B. NEWTH.

MECHANISM FOR FEEDING BLAST FURNACES.

APPLICATION FILED AUG. 2, 1918.

1,376,458.

Patented May 3, 1921.

6 SHEETS—SHEET 1.

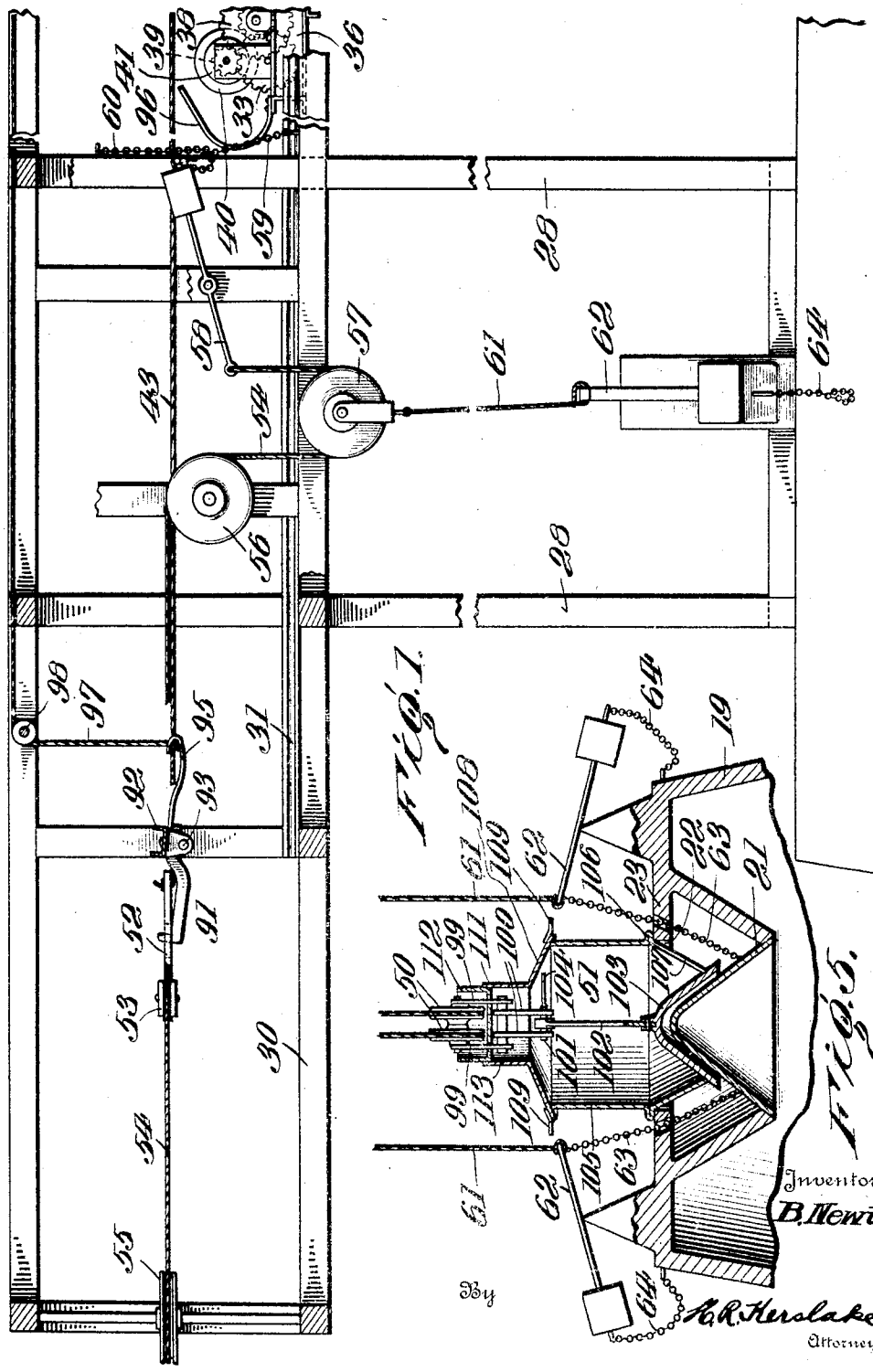


Fig. 1.

Fig. 5.

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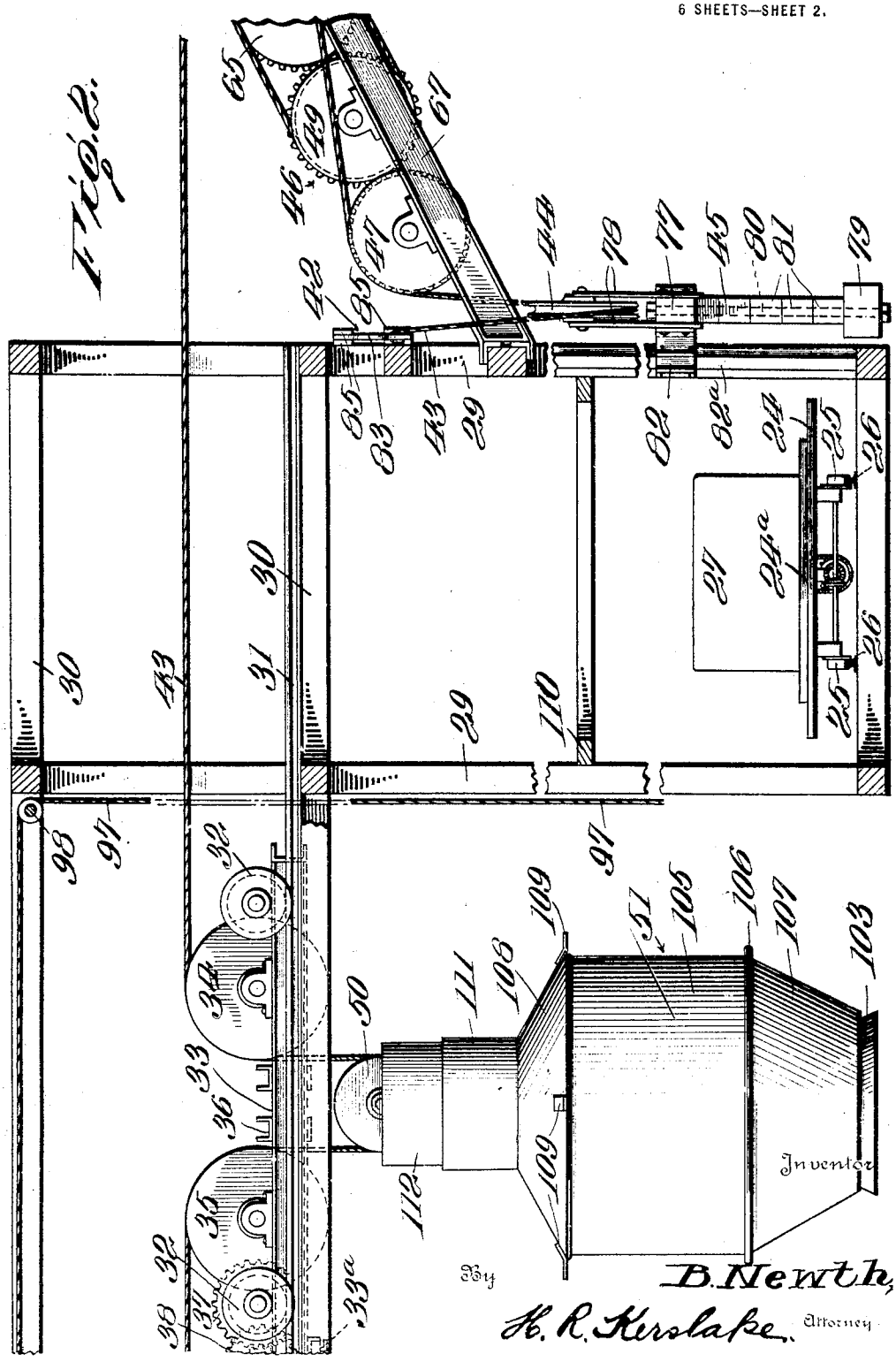
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6 SHEETS—SHEET 2.

