C. P. TURNER.

BLAST FURNACE CHARGING DEVICE.

APPLICATION FILED AUG. 14, 1907.

947,206.

Patented Jan. 18, 1910.

5 SHEETS—SHEET 1.

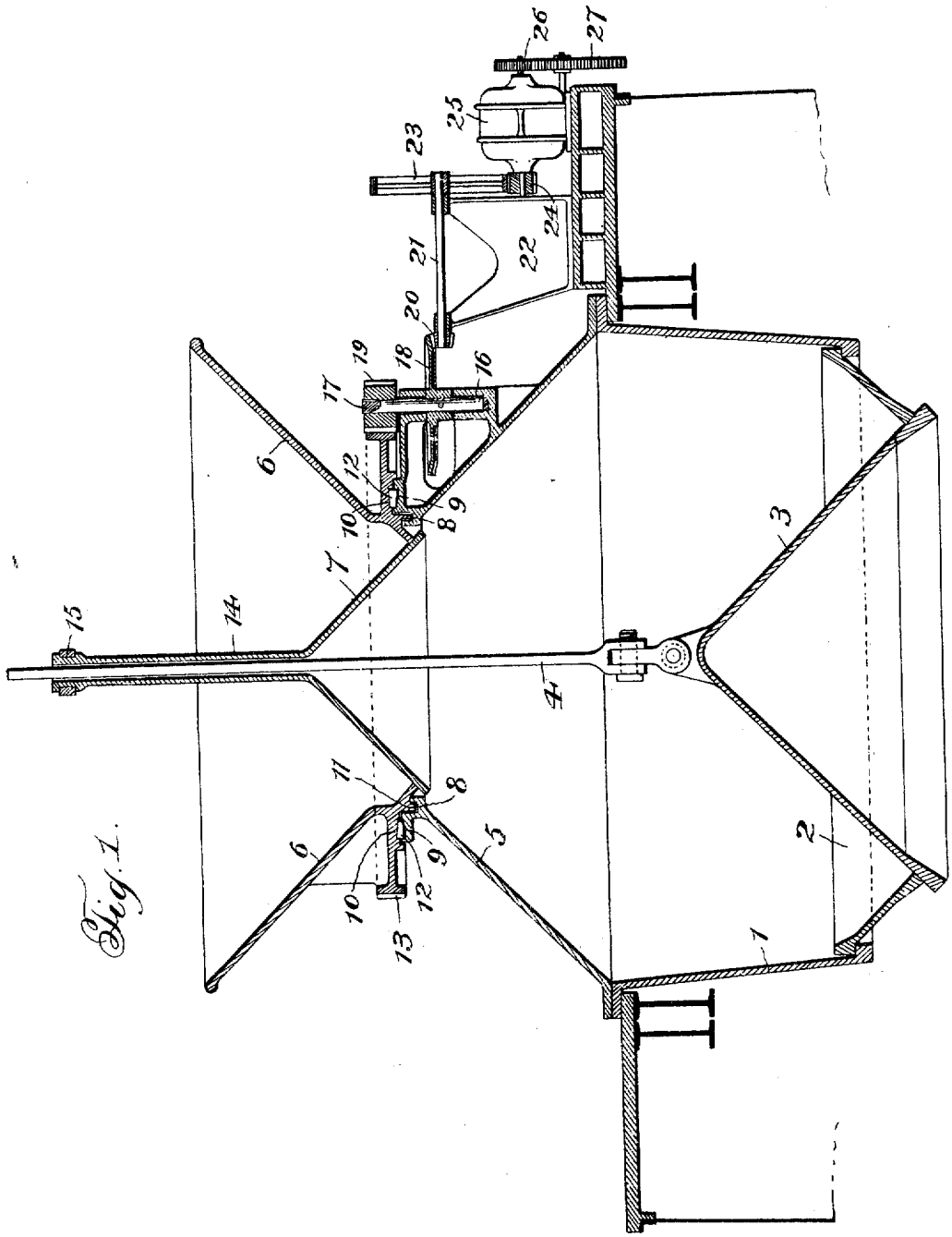

Fig. 1.

