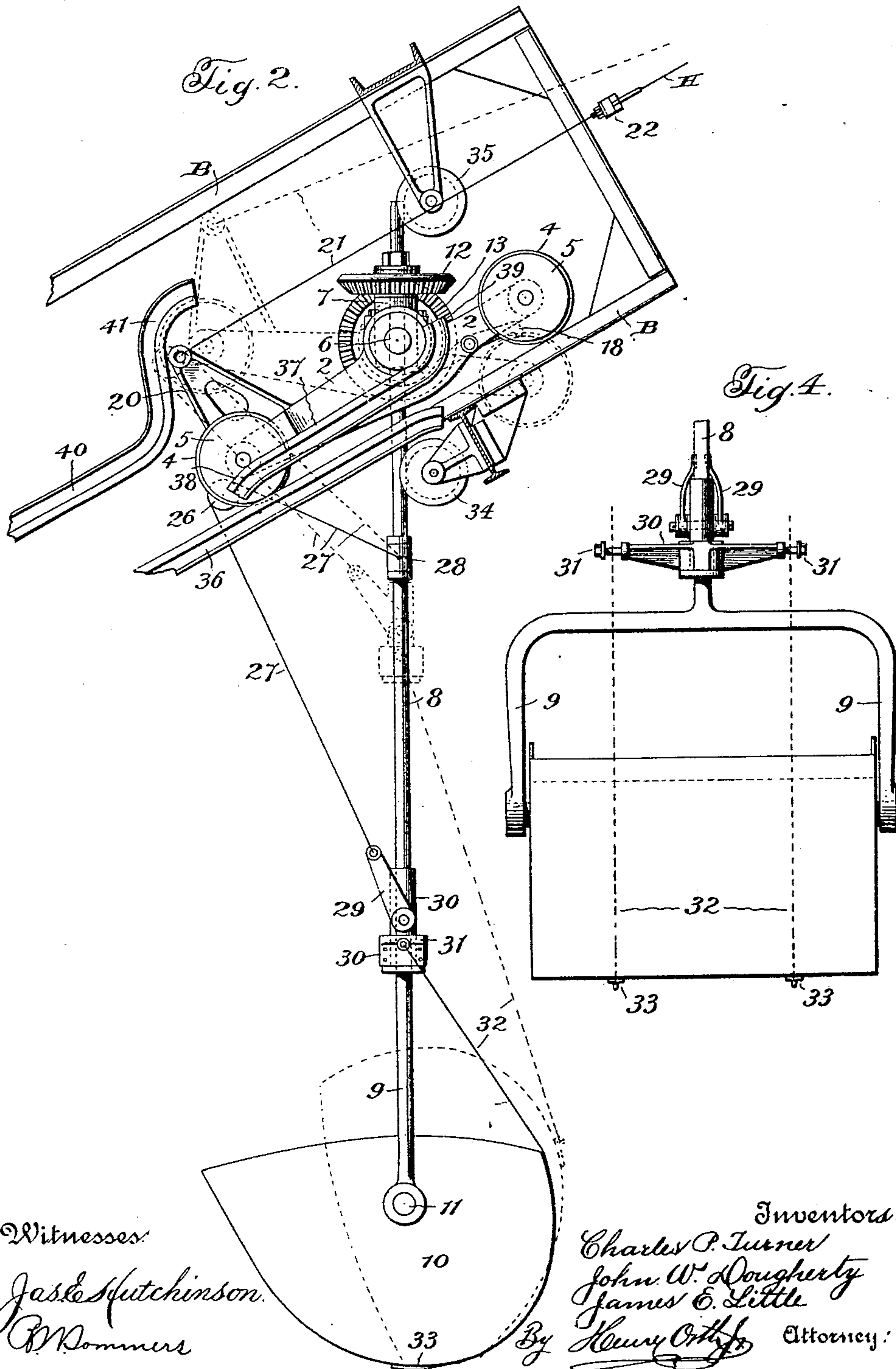
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6 SHEETS—SHEET 2.