Fig. 2.



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6 SHEETS—SHEET 3.

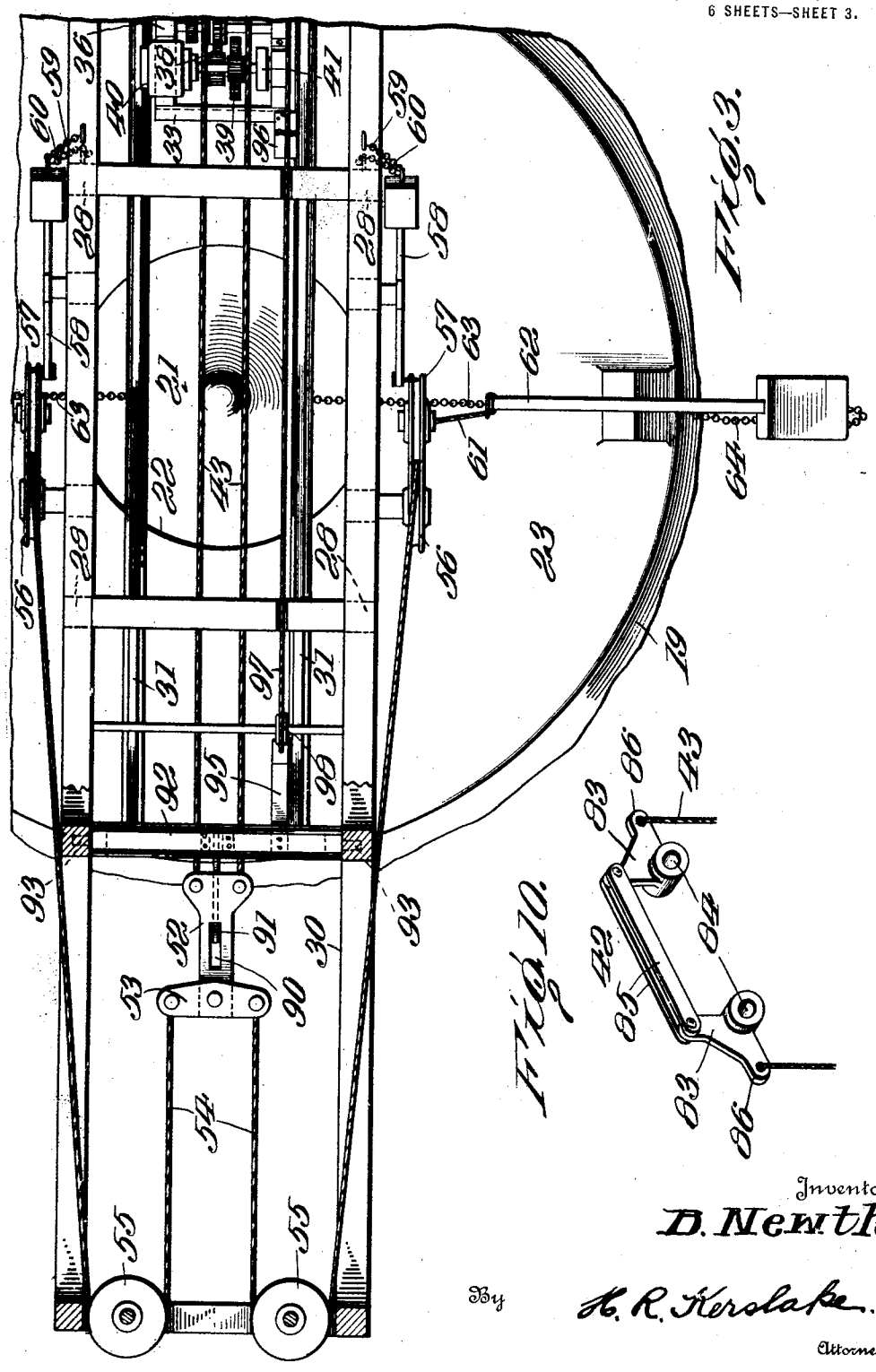


FIG. 3.

FIG. 10.

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6 SHEETS—SHEET 4.