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5 SHEETS—SHEET 2.

Fig. 3.

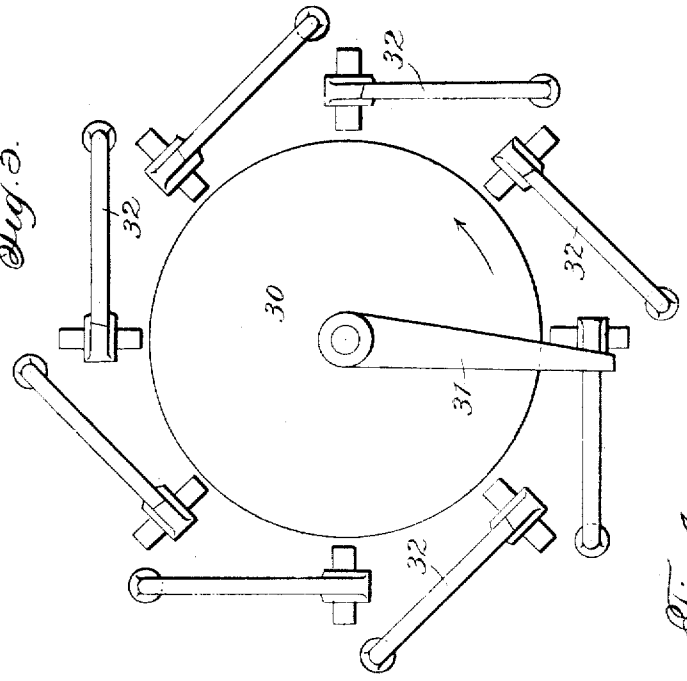


Fig. 4.

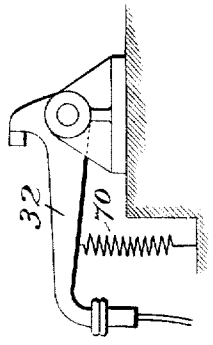


Fig. 2.a

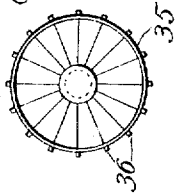
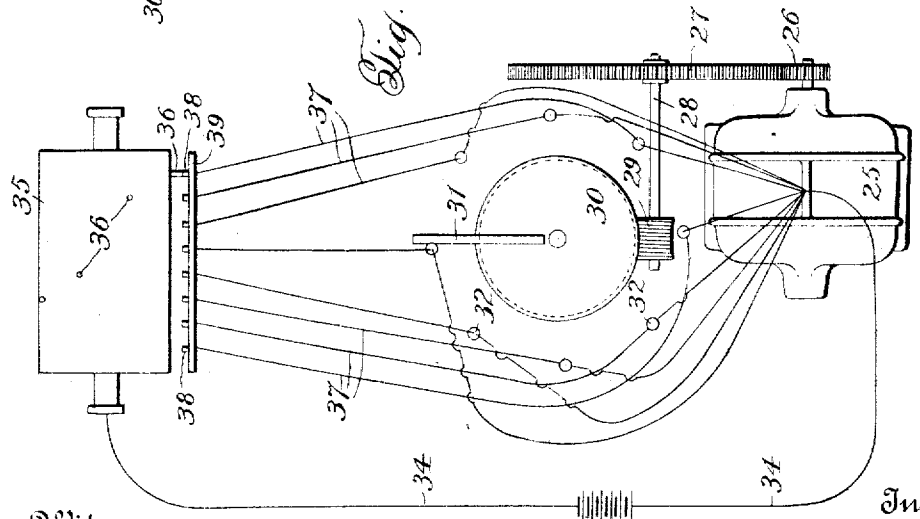


Fig. 2.