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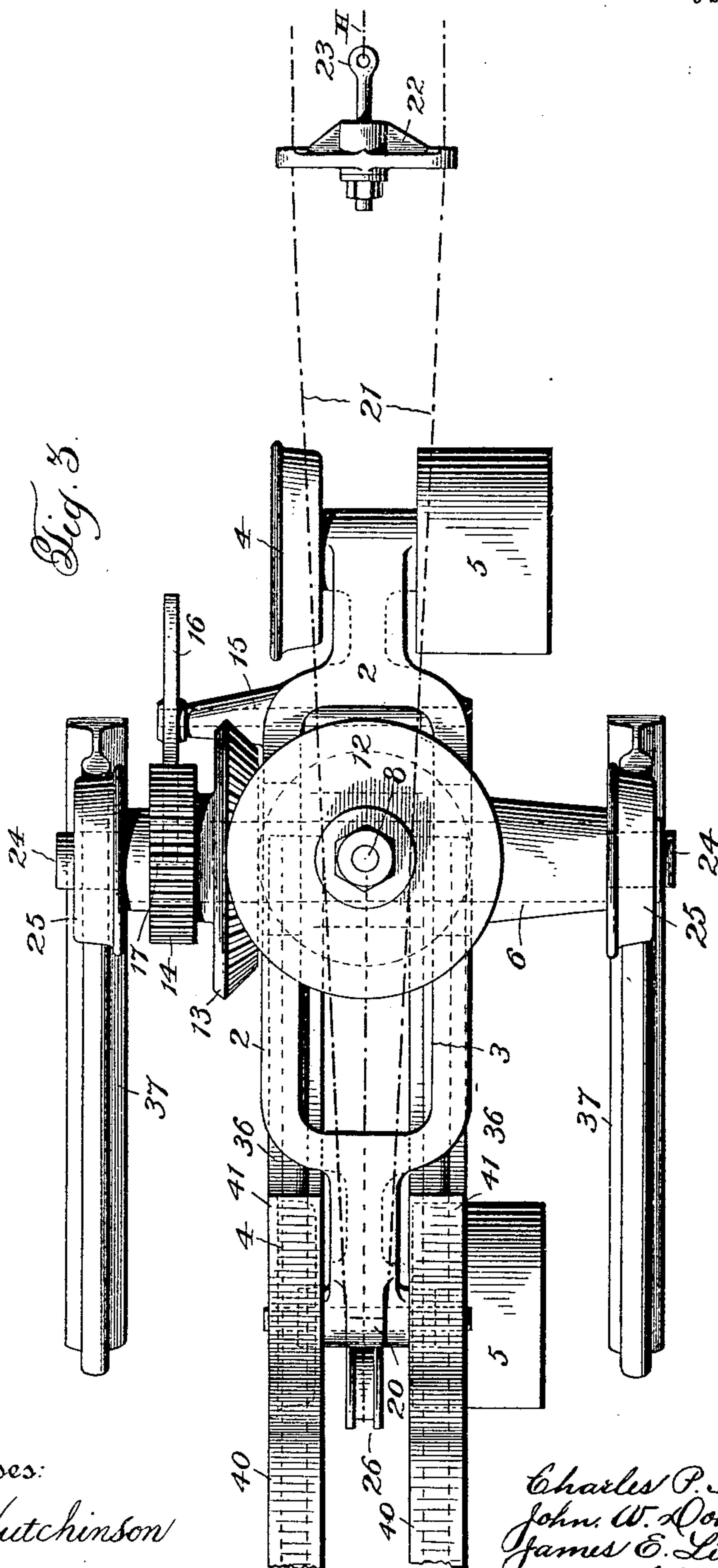
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5 SHEETS—SHEET 3.



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6 SHEETS—SHEET 4.