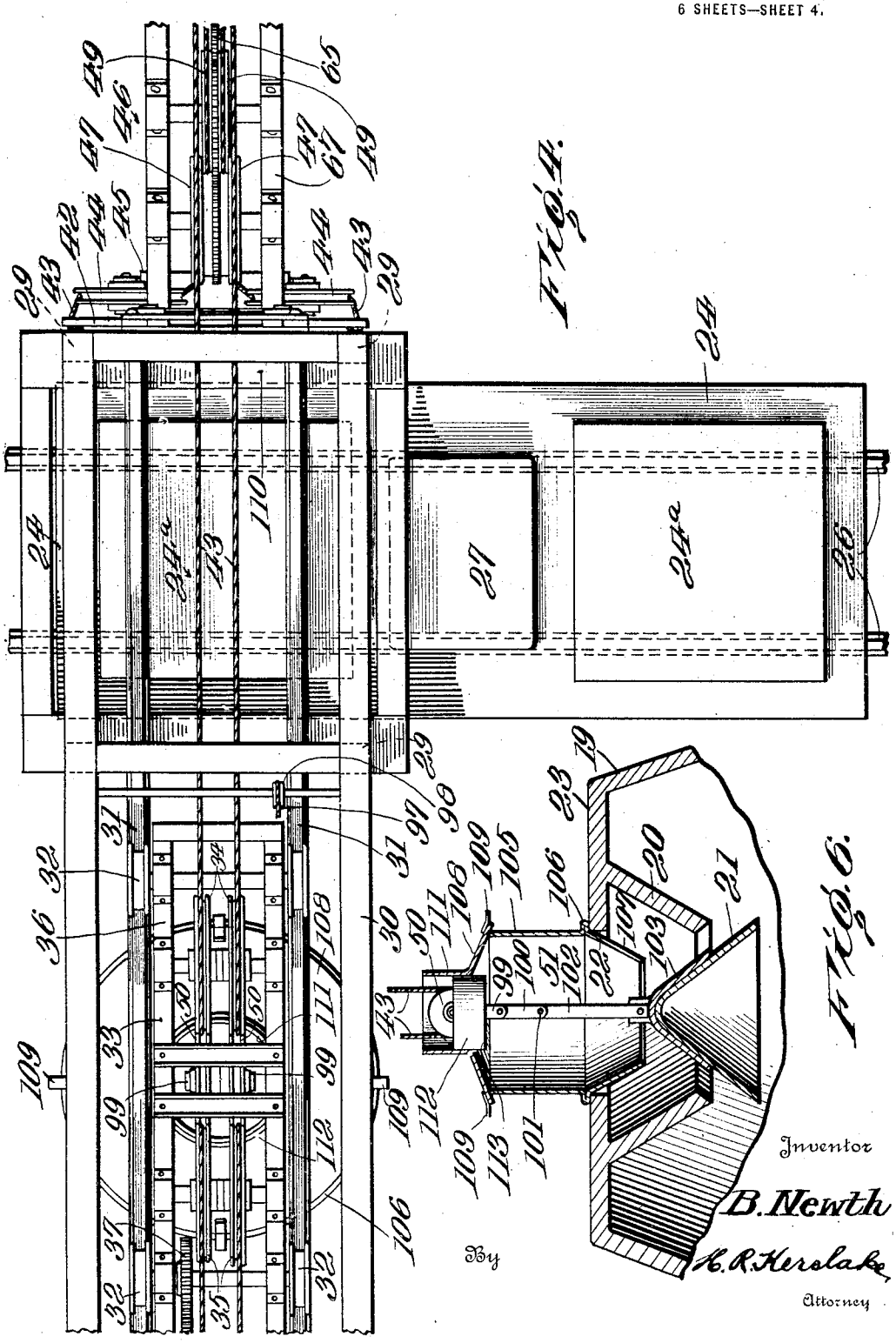


Fig. 4.

Fig. 6.

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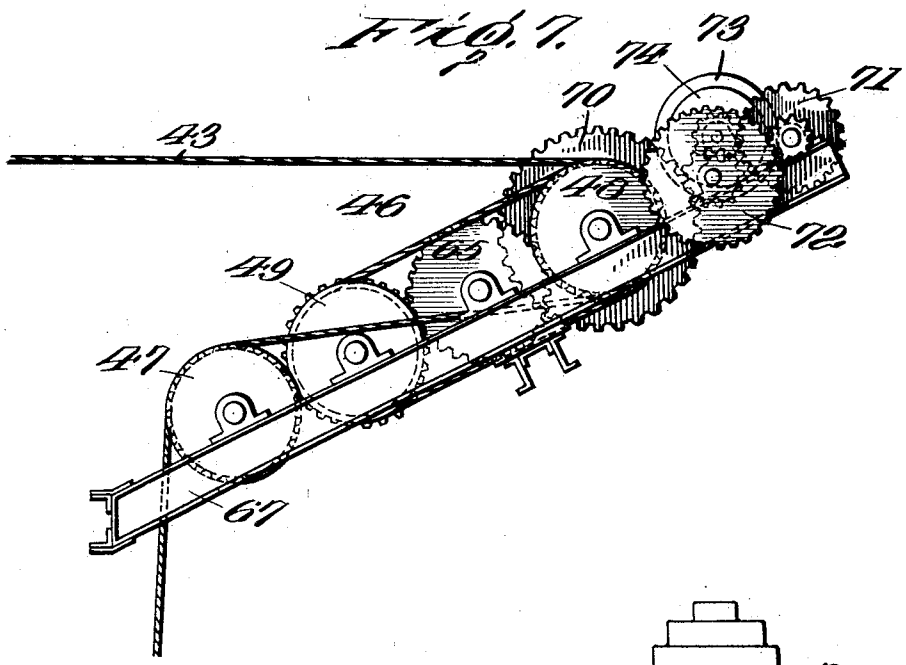
MECHANISM FOR FEEDING BLAST FURNACES.

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1,376,458. Patented May 3, 1921.

6 SHEETS—SHEET 5.

Fig. 7.



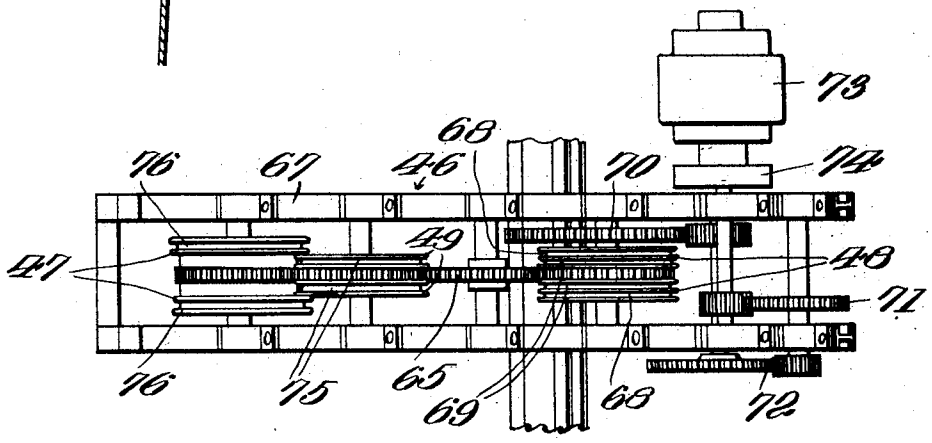


Fig. 8.