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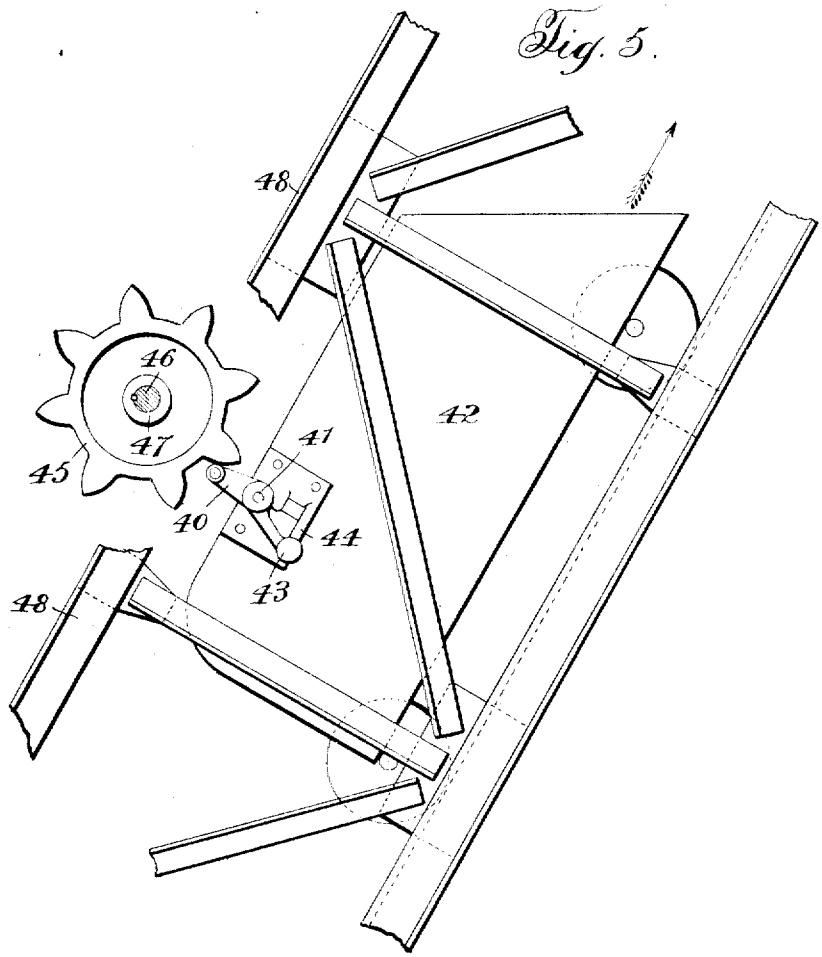
5 SHEETS—SHEET 3.

Fig. 5.



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5 SHEETS—SHEET 4.