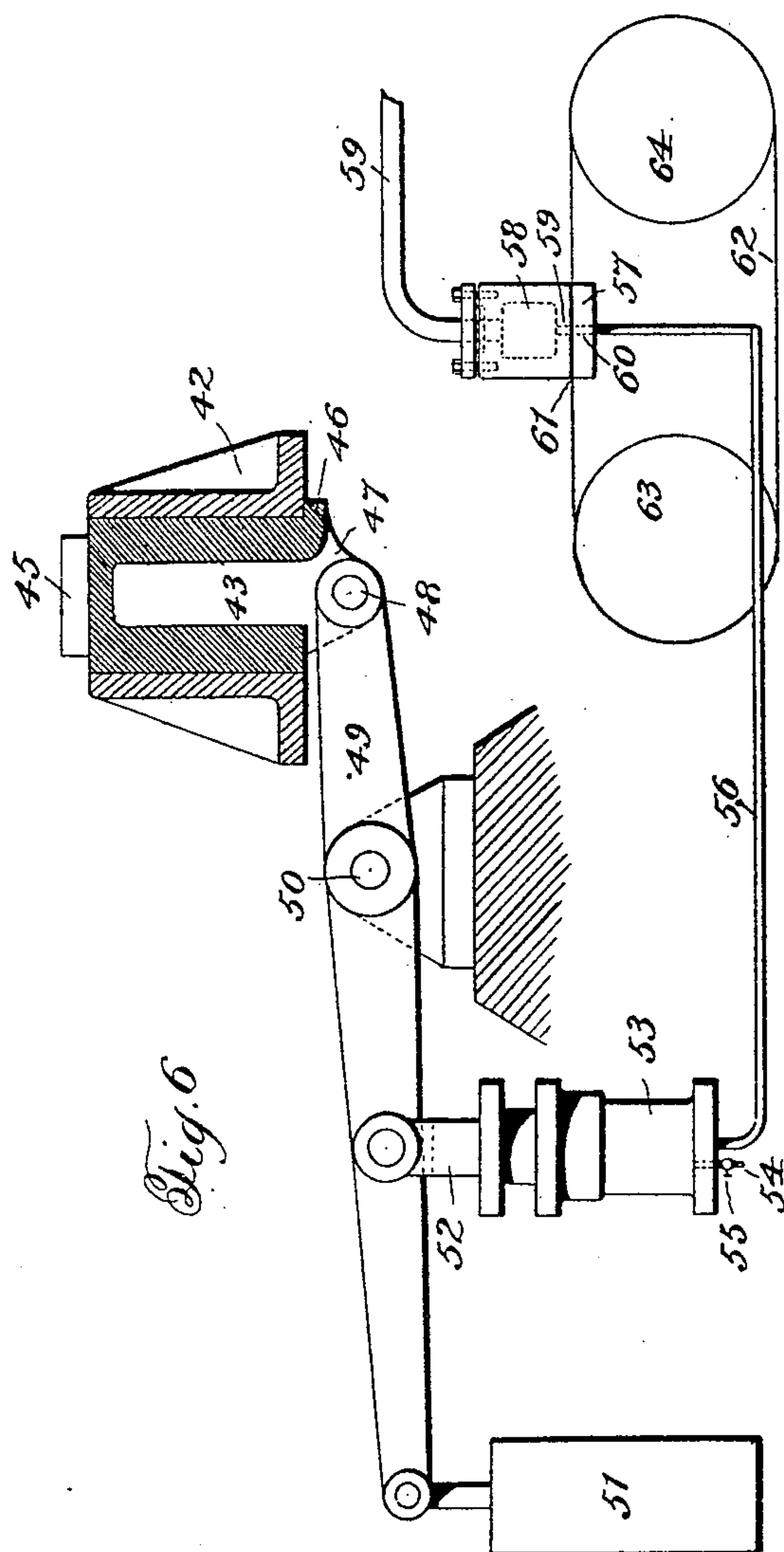


Fig. 6

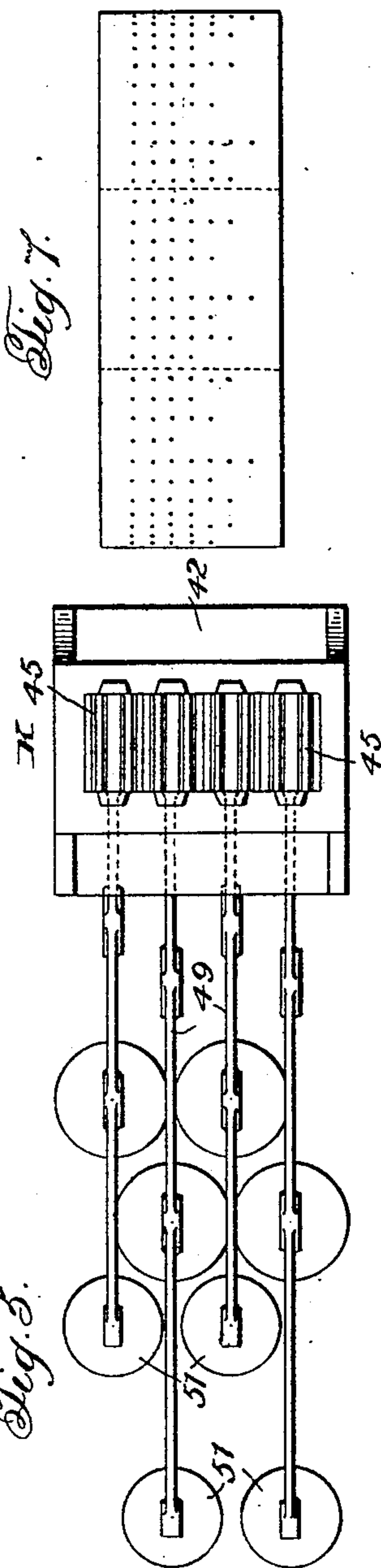


Fig. 7

Fig. 5

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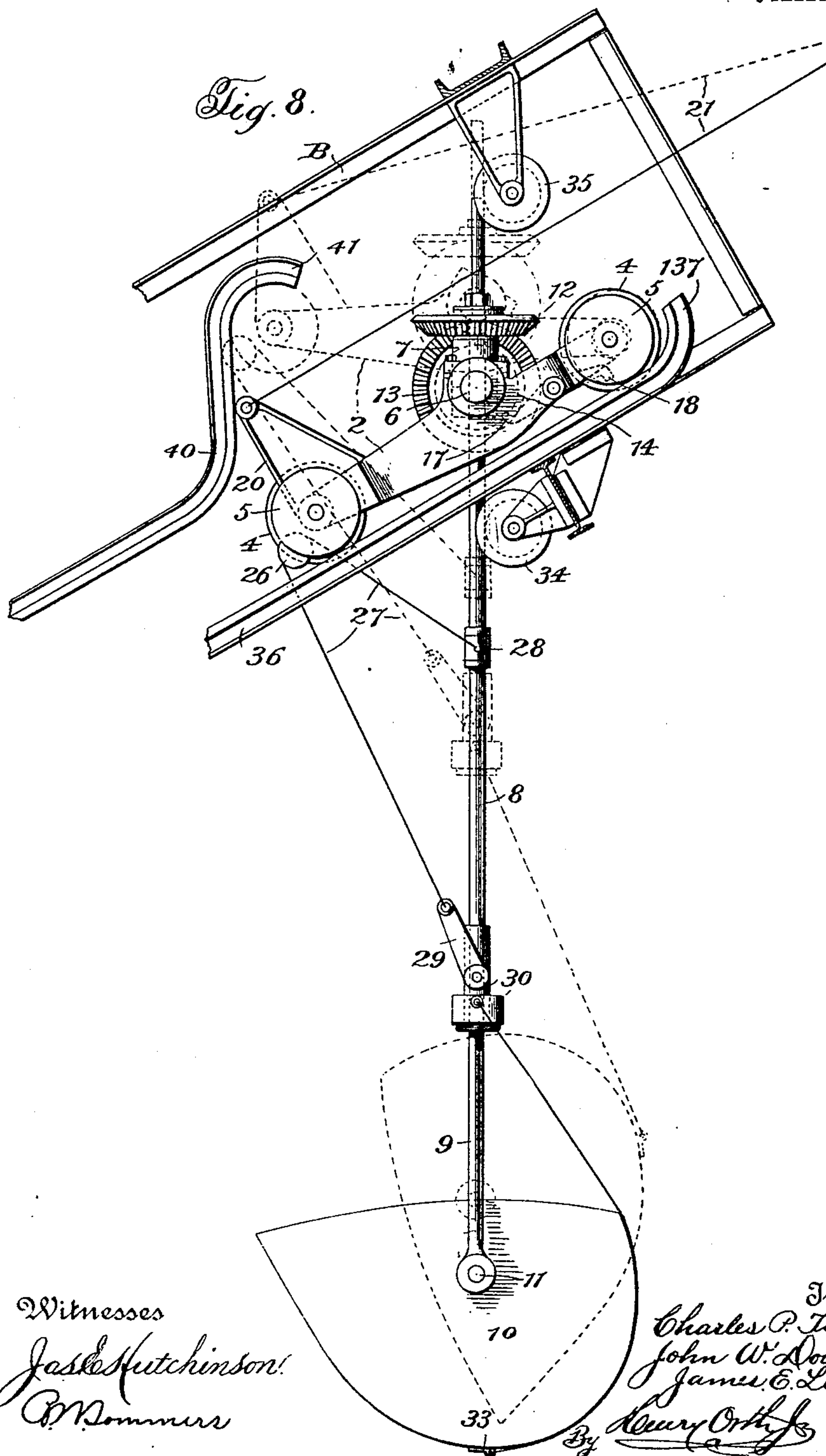
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5 SHEETS—SHEET 5.



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# UNITED STATES PATENT OFFICE.

CHARLES P. TURNER, OF HARRISBURG, AND JOHN WEBSTER DOUGHERTY AND JAMES E. LITTLE, OF STEELTON, PENNSYLVANIA.

## BLAST-FURNACE-CHARGING DEVICE.

No. 868,507.

Specification of Letters Patent.

Patented Oct. 15, 1907.

Application filed February 14, 1907. Serial No. 357,429.