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MECHANISM FOR FEEDING BLAST FURNACES.

APPLICATION FILED AUG. 2, 1918.

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6 SHEETS—SHEET 6.

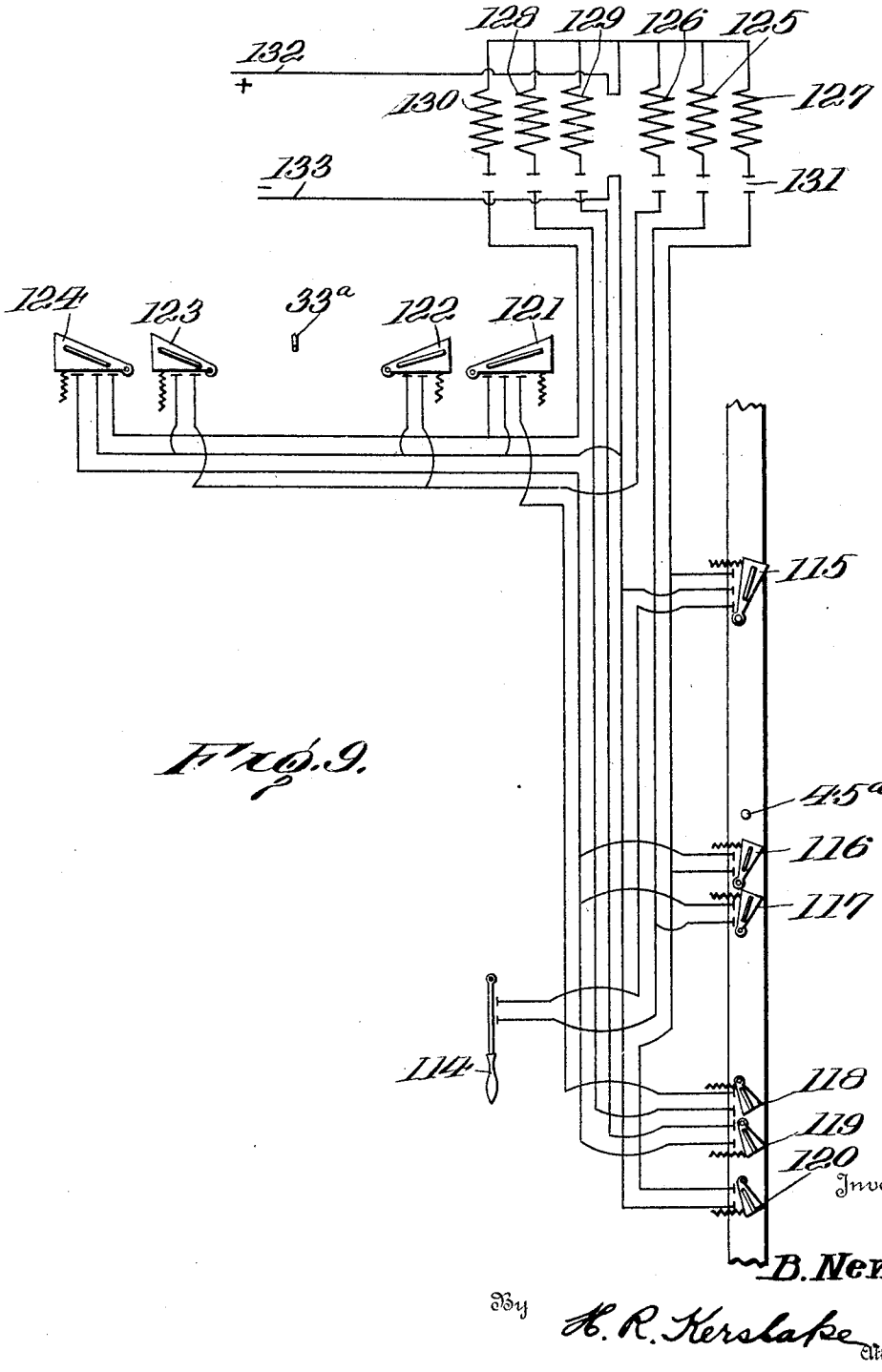


FIG. 9.

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UNITED STATES PATENT OFFICE.

BASIL NEWTH, OF SYDNEY, NEW SOUTH WALES, AUSTRALIA, ASSIGNOR TO ROBERT HOUSTON BARR, OTTO BOHRSMANN, IVAN HENRY, AND ALEXANDER MARKELL, ALL OF SYDNEY, NEW SOUTH WALES, AUSTRALIA.

MECHANISM FOR FEEDING BLAST-FURNACES.

1,376,458. Specification of Letters Patent. **Patented May 3, 1921.**

Application filed August 2, 1918. Serial No. 247,974.

To all whom it may concern:

Be it known that I, BASIL NEWTH, a subject of the King of Great Britain and Ireland, residing at Sydney, in the State of New South Wales, Commonwealth of Australia, have invented certain new and useful Improvements in Mechanism for Feeding Blast-Furnaces, of which the following is a specification.

The present invention relates to apparatus for conveying charges of raw material in buckets to the tops of blast furnaces, and to means for transferring the contents of these buckets into the interior of these furnaces.

The object of this invention is to provide an improved bucket conveying mechanism suitable for the purpose of transferring buckets to and from the top of a glass furnace. These buckets are provided with means for closing their lower ends to retain their contents and I have provided means for opening the bottoms of the buckets to permit them to discharge their contents. My mechanism includes means for supporting the bell with which the mouth of the blast furnace is sealed and for allowing it to lower to admit the charge delivered from the bucket, and means for closing the top of the bucket to retain and opening it to release the gases which escape from the furnace in the charging operation.