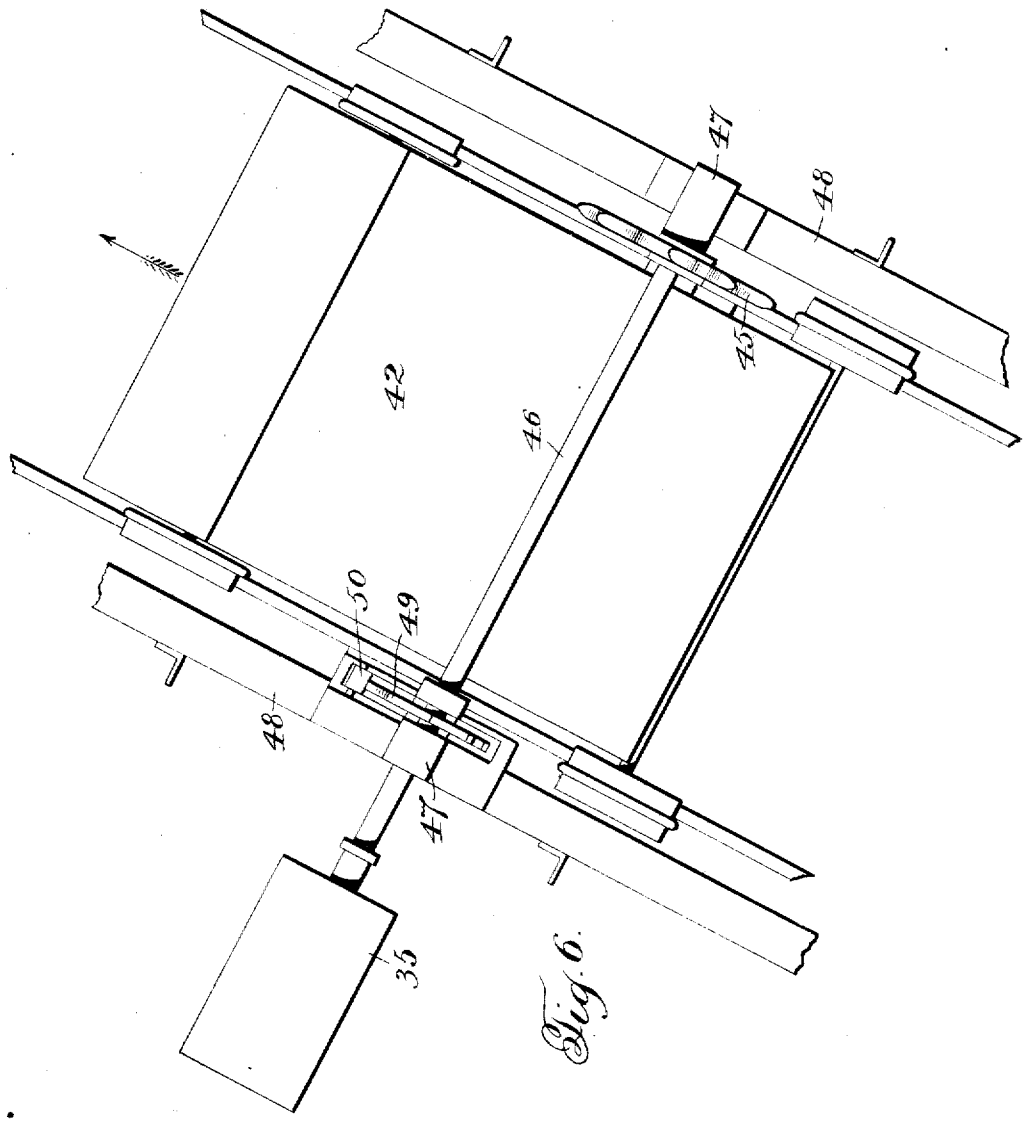

Fig. 6.