*To all whom it may concern:*

Be it known that we, CHARLES P. TURNER, a citizen of the United States, residing at Harrisburg, JOHN WEBSTER DOUGHERTY and JAMES E. LITTLE, citizens of the United States, residing at Steelton, both in the county of Dauphin, State of Pennsylvania, United States of America, have invented certain new and useful Improvements in Blast-Furnace-Charging Devices; and we 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, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

Our invention relates to furnace charging devices and has for its object to provide a hoist to carry the stock to the top of the furnace in a suspended bucket, said bucket capable of being oriented or directed to dump in any desired direction, together with means to position the bucket in its dumping direction and means for automatically dumping the bucket, together with details of construction hereinafter described and claimed.

Referring to the drawings in which like parts are similarly designated, Figure 1, is a diagrammatic view of the way shown in relation to a typical blast furnace. Fig. 2, is a side view of the upper end of the way over the furnace together with the buggy for carrying the bucket. Fig. 3, is an enlarged plan of the buggy at its upper end position over the furnace. Fig. 4, is a rear view of the bucket showing the cross head to which the dumping chains or ropes are attached. Fig. 5, is a plan view, and Fig. 6, is a side elevation, partly in section, of the means for orienting the bucket, and Fig. 7, is a front view of the sheet controlling the operation of the orienting device, and Fig. 8, is a modification of Fig. 2.

In Fig. 1, we have shown an ordinary blast furnace A provided with our automatic charging device comprising an overhead inclined way B supported from the top of the furnace at its upper end by columns 1 or other suitable devices, the lower end of the way, B, preferably but not necessarily entering the stock house which is provided with a pit D in which the bucket is positioned when being loaded either by barrows or from a lorry car E which receives stock from overhead bins F, said bins being of any usual or well known construction. In the upper part of the stock house is a driving drum G from which proceeds a cable H passing over a pair of guide sheaves I and guide sheaves J on the way, the two ends of the rope being connected preferably to two buggies one traveling up and the other traveling down the way. Preferably, but not necessarily at the lower end of the way is located the orienting device K

for changing at will or for selectively changing the dumping direction of the bucket.

Referring to Figs. 2 and 3, the buggy 2 has substantially a central opening 3 through which the bucket suspending rod passes and at its two ends has a flanged wheel 4 and a broad faced plain wheel 5 so that the flanged wheels 4 act as guides for the buggy and the broad faced wheel 5 will permit the buggy to pass over the frog uniting the parallel tracks on to the single track portion passing over the top of the furnace such track structure and frog being fully described in application Serial No. 354,428, filed February 14, 1907.

Swingly mounted on trunnions 6 is a block 7 over the opening 3 in the frame of the buggy and through this block passes the bucket supporting rod 8 on whose lower end is a yoke 9 in which the bucket 10 is mounted by means of trunnions 11. Keyed or otherwise secured to the rod 8 is a bevel gear wheel 12 meshing with a like bevel gear wheel 13 mounted on an extension of one of the trunnions of the block 7. Made in one piece with the bevel gear wheel 13 or secured thereto is a spur wheel 14 said spur wheel and bevel gear wheel 13 loose on the trunnion 6.

Mounted in the buggy 2 is a shaft 15 and free to move thereon, is a detent pawl whose nose 17 engages the teeth of the spur wheel 14 and whose tail is bent downward at 18 to engage any suitable form of cam device situated in proximity of the orienting device K and here shown as a cam rail 19 to cam the pawl out of engagement with the spur wheel as the buggy moves into operative position with relation to the orienting device. At the rear of the buggy is a horn 20 through which rope 21 passes and whose ends are secured in the rope clamp 22 at the center of which is an eye 23 to which one end of the main hauling rope H is secured.

On the ends of the trunnions 6 or on extensions 24 thereof, are loosely mounted, on each side of the buggy, pivot wheels 25 coming into operation at the upper end of the way. At the rear of the buggy is a guide pulley 26 over which passes a rope 27 secured at one end to the bucket supporting rod at 28 and at the other end to the forked lever 29 pivoted to a cross head 30 slidable on rod 8. From the ends 31 of the cross head 30 extend ropes 32 secured to eyes 33 on the bottom of the bucket 10. Beneath the way at its upper end is mounted a stop pulley 34 and over the top of the buggy on the way is a similar stop pulley 35 against both of which the rod 8 abuts when in its upper end position to prevent the rod from swinging.

Above the upper ends of the main tracks 36 of the way is a short track section 37 whose entering end 38 is slightly curved downward to facilitate the pivot wheels 25 in riding on them, while their upper ends 39 are curved upward to substantially fit the pivot wheels. Above the main rails 36 and extending over the enter-



ing end 38 of rails 37, is a pair of curved limit rails 40 whose forward curved ends 41 are engaged and limit the upward movement of the rear wheels 4 and 5 when the bucket is dumped, the forward wheels of the buggy 5 being free to swing over the end of the main track as shown in dotted lines in Fig. 2.