This invention consists essentially of a combination comprising an overhead carriage, a system of ropes, pulleys and weighted levers, a winding machine and balance weight, a retaining hook, a bucket pick up, one or more buckets of the type used in which the wall is separate from and rests on a bottom by which the bucket is picked up, one annular cover, and a system of switches, automatic and interlocked, controlling the operation in one complete cycle, all secured to a framework suitably disposed about a blast furnace and sufficiently rigid for its purpose, with a landing for the buckets provided over the mouth of the furnace, and the rope system connected with the furnace bell, the whole combination so disposed and coördinated that the bucket is so suspended under the carriage that it can be raised or lowered by the winding machine independently of the position or movement of the carriage, that the carriage can be moved to transfer the bucket horizontally without changing the level of the bucket or moving the winding machine, that the tackle carrying the bucket is so connected with that holding up the furnace bell that the bell is held closing the mouth of the furnace as long as the bucket is in suspension, that the bell is still held, but by the retaining hook, when the bucket is not in suspension, excepting when the bucket is landed upon the furnace top, that the tackle holding the bell does not slacken when the bucket is landed, and that at a point in the course of the emptied bucket returning from the furnace the cover of the bucket is caught and retained, allowing the release of included furnace gases, all of this mechanism being designed for the purpose of picking up the bucket with a charge of raw material from the truck, bringing it from under the chutes of the storage bins, conveying it to a landing place over the mouth of the furnace, opening the mouth of the furnace and the bottom of the bucket only after the bucket is landed in the seating provided, closing both these before picking up the empty bucket, clearing the bucket of noxious gases and returning it to the truck again for refilling.

Referring to the accompanying drawings, illustrating this improved mechanism for feeding blast furnaces constructed and arranged in accordance with this invention:—

Figures 1 and 2 exhibit the general arrangement of this invention in side elevation, Fig. 1 showing the portion disposed over and about the blast furnace and Fig. 2 the rest of the combination.

Figs. 3 and 4 illustrate the general arrangement of this invention in top plan, Fig. 3 showing the portion disposed over the furnace, and Fig. 4 the remainder of the arrangement.

Figs. 5 and 6 are sectional elevations in outline on the center line of the furnace, showing the bucket landed over the fur-

nace mouth, Fig. 5 representing the bucket as landed or as picked up and Fig. 6 the bucket with its bottom and the furnace bell both lowered to allow the contents of the bucket to fall into the interior of the furnace.

The section in Fig. 6 is taken at right angles to that of Fig. 5 to exhibit a further detail of the arrangement of this invention.

Fig. 7 is a side elevation of my winding mechanism.

Fig. 8 is a top plan view of the same.

Fig. 9 is a diagrammatic view of the electric wiring and switches for electric automatic control of the whole operation of this invention in one cycle.

Fig. 10 is a detail view of one of the rope equalizers.

The top of the blast furnace, to the feeding of which this invention is to be applied, is shown in outline 19. There is ordinarily a conical hopper 20 opening into the interior of the furnace, and suspended in the opening a cone shaped stopper 21 usually called the bell.

For the purpose of this invention there must be a circular seating 22 to fit the side of the bucket with which the furnace is to be fed, and a covering 23 forming an inclosure about this seating over the conical hopper forming the mouth of the furnace.

The truck or lorry upon which the buckets, with which the furnace is charged, are brought from under the chutes of the storage bins is shown at 24. The lorry runs ordinarily on wheels 25 on rails 26 and in the drawing it is shown standing at that point in its course best suited for delivering a filled bucket to the hoisting mechanism which conveys it to the furnace top.

The lorry is ordinarily power driven, adapted to carry a bucket resting on weighing platforms 24^a at either end, and has a housing 27 as shown in Figs. 2 and 4, which is arranged in the middle about the scale beams and the controlling gear of the lorry and forms a stand for the man in charge of the driving, filling and weighing operations.

Upright framework 28 is built upon the furnace 19 and upright framework 29 is arranged above the specified position of the lorry 24, and bridging the space between these frameworks is a transverse framework 30 carrying rails 31.

The framework is understood to be of ordinary engineering construction, suitably disposed and sufficiently rigid for its purpose, and the rails properly supported and secured to provide a straight level sound track 31 for the wheels 32 of the carriage or crab 33, which carries a loaded bucket from the lorry 24 to a point directly over the furnace, whence the bucket is lowered to the furnace top.

Rope wheels 34 and 35 for the bucket suspension are mounted on the crab 33 on an underslung framework 36 and the crab is propelled in either direction by the toothed gears 37, 38, 39 and a reversible motor 40, all suitably mounted on the said framework.

Necessary braking provision is shown in the pulley 41.

To a rope equalizer 42 mounted in the framework 29 ropes 43 are attached. These ropes pass around and hold in suspension pulleys 44 carrying a balance weight 45 and from the weight, the ropes pass to and over the winding mechanism 46 mounted at one end of the transverse framework 30. The ropes 43 pass upwardly over the wheels 47 of the winding mechanism to and around the wheels 48, thence back and around the wheels 49, thence forward to and again around the wheels 48 and thence to and over the rope wheel 34 on the crab. From the wheels 34, the ropes pass down to, around and hold in suspension the pulleys 50, which carry the bucket 51. From the wheels 50, the ropes 43 pass to and over the rope wheels 35 and their ends are fastened to one end of a plate 52. On the other end of the plate 52 is pivoted an equalizer 53 to which ropes 54 are attached, these ropes passing to and around the sheaves 55 and 56 mounted on the transverse framework 30. From the sheaves 56 the ropes 54 pass to, around and hold in suspension the pulleys 57 from which the ropes extend to and are secured to weighted levers 58 pivoted on the framework 30. Movement of the levers 58 in opposite directions is limited by the chains 59 and 60, which connect the weighted ends to the main frame.

Cables 61 connect the pulleys 57 with the free ends of weighted levers 62 fulcrumed on the top of the furnace. Chains 63 connect the same ends of the levers with the furnace bell 21, and the extent of movement of the weighted ends of these levers is limited by chains 64 connected to the furnace sides.

In the winding mechanism 46, shown in Figs. 7 and 8, the wheels 47, 48, and 49 already referred to and another wheel 65 are all faced for running in contact and mounted in bearings on a frame 67 suitably secured to the main framework in the position indicated in Fig. 2. The wheels 48 about which the ropes 43 pass twice have outer and inner grooves 68 and 69 and are driven by toothed gearing 70, 71, 72 and a reversible motor 73, with necessary brake provision in the pulley 74, all suitably mounted in the frame 67.

The wheels 49 are grooved as shown at 75 and the wheels 47 have the shaped grooves 76.