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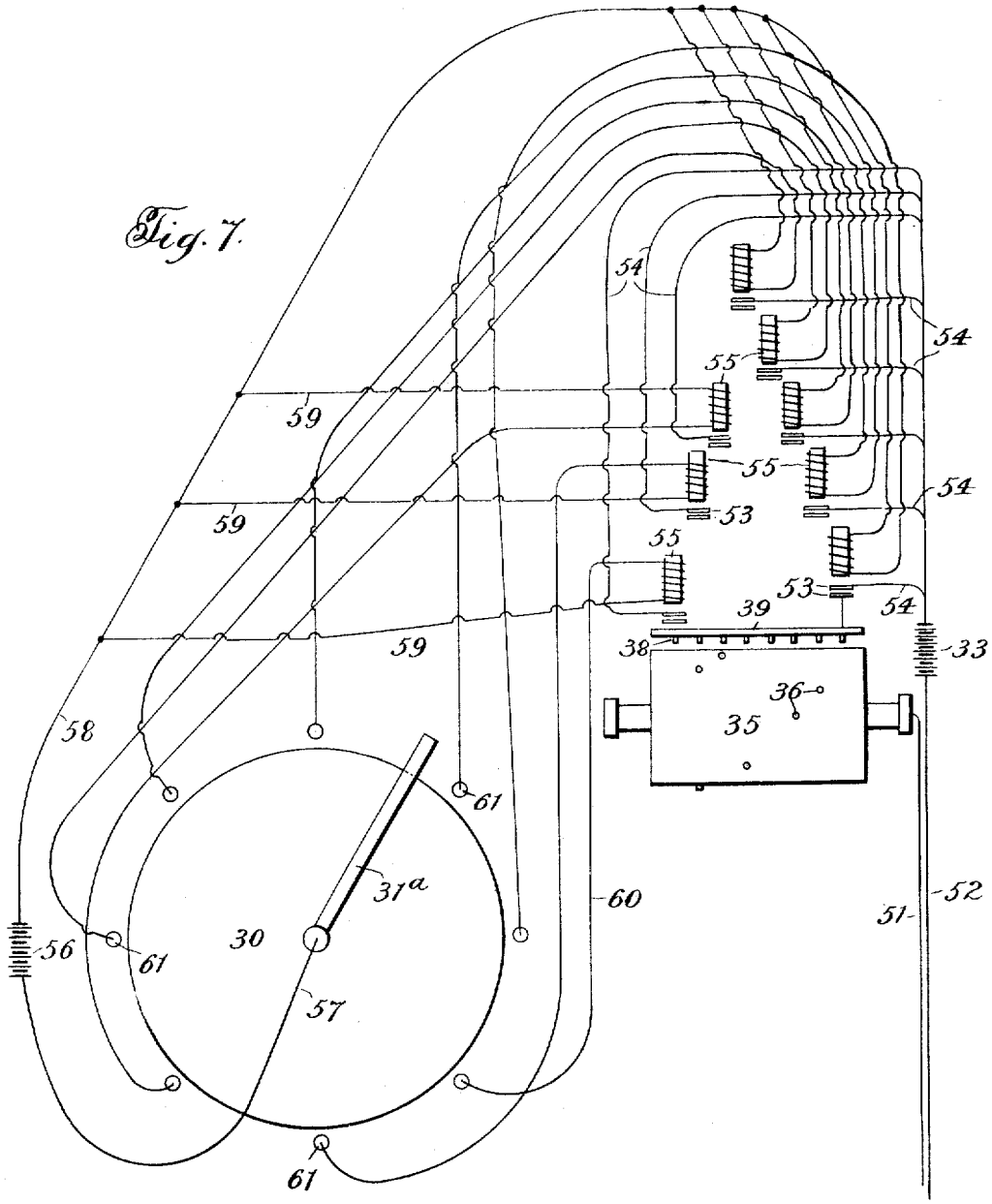
5 SHEETS—SHEET 5.

Fig. 7.



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UNITED STATES PATENT OFFICE.

CHARLES P. TURNER, OF HARRISBURG, PENNSYLVANIA.

BLAST-FURNACE-CHARGING DEVICE.

947,206. Specification of Letters Patent. Patented Jan. 18, 1910.

Application filed August 14, 1907. Serial No. 388,487.

To all whom it may concern:

Be it known that I, CHARLES P. TURNER, a citizen of the United States, residing at Harrisburg, county of Dauphin, State of Pennsylvania, United States of America, have invented certain new and useful Improvements in Blast-Furnace-Charging Devices; 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, reference being had to the accompanying drawings, and to figures of reference marked thereon, which form a part of this specification.

This invention relates to blast furnace charging apparatus and more especially to that class known as furnace charge equalizers, in which a portion of the charge is successively dropped and distributed around the charging bell so that the entire charge that is on this bell will be dropped, as nearly as may be, as a uniform layer within the furnace and the invention comprises means for distributing the charge as uniformly as possible around the charging bell, together with means to control the distribution of the charge over the bell by suitable mechanism, preferably automatically operated from the skip bucket or other devices used for carrying the materials to the top of the furnace, and details of construction hereinafter more particularly to be described and claimed.