Preferably but not necessarily at the lower end of the way, we position the orienting device for the bucket, comprising a rack positioned to engage the spur wheel 10 14 as the buggy ascends and descends, the locking pawl 16 having previously been cammed from engagement with the spur wheel 14 by its tail 18 riding on a cam rail 19. This rack consists of a number of teeth, a number of which project above the plain of the roots of the teeth 15 and are capable of being selectively controlled. The mechanism comprising the orienting device is illustrated in Figs. 5, 6 and 7, in which K is the rack whose teeth or a number of whose teeth on one end or the other of the rack, are moved and selectively controlled.

20 In a suitable frame 42 are mounted a number of slides 43 each carrying on its end one or more rack teeth 45, the slides 43 having stops 46 taking against the frame 42 to limit their movements, and ears 47, in which they are pivotally secured at 48 to one end of the lever 49 25 mounted on a suitable center 50 and carrying at its rear end a counter-weight 51.

Secured between the pivot point 50 and the counter-weight 51 is a piston rod 52 operated by an air cylinder 53. This air cylinder has a vent 54 normally open and 30 controlled by any suitable valve 55. The piston of said cylinder is a single acting one and the pressure fluid or compressed air is admitted to each cylinder by a pipe 56 terminating in the manifold 57. Opposite the manifold and slightly distant from it is a fluid pressure chamber 58 supplied by pressure fluid from a pipe 35 59 from any suitable source of supply. The bottom of chamber 58 is perforated with a row of holes 59 corresponding in number to the number of cylinders 53, each hole being opposite and axially aligned with holes 40 60 in the manifold.

Passing through the slot 61 between the manifold and the end of chamber 58, is an endless or other suitable belt or strip 62 passing over drums 63 and 64. These 45 drums are moved by any suitable and well known mechanism, preferably by mechanism connected with a lever which starts the hoisting engine for elevating the stock to the top of the furnace and such mechanism may be varied according to the requirements or existing conditions and therefore forms no specific part of 50 the present invention, it being sufficient that the strip is moved when the engine is started or otherwise if desired. The strip is provided with rows of holes extending transversely across it, which holes are adapted to register with those 59 and 60 and the number of holes, 55 in the row is varied in accordance with the selective control desired to be given to the rack teeth, so that when no hole is in the belt to permit the passage of motive fluid from 58 to 57 that particular cylinder has no power to withdraw its rack teeth out of operative position. 60

The operation of the charging device is as follows: When the buggy 2 with the bucket 10 swinging therefrom and rotatably carried thereby, is in its lowermost end position the bucket 10 is suspended within the pig 65 D so that the lorry car can discharge into it, and the

tail 18 of the pawl 16 is resting on the cam rail 19. The engine is started and the rack teeth on the orienting device are now set and the buggy at the bottom of the way proceeds to ascend while the one at the top of the way proceeds to descend. During the ascent of the 70 bucket the spur wheel 14 engages the rack teeth 45 of the orienting device K and is rotated by the continued movement of the buggy, thus rotating bevel wheel 13 which in turn rotates bevel wheel 12 secured to rod 8 and turns said rod in accordance, corresponding 75 to the number of teeth projecting into the path of the spur wheel 14 and thereby orienting or directing the dumping position of the bucket 10, mounted at the end of the rod 8. Continuing the ascent, the tail 18 of the pawl 16 rides off the cam rail 19 and the pawl 80 16 is free and moved by gravity so that its nose 17 engages the spur wheel 14 and locks it against any accidental further rotation, thereby locking the bucket in its oriented or dumping direction. As the buggy approaches the top of the way, the pivot wheels 24 85 ride upon the rail 37 until they are stopped by the upwardly curved ends 39 of said rail. The front wheels 4, 5 of the buggy are now projecting beyond the ends of the main rails 36 and further continued pull of the hauling rope H, pulling on clamp 22 and 90 rope 21 that passes through the eye in the horn 20, will tilt the buggy about trunnions 6 and the pivot wheels 24, the horn 20 being narrow enough to pass between the limit rails 40 so that the rear wheels 4, 5 of the buggy will be stopped by the upper curved end 41 of the limit 95 rails. At the same time the bucket supporting rod 8 is moved into contact with the stop wheels 34 and 35, and is thereby prevented from swinging. During the upward movement of the rear end of the buggy, the pulley 26 moves with it, pulling in the bight of 100 rope 27 which in turn pulls up the sliding cross head 30 to draw on ropes 32 passing under the bucket to dump the same. When the pull of the hauling rope H is stopped and the ropes slacken as the buggy at the bottom of the way begins its ascent, the buggy at 105 the top of the way drops back into full line position shown in Fig. 2, and proceeds to descend, the flanged pivot wheels 25 guiding the buggy during its descent until the buggy wheels 4, 5 are in full engagement with the main rails 36. As the buggy approaches its lowermost position, the tail of pawl 16 rides on a cam rail 19 and is disengaged from the spur wheel 14 and thereafter the spur wheel 14 engages the rack of the orienting device K to return the bucket into its normal position ready for loading. As the bucket starts on its 115 way up again, the orienting device is again selectively controlled, the drums 63 and 64 are moved one step bringing another row of holes in the belt 62 into registration with the holes 59 and 60, thereby operating one or more pistons in the air cylinders by permitting 120 compressed air to enter said cylinders, said air forcing piston and rod 52 out, thereby moving one or more levers 49 about their pivots 50. The movement of the lever 49 by means of this compressed air cylinder withdraws one or more teeth from operative position in the 125 rack and the buggy moves so that its spur wheel 14 engages with the rack and the buggy is given the selected orientation. The levers 49 not operated or whose motive fluid has been cut off, are automatically brought into normal position in the rack by the counter- 130