Referring to the balance weight 45 and its suspension the pulleys 44 carry the top weight 77 in strips 78, the bottom weight

79 being suspended from the top weight by bolts 80, and the upper weights 81 are mounted on the bolts 80 and carried by the bottom weight.

Guide shoes 82 on brackets on the end weights 77 retain the whole balance weight on guides 82ª suitably disposed in the framework 29, Fig. 2. The rope equalizer 42, referring now to Fig. 10, has quadrants 83 of suitable radius, centered at 84 on pivots mounted in the frame 29. These quadrants are connected by links 85. The ropes 43 already referred are connected to the eyes 86 and the pivots must be placed in the right position for a vertical disposition of the ropes passing about the pulleys 44.

In the plate 52 is a slot 90 for engagement with a retaining hook 91, see Figs. 1 and 3. The hook 91 is bolted to the channel iron 92 carrying the pintles 93 which fit in bearings mounted in the framework 30. An arm 95 bolted to the channel iron 32 is shaped for engagement by a cam 96 mounted on the crab 33 designed to raise the arm 35 and thus depress the hook 91 clear of the slot 90 in the plate 52 when the crab stands directly over the top of the furnace.

A hand line 97, see Figs. 1 to 4, is attached to the arm 35 and passes over the pulleys 98 to a convenient point near the lorry 24 in the position specified.

Referring particularly to Figs. 5 and 6, the pulleys 50 already referred to as carrying the buckets 51, have side plates 99 carrying pivoted links 100 which are connected by the pin 101 to the rod 102 fastened to the bottom 103 of the bucket, the pin 101 for this purpose passing through holes in the ends of the links 100 and through an eye in the end of the rod 102 and for purposes of manipulation being fitted with a handle 104. The body 105 of the bucket is detachable from and carried by the bottom 103. The body 105 is cylindrical and is provided with a ledge 106, which is adapted to fit on the seating 22 already specified for landing the bucket on the top of the furnace.

The lower portion of the bucket is conical-shaped as shown at 107. The cover 108 of the bucket is annular and it provided with projecting lugs 109 designed to engage a ledge 110 disposed in the framework 29, see Fig. 2. The cover 108 is provided with a cylinder 111 of a size to readily fit about a cap cylinder 112 which partially incloses the pulleys 50 and carrier a circular plate 113 that is supported by the side plates 99 of the bucket suspension, the cylinder 112 forming with the plate 113 a shield about and below the pulleys 50 constituting a central part to the bucket cover. With the bucket in suspension under the pulleys 50 the cylinders 111 and 112 are just within each other as in Figs. 2 and 5, and they may be of equal length, and long enough to be still within each other, as in Fig. 6, when with the side of the bucket supported on the seating 22 the bottom 103 is lowered to the full extent required to allow the contents of the bucket to fall into the furnace.

Referring to the diagram in Fig. 19, an ordinary hand-switch 114 is mounted conveniently near to the lorry 24 in its specified position, and switches 115, 116, 117, 118, 119, and 120 are disposed in the framework 29 in the track of a pin 45ª carried by the balance weight 45. Switches 121, 122, 123 and 124 are mounted in the framework 30 in the path of a pin 33ª carried by the crab 33.

The switch 115 is so located as to be operated when the bucket pick up pulley 50 is in its lowest position over the lorry; the switch 116 when this pulley is lowest over the furnace; the switch 117 where is can be operated at the same time as the switch 116; the switches 118 and 119, where they can both operate a little before the bucket reaches its highest position; and the switch 120 to operate when the bucket reaches its highest position.

The switch 121 is located to operate with the crab 33 standing over the lorry 24; the switch 122 a little way toward the furnace; the switch 123 a little before the crab reaches its position over the furnace; and the switch 124 with the crab standing over the furnace.

In the switch 117 only, engagement with the operating cam, instead of making instant circuit in the switch, operates an ordinary timing device, the purpose of which is hereinafter referred to.

In the switches 118 and 119, the arms engaged by the pin 45ª on the balance weight only operate the circuit when the bucket is descending; in the switch 122 the arm engaged by the pin 33ª on the crab only operates the circuit when the crab is moving from the furnace, and in the switch 123 only when the crab is moving toward the furnace.

A controller of the ordinary automatic type controls the operation of the winding mechanism motor 73, with suitable electric magnets, as shown in Fig. 9, the magnet 125 operating to start the motor in one direction for hoisting, the magnet 126 operating to start the motor in the opposite direction to lower the bucket, and the magnet 127 operating to stop the motor.

A similar stationary controller for the crab motor 40 is arranged near the winding mechanism controller, both controllers being preferably arranged in a housing operated near the winding machine 46. The controller for the crab motor is provided with a magnet 128 operating to start the motor 40 in one direction to move the crab toward the furnace, the magnet 129 operating to start the motor in the opposite direction to return the crab to the winding

mechanism, and the magnet 130 to stop the motor.

With each of the six magnets specified the interruption 131 indicated in the circuit is made to occur automatically at each operation of the magnet as soon as such operation is complete.

The electric circuit available for the purpose is connected to the wiring at the terminals 132, 133.

With the wiring connections indicated in Fig. 9 the switch 114 when operated completes the circuit in the magnet 125 but only through a circuit in the switch 115; the switch 115 completes the circuit in the magnet 127 and the circuit required for the switch 114; the switch 116 the circuit in the magnet 127 but only through a circuit in the switch 124; the switch 117 the circuit in the magnet 125 but only through the switch 124; the switch 118 the circuit in the magnet 129 but only through the switch 124; the switch 120 the circuit in the magnet 127; the switch 124 the circuit in the magnet 130 and the circuit required for the switch 118; the switches 122 and 123 each the circuit in the magnet 126; and the switch 124 the circuit in the magnet 130 and the circuit required for the switches 116 and 117.

The brake (not shown) for the winding machine about the pulley 74 and the brake (not shown) for the crab about the pulley 41 will be the usual contrivances of shoes or bands held in contact with the pulleys by springs or weights, the effect of which is overcome by electro-magnets in the circuits to the motors, consequently operating all the time the motors are driven by the current from the controllers.

The purpose of the balance weight 45 is to minimize the winding effort of the mechanism 46 by determining the same load on the pulleys 44 as that on the pulleys 50 with the bucket 51 in suspension and half full of the charge it has to carry and without the annular cover 108.