Referring to the drawings in which like parts are similarly designated, Figure 1 is a vertical central section through a charging apparatus. Fig. 2 is a diagram of the electric circuits controlling an electric motor for rotating the equalizer, and mechanism for controlling the circuits. Fig. 2ª is an end view of the commutator drum. Fig. 3 is a detail of the circuit breaker devices. Fig. 4 is a detail of one of the switches or circuit breakers. Fig. 5 is a side elevation of a skip bucket on its way and means for rotating the commutator drum. Fig. 6 is a plan thereof, and Fig. 7 is a modification of the arrangement of electric circuits and the mechanism that controls them.

In Fig. 1, is shown a portion of the top of the blast furnace closed by the usual arrangement comprising a two part hopper 1, 2, closed by the charging bell 3 suspended from the bell rod 4 within and closing the hopper. The hopper is continued above the top of the furnace in the form of a frustum of a cone 5, the top of which is closed by a hopper or receptacle 6 in conjunction with a small distributing bell 7. The upper end of the conical portion 5 is provided with a groove 8 and adjacent thereto with a roller raceway 9, and the hopper or receptacle 6 is provided with a coöperating raceway 10 and a flange 11 taking into the groove 8 to form a gas seal. Suitable rollers, here shown as conical rollers 12, are mounted in the raceway 9—10. The receptacle or hopper is also provided with a toothed rim 13 and the distributer bell 7 is provided with a hollow supporting rod 14, mounted in a suitable bearing 15 so that it will be free to rotate in said bearing. This structure allows the hopper or receptacle 6 and the distributing bell 7 to be readily turned about their vertical axis so as to permit the materials for charging the furnace, and which will be delivered to the receptacle 6 from one side thereof, in such a manner that it will not be uniformly filled, to be dropped onto the bell 3 from a number of different positions thereby securing a practically uniform disposition of the materials on the charging bell 3 and from which bell the whole charge is dropped into the furnace in substantially a uniform layer.

The object of the present invention is a provision of means whereby the turning of the receptacle or hopper 6 will be preferably, but not necessarily, automatically accomplished in such a manner that the successive portions of material delivered to it will be dropped from positions which will give the desired distributions to avoid the so-called "spiral charging" by reason of the hopper always revolving in the same direction.

Mounted in a suitable bracket 16 on the conical portion 5, or otherwise, is a spindle 17 carrying a bevel gear wheel 18 and a pinion 19, which latter engages and drives the toothed rim 13. The bevel wheel 18 is driven by bevel pinion 20 on a shaft 21 mounted in a suitable standard 22 on the top of the furnace and the shaft 21 also carries gear wheel 23, that is driven by a pinion 24 on one end of the shaft of the electric motor 25, the other end of which shaft carries a pinion 26 that drives the gear wheel 27. Gear wheel 27 is mounted on a shaft 28 supported in any suitable manner and carries a worm 29 that drives a disk or worm wheel 30 at preferably but not necessarily, the same angular speed as

the receptacle or hopper 6. The worm wheel or disk 30 carries an arm 31 that mechanically operates a number of circuit breakers or switches 32 arranged in its path of movement, preferably but not necessarily, uniformly spaced apart.

The motor 25 is supplied from any suitable source of current indicated at 33 and the motor circuit includes in series a multiple circuit controller or commutator drum 35, on the surface of which are arranged a set of contact points 36 positioned to close circuit successively or otherwise through a number of wires 37 arranged in parallel and connected at one end to a row of contact points 38 mounted in a support or bar 39 and connected at the other end to the motor thereby forming a plurality of different paths or circuits to the motor. In each of these wires is included a mechanical circuit breaker 32 more clearly shown in detail in Fig. 4.