weights 51, the weight of which causes the motive fluid to vent through 54.

It is obvious that should it be desired to cause the movable rack teeth to be normally held out of operative position the weight 51 and cylinder 53 will simply have to be connected to the lever 49 between the points 48 and 50.

In the modification in Fig. 8, we have dispensed with the rails 37 and the pivot wheels 25 bending the ends of the main rails 37 up at their ends at 137 to conform to the curvature of the front wheels 4 and 5 of the buggy so that instead of turning the buggy about the trunnions 6 and pivot wheels 25 as a center to dump, as in Fig. 2, we lift the whole buggy, it turning about the front wheels 4, 5 in the curved ends 137 of the main rails 37 as shown in Fig. 8.

We claim:—

1. In a furnace charging device, the combination with a buggy, of a bucket suspension, a bucket mounted in trunnions in said suspension, flexible means connecting the bucket and buggy whereby the bucket will be rotated on its trunnions by the tipping of the buggy.

2. In a furnace charging device, the combination with a buggy; of a bucket hung in trunnions from said buggy, means to tip the buggy and devices operated by the tipping of the buggy to rotate the bucket on its trunnions.

3. The combination with a buggy and means to haul the same; of a bucket suspension swingingly mounted in the buggy, a bucket on said suspension, means to stop the travel of the buggy and cause it to tip by a continued pull on the hauling means, means to prevent the swing of the suspension during the tipping of the buggy and mechanism operated by the tipping movement of the buggy to discharge the bucket.

4. The combination with a buggy and means to haul the same; of a rigid bucket suspension swingingly suspended from the buggy, a bucket carried by said suspension, means to stop the travel of the buggy and cause it to tip by a continued pull in the hauling means, means to limit the tilting of the buggy, means to prevent the swinging of the suspension and bucket during the tilting of the buggy, and means actuated by the tilting of the buggy to discharge the bucket.

5. In combination, a buggy, a hauling horn thereon, a bucket supporting rod swingingly mounted in the buggy, a bucket carried by the end of the rod, means to stop the buggy in its end position and cause the buggy to tip by a continued pull on the horn, means to hold the rod substantially vertical during the tipping of the buggy and means operated by the tipping of the buggy to discharge the bucket.

6. In combination, a buggy, a bucket hung therefrom, means to orient the bucket, means to tip the buggy and devices actuated by the tipping of the buggy to discharge the bucket.

7. In combination, a buggy, a bucket hung therefrom, means to orient the bucket actuated by the movement of the buggy, means to lock the bucket in oriented position, means to tip the buggy, and devices actuated by the tipping of the buggy to discharge the bucket while being held in its oriented position.

8. In combination, a buggy, suspension rod mounted to swing with relation to the buggy, a bucket rotatively mounted on the rod, means to tip the buggy and means operated by the tipping of the buggy to rotate the bucket to discharge the same.

9. In combination, a buggy, a suspension rod mounted in trunnions a bucket at the end of said rod, means to tip the buggy, means slidable on the rod and actuated by the tipping of the buggy to rotate the bucket on its trunnions to discharge the same.

10. In combination, a buggy, a suspending rod passing through the buggy and mounted on trunnions therein, a tilting bucket on the end of said rod, means to tilt the buggy, a slidable member on the rod, means to connect the member with the bucket, a pulley on the buggy a flexi-

ble member connected at one end to the rod passing over the pulley and connected at its other end to said sliding member and means to prevent the rod from swinging during the tilting of the buggy.