Additional weight must be carried by the pulleys 50 if their weight together with their bearings and the side plates and links and the shield under these pulleys is not otherwise enough to make good the grip of the ropes in the grooves of the winding wheels when the winding machine 46 is raising the balance weight 45 to lower the pulleys 50 after the bucket is landed on the lorry 24 to allow the connecting pin 101 to be taken out.

The weight and purchase in the levers 62 must be so proportioned that their effect, together with that of the weight of the pulleys 50 their bearings and the side plates and links and the shield under these pulleys, and allowing for inertia and friction, is distinctly less than the weight of the furnace bell but distinctly greater when the bucket, empty and without the annular cover, is suspended from the said pulleys.

The weight and purchase in the levers 58 must be so proportioned that their effect is enough in conjunction with that specified for the weighted levers 62 to hold the furnace bell up but not enough to raise the pulleys 50 when the bucket, empty, and without the annular cover, is suspended therefrom; in each case making full allowance for inertia and friction.

The lengths of the ropes 54 are adjusted to hold the weighted levers 58 horizontal when the plate 52 is pulled by their effect into taut engagement with the retaining hook 91.

The chains 59 are adjusted to allow the weighted ends of the levers 58 to rise sufficiently to allow the plate 62, drawn by the weight of the bucket in suspension, to move far enough toward the crab 33 to completely free the retaining hook 91 in the slot 90, and the chains 60 to allow the weighted ends of the levers 58 to fall enough to allow the plate 52, drawn by the effects of the weighted levers 58 from the crab 33 after the bucket is landed on the lorry, to come into full engagement with the retaining hook 91 without relaxing the tension in the ropes 54 holding up the furnace bell.

In operation with this invention with the pulleys 50 in position with the links 100 hanging ready for connecting to lift a bucket from the lorry 24, and the weighted levers 58 holding the plate 52 in taut engagement with the retaining hook 91 and the furnace bell 21 hard up to the inner edge of the conical hopper 20, and the circuit in the switch 121, required to complete circuits in the switches 115 and 121, closed, and a filled bucket on the lorry in position under the pulleys 50, the links 100 are fitted about the eye in the rod 102 by which the bucket is lifted, the pin 101 is inserted to make the connection, using the handle 104, and the winding machine 46 is set in motion by the hand switch 114.

The effect of winding in the ropes about the pulleys 50 after first lifting them till the connection made with the pin 101 draws tight is to raise the weighted ends of the levers 58, drawing the plate 52 toward the crab 33 and freeing the hook 91.

The bucket is picked up as soon as further movement of the weighted levers is prevented by the chains 59.

The operation of the winding machine continuing the bucket ascends toward the crab, in due course picking up the annular cover 108 which is resting on the ledge 110.

The balance weight 45 descending, the

switch 118 is next operated to set the crab in motion toward the furnace and this causes the crab to carry the bucket in that direction, and the balance weight still descends until the switch 120 is operated and this causes the winding machine to stop.

The operation of the winding gear raising and lowering the bucket and the changing position of the crab are quite independent the one of the other.

The position is now that indicated in Figs. 2 and 4, the bucket traversing horizontally under the crab in motion toward the furnace.

The crab 33 having traveled with the bucket nearly far enough to bring it over the top of the furnace, the switch 123 is engaged and the operation of this switch sets the winding machine in motion to lower the bucket. As the crab continues toward the furnace it next engages the switch 124 and the operation of this switch causes the motor 40 to stop with the bucket directly over the furnace and descending to land upon it. With the crab 33 in this position and the cam 96 on the crab engaging the arm 95 of the retaining hook mechanism, the retaining hook 91 is now clear of the slot in the plate 52.

Also the circuit in the switch 124 required for the switches 116, 117 is now closed.

As the bucket descends into the seating 22 on the furnace top, its body is retained by the ledge 106 engaging the edge of the seating. This is the position indicated in Fig. 5.

The motion of the winding machine continuing, the weighted ends of the levers 58, the furnace bell 21 and the bucket bottom 103, all sustained only by the tension in the ropes 43 and 54, and the plate 52 free to move, now all descend, the weighted ends of the levers 58 till held by the chains 60, the furnace bell till the weighted ends of the levers 62 are held by the chains 64 and the bucket bottom till it rests upon the furnace bell in its new position.

This is the position indicated in Fig. 6.

The amount of rope passed over the winding machine and the elapsed time are the same in whichever order these three events, namely the relaxing of the levers, the lowering of the bell, and the lowering of the bucket bottom, occur, neither has the order of these events the least significance.

The exact location of the switch 116 relative to the balance weight pin 45^a is determined so that the winding machine is stopped always just enough in advance of the completion of these events to preclude the possibility of the ropes 43 and 54, slacking, leaving instead either the chains 60 slack, or the chains 64 or the bucket bottom in suspension.

The charge, not shown, carried in the bucket, of course commences falling out as soon as the bottom 103 lowers away from the lower position 107 of the bucket, continuing to do so until the position shown in Fig. 6 is reached and afterward until the whole contents of the bucket has fallen into the furnace. The formation of the bucket bottom, the conical hopper and the bell being all designed to insure and facilitate this and to spread the charge as it falls in a suitable manner inside the furnace.

It will be noted that the cover plate 113 prevents the escape of gas while the bucket is emptying. The switch 117, operated simultaneously with the switch 116, is timed to start the winding machine no sooner than will give full time for the whole of the charge to fall into the furnace.

The effect of the winding in the rope 43 is to raise the bottom 103 of the bucket and to draw in the plate 52 to raise the furnace bell 21 and the weighted ends of the levers 58.

The order of events is again of no importance.

As soon as the bucket bottom is back in contact with the body of the bucket, the furnace bell is closed, and the weighted ends of the levers 58 are again raised to the height allowed by the chains 59, the operation of the winding mechanism continues and the bucket is picked out from the seating 22 and hoisted toward the crab.

The exact location of the switch 119, engagement with which by the pin 45^a on the balance weight 45, when, as is now the case, the circuit through the switch 124 is complete, sets the crab in motion returning from the furnace with the bucket, is determined so as to start the crab toward the winding mechanism as soon as the bucket is picked up.

With the departure of the crab, the retaining hook 91, which is balanced so to do, moves back into engagement in the slot in the plate 52.

The balance weight 45 next engages the switch 120, stopping the winding machine, and the bucket continues the return journey horizontally.

Arrived nearly over the point where the bucket is lowered to the lorry, the crab 33 engages the switch 122 setting the winding machine in motion lowering the bucket and next engages the switch 121 which acts to stop the crab. The bucket then continues to lower inside the framework 29 over the place from which it was originally picked up. And the circuit required later for operation of the switch 118 is now complete.