The commutator drum 35 may be arranged to be turned in any suitable manner; this may be done by any suitable hand operated mechanism, but I have shown in Figs. 5 and 6, means for doing this automatically. In these figures the device for lifting the stock to the top of the furnace is presumed to be an ordinary skip bucket, but any other form of hoisting mechanism may be used without departing from the nature of the invention.

On the bucket or other stock hoisting device, is a tappet 40 mounted on a pivot pin 41 at the side of the bucket 42 and provided with a counter-weight 43 that normally rests against an abutment 44. This bucket moves in the path of a star wheel 45 that is fixed to a shaft 46 mounted in bearings 47 on the skip way 48. The shaft 46 also carries a ratchet wheel 49 engaged by a pawl 50 and from this shaft 46 is rotated the commutator drum 35, said drum being shown in Fig. 6 as end-connected to the shaft.

The operation of the device is as follows: When the skip bucket 42 is moved along the skip way 48 to the top of the furnace, it passes the star wheel 45 located in any suitable part of the way 48, and during this passage the tappet 40 strikes a tooth of the star wheel and causes it to rotate one step, the counter-weight 43 resting against the abutment 44 and preventing the tappet from rotating on its spindle 41 when the bucket travels in the direction of the arrow. This rotates the shaft 46 and the drum 45 one step, thereby bringing one of the contacts 36 of the drum 35 into engagement with its mate 38 upon the bar 39 to close circuit from the source of electrical supply 33 through the motor circuit 34, drum 35, contact 36, contact 38, bar 39, the wire 37 that is connected to the contact 38, switch 32 in said wire and motor 25 back through motor circuit 34 to the source of electrical supply. The motor is thereby set in rotation, rotating the receptacle or hopper 6 through the speed reducing gearing 13, 19, 18, 20, 23, 24 and at the same time by means of pinion 26, gear wheel 27, worm 20 and worm wheel 30 rotates the arm 31 until said arm is rotated into engagement with circuit breaker 32 that is in the particular wire 37 through which current is closed when the circuit of the motor will be broken and the motor, receptacle and arms 31 will be stopped, the arm 31 keeping the circuit breaker 32 open against the stress of its spring 70. Meanwhile the skip bucket 32 reaches the top of the furnace and dumps its contents into the receptacle 6, the skip bucket then descends moving past star wheel 45, the tappet 40, contacting with the star wheel, rides under the same without operating it, the shaft 46 and star wheel 45 being held against accidental negative rotation by means of the pawl and ratchet 50 and 49. When the bucket ascends again the operations heretofore described are repeated, the drum 35 is moved one step further, another contact 36 is rotated into engagement with its mate 38 thereby closing circuit through another one of the parallel wires 37 to start the motor rotating again thereby rotating the receptacle or hopper 6 and the arm 31, said arm first releasing the circuit breaker 32 held open by it and moving until it operates another selected live circuit breaker in the motor circuit when the mechanism is again stopped from movement as before described. The charge on the distributer bell 7 is dropped onto the charging bell 3 after each ascent of the bucket or otherwise as desired. The sequence of the intervals may be regular or not, as desired, and is controlled by the relative arrangement of the contacts 36 on the drum 35.

In Fig. 3 is shown an arrangement of the circuit breakers 32 with respect to the rotating arm 31, and in Fig. 4 is shown a detail of the circuit breaker.

In the arrangement shown in Fig. 1, the motor may also be operated in accordance with the diagram of circuits shown in Fig. 7 the commutator drum 35 being connected by wire 51 directly to the motor, and the other wire 52 containing the source of electric supply 33, is connected to a number of normally closed switches 53 by branch parallel wires 54, said switches adapted to open the circuit through the contacts 38. Each switch 53 is provided with an electro-magnet 55 energized by current from the source 56 or otherwise.