11. In combination, a buggy, a hauling horn on the rear thereof, a rod swingingly and revolubly mounted in the buggy, a bucket carried by the rod, rails to stop the buggy and cause it to tilt and limit rails above the buggy to limit the tilting of the buggy, said hauling horn capable of passing between the limit rails.

12. In combination, a buggy, a bucket carried by the buggy, means to tip the buggy and flexible means connected to the bucket and engaged by the buggy to dump the bucket when the buggy is tipped.

13. In combination, a buggy, a bucket carried thereby and mounted to rotate in two planes, means to lock the bucket in its rotated position in one of its planes, means to tilt the buggy and means operated by the tilting of the buggy to rotate the bucket in the other of its planes of rotation.

14. In combination, a buggy, a bucket-suspending rod, a block having trunnions mounted in the buggy, said rod revoluble in the block, a bucket carried by the rod, means independent of the buggy to cause it to tilt about the trunnions as a center and means operated by the tilting of the buggy to discharge the bucket.

15. The combination with a way having main track rails, tilting and limit rails above the track of a buggy, a block having trunnions mounted in the buggy, wheels on said trunnions to engage the tilting rails, a bucket on the rod, means operated by the tilting of the buggy to discharge the bucket, and stop wheels on the way to engage the rod during the tilting of the buggy to prevent said rod from swinging.

16. The combination with a way, a buggy to travel thereon, and a bucket mounted to swing and rotate about substantially a vertical axis of an orienting device comprising a rack on way to rotate the bucket about the vertical axis, and means to selectively control the number of teeth of said rack that are in operative position in relation to the buggy.

17. In a furnace charging device a bucket orienting mechanism comprising a rack having movable teeth and mechanism to selectively move them into and out of operative position in the rack.

18. In a furnace charging device, a bucket orienting device comprising a rack having teeth movable with respect to the rack and fluid pressure actuated mechanism to selectively control the number of teeth in operative position in the rack.

19. In a furnace charging device, a bucket orienting device comprising a rack, movable teeth therein, levers to which the movable teeth are connected, fluid pressure mechanisms actuating the levers, and controlling mechanism to control the operation of the fluid pressure mechanism and levers.

20. In a furnace charging device, a bucket orienting device comprising a frame, slides carrying rack teeth mounted therein, stops to limit the movement of the slides into operative position, a pivoted lever connected to each slide, means to normally hold the levers and slides to position the teeth in operative position and fluid pressure means to actuate the levers to move the teeth out of operative position.

21. In a furnace charging device, a bucket orienting device comprising a rack, movable teeth therein, means to normally hold the teeth in operative position, fluid pressure mechanism to move the teeth out of operative position and a perforated band controlling the selections.

22. In a bucket orienting device, a frame, slides in said frame, rack teeth carried by the slides, a pneumatic piston and cylinder for actuating each slide, a chamber supplied with motive fluid and having a row of holes therein, a manifold adjacent the chamber, also having a row of holes therein and registering with those in the chamber, a band having perforations therein passing between the manifold and chamber to control the passage of motive fluid from the chamber to the manifold, and pipes connecting each hole in the manifold with a pneumatic cylinder.



23. In a bucket orienting device, a frame, slides mounted therein, one or more rack teeth on each slide, a stop to limit the movement of the slide into the frame, a pivoted lever connected to each slide, a counter-weight on each lever to normally hold the slides in operative position, a pneumatic cylinder and single acting piston to actuate each lever, said cylinder vented to the atmosphere, a compressed air chamber having a row of holes in its bottom corresponding in number to the number of cylinders, a manifold having a like number of holes registering with those in the chamber, a pipe connecting each hole in the manifold with a cylinder, and a perforated belt between the chamber and manifold to control the passage of air from the chamber through the manifold to the cylinders and thereby control the sequence of actuation of the slides, as well as the number of slides to be simultaneously operated.

24. In combination, a buggy, a bucket suspended below the same to tip, a flexible connection between the bucket

and buggy and means operated by the tilting of the buggy to exert a pull on said flexible connection to tip the bucket.

25. In combination, a buggy, a bucket suspending rod mounted to swing and to rotate in said buggy, mechanism to rotate the rod, devices to prevent the swinging of the rod at the end of the travel of the buggy, means to tip the buggy, a bucket mounted on the rod and a flexible wire connected to the bucket and pulled by the buggy during the tipping thereof.

In testimony that we claim the foregoing as our invention, we have signed our names in presence of two subscribing witnesses.

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