Next the lugs 109 on the annular bucket cover 108 engage the ledge 110 provided in the framework 29, retaining the cover at this point, the bucket descending without it, and

the motion effectively clearing the interior of the bucket of the furnace gases admitted during the charging operation.

In the time elapsed since the filled bucket was picked up from the lorry 24 the lorry will have brought another filled bucket from the bins and will now be waiting in position to receive the returning emptied bucket on the other end of the platform.

The bucket lands upon the lorry on its bottom and the motion of the winding machine continuing the weighted ends of the levers 58 lower until the slotted plate 52 is drawn into taut engagement with the retaining hook 91. This done the next effect of the motion of the winding machine is to lower the pulleys 50 and slacken the connection at the pin 101 making it possible to withdraw this pin by hand, thus detaching the pick up from the bucket.

The winding machine is now stopped by the operation of the switch 120 and this switch is exactly located to stop the winding machine before the pulleys 50 are lowered any farther than necessary for disconnecting and attaching the links with which the buckets are picked up.

The lorry is now moved so as to bring the filled bucket into position for picking up, and the cycle is complete. In the management of blast furnaces it is desirable at times to allow the furnace gases to escape continuously through the conical hopper with the bell lowered just for that purpose.

To provide for this contingency in this invention it is only necessary to move the hook 91 clear of engagement with the plate 52 at the time of landing the bucket upon the lorry. This is the purpose of the handline 97 already referred to.

With this done, as soon as the bucket is landed upon the lorry, the operation of the winding gear continuing, the plate 52 is drawn forward by the weighted levers 58 until these are restrained by the chains 60 and then by the tension in the chains 61, 63, the bell lowering as far as its descent is allowed by the chains 64 holding the levers 62.

To prevent slacking in the ropes 43 and 54 the winding machine is stopped before the furnace bell is lowered the distance allowed by the chains 63. A special switch is provided and contrived to be only in circuit when there is tension in the handline 97, located in the track of the balance weight 45 where it will stop the winding machine at the right moment.

To close the furnace, the winding machine is set in motion in the opposite direction by the hand switch 114 which is put in circuit by the special switch, the effect of which is to raise the furnace bell and the weighted ends of the levers 58 and then pick up the bucket. As soon as the bucket is again in suspension the retaining hook 91 is allowed to move back into engagement with the plate 52 after which the regular cycle of operation may proceed as usual.

Bell crank levers and wire lines to the engine house can be substituted for the electric switches in the system of automatic control specified.

A barrel to which the ropes of the bucket suspension and other ropes carrying the balance weight are attached can of course be used in this invention if desired instead of the system of V grooved wheels herein specified.

Having now fully described and ascertained my said invention and the manner in which it is to be performed, I declare that what I claim is:—

1. The combination with a blast furnace having an inlet provided with a normally closed bell, of mechanism for conveying a bucket to said furnace, and means included in said bucket conveying mechanism for causing depression of said bell when the bucket is connected with the inlet opening of said furnace.

2. The combination with a blast furnace having an inlet opening normally closed by a bell, of a bucket designed to discharge its contents into said furnace through said inlet, mechanism for conveying said bucket to said furnace, a movable bottom for said bucket designed to engage said bell for opening the same, and means included in the bucket conveying mechanism for causing said bucket bottom to descend for depressing said bell.

3. A combination as defined by claim 2 in which the bell and bucket bottom are of conical shape.

4. A combination as defined by claim 2 in which the lower portion of the bucket is of conical shape, and the bucket bottom is of conical shape and operates with the lower portion of said bucket for distributing material from the bucket into the furnace.

5. A combination as defined by claim 2 in which the bucket conveying mechanism includes a vertical framework arranged over the furnace, a vertical framework remote from the furnace, a horizontal frame connecting said frameworks, and a crab traveling in said horizontal frame and supporting said bucket.

6. A combination as defined by claim 2 in which the conveying mechanism includes a horizontal track arranged above the furnace, a crab traveling on said track and provided with rope pulleys, a winding mechanism, and ropes connected to said winding mechanism, passing over the pulleys of the crab and connected to said bucket.

7. A bucket conveying mechanism for feeding blast furnaces comprising a horizontal track arranged above the furnace, a

vertical framework connected to said track and forming a shaft in which a bucket may be raised and lowered, a weight movable longitudinally of said shaft, a crab mounted on said track, a bucket, winding mechanism, and ropes connected to said weight, winding mechanism, crab and bucket for elevating and lowering said bucket.

8. In a blast furnace feeding mechanism, a vertical frame forming a bucket shaft, a trackway passing through said shaft, a conveyer truck mounted on said trackway and designed to carry feeding buckets to the shaft, a horizontal frame connected to said shaft and provided with a horizontal track, a winding mechanism associated with said shaft, a weight provided with pulleys, a bucket conveying crab mounted on said horizontal track and provided with pulleys, a bucket provided with pulleys, and ropes passing around the pulleys of the weight, the winding mechanism, certain of the pulleys of the crab, thence around the pulleys of the bucket, thence around the other pulleys of the bucket and thence to relatively fixed parts on the horizontal frame.

9. A blast furnace feeding mechanism including a bell normally closing the inlet to said furnace, weighted levers normally holding said bell in closed position, a bucket designed to discharge its contents into said furnace and provided with a bottom engageable with said bell for depressing the same, means for transferring said bucket to said furnace, and means included in said transfer mechanism for permitting the depression of said bucket bottom and said bell.

10. The combination with a blast furnace having an inlet opening normally closed by a bell, of a vertical shaft arranged away from said furnace, a horizontal framework extending between said shaft and said furnace and provided with a track, fixed pulleys provided on said framework, weighted levers connected to said bell, weighted levers mounted on said framework, a latch provided on said framework, flexible members connected to the weighted levers on the furnace and provided with pulleys, ropes connected to the weighted levers of the framework passing around the last named pulley, thence around the fixed pulleys on the framework, a rope equalizer connected to the other ends of said ropes and carrying a slotted plate, the slot of which is normally engaged by said latch, a bucket conveying mechanism, and means included in said bucket conveying mechanism designed to engage and operate said latch to permit said weights to be elevated for depressing said bell.

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

BASIL NEWTH.

Witnesses:
T. P. ALLEN, Jr.,
H. C. CAMPBELL.