The disk 30 carries a conductive contact arm 31^a connected by wire 57 to one pole of the electrical supply 56, the other pole of which source is connected by wire 58 and

branch wires 59, in parallel, to the respective electro magnets 55 and then by wires 60 to a row of contacts 61 in the path of arm 31ª. The commutator drum 35 and the disk 30 operate in the manner heretofore described in connection with Fig. 2. Current is passed from the source 33, wire 52, the motor, wire 51, commutator drum 32, contact pin 36 thereof, its mate 38, normally closed switch 53, wire 54, back to the source 33. The motor will be driven to drive disk 30 and arm 31ª, until the conductive arm 31ª closes circuit through the contact 61 and the magnet 55 that contains the live circuit and breaker 53. Circuit will then be broken at breaker 53 and the motor and mechanism driven by it will be stopped to be restarted when the commutator drum 35 is moved the next step by the bucket.

I claim:—

1. In a furnace charging device, a rotatable receptacle for stock, an electric motor to drive the same successively always in the same direction, a commutator device to close any one of a number of electric circuits through the motor, a circuit breaker in each circuit through the motor and means operated by the motor to break the particular circuit closed after the receptacle has been rotated through the angular distance determined by said particular circuit.

2. In a furnace charging device, a rotatable receptacle for stock, an electric motor to drive the same always in the same direction, a commutator device to close any one of a plurality of electric circuits through the motor to successively effect rotation of the charging device, a circuit breaker in each circuit, and means operated by the motor to break the circuit through the commutator device and motor.

3. In a furnace charging device, a rotatable receptacle for stock, means to elevate stock to the receptacle, an electric motor to drive the same, a device to close an electric circuit through the motor operated by the stock elevating means, a circuit breaker in the circuit through the motor and means operated by the motor to break the circuit.

4. In a furnace charging device a rotatable receptacle for stock, a device to deliver stock thereto, a motor to rotate the receptacle, means operated by the stock delivering device to direct motive power to the motor and means operated by the motor to cut off the motive power after the motor has driven the receptacle through a given angular distance.

5. In a furnace charging device, a rotatable receptacle for stock, means to elevate stock to the receptacle, an electric motor to rotate the receptacle, a plurality of normally open electric circuits to direct current through the motor, a commutator device operated by the stock elevating means to close any one of said circuits, a normally closed circuit breaker in each of the circuits and means driven by the motor to operate the circuit breakers successively until circuit is broken in that circuit that is closed through the motor.

6. In a furnace charging device, a rotatable receptacle for stock, a device to deliver stock thereto, an electric motor to rotate the receptacle, a plurality of normally open electric circuits connected to the motor in parallel, a bar having a set of contacts thereon each contact being a terminal for one of the parallel circuits, a commutator drum having a plurality of contacts on its periphery, said contacts moved into contact with those on the bar during the revolution of the drum to close circuit through the motor, mechanism operated by the stock delivering device to rotate the drum step-by-step, a normally closed circuit breaker in each of said circuits and means operated by the motor to operate the breakers.

7. In a furnace charging device, a rotatable receptacle for stock, a skip-bucket to deliver stock to the receptacle, an electric motor to rotate the receptacle, a plurality of normally open electric circuits connected to the motor, a commutator drum to close any one of said circuits, a shaft from which the drum is rotated, a star wheel on the shaft, a pivoted tappet on the bucket to engage the star wheel and rotate it one step when the bucket moves in one direction, a pawl and ratchet wheel to prevent the shaft from rotating in an opposite direction, a circuit breaker in each of said circuits and means operated by the motor to actuate the circuit breakers.

8. In a furnace charging device, a rotatable receptacle for stock, means to deliver stock thereto, an electric motor to rotate the receptacle always in the same direction, a plurality of normally open electric circuits connected to the motor, a commutator device to selectively close any one of said circuits, a normally closed circuit breaker in each of said circuits, electro-magnets to operate the circuit breakers, connected in parallel and to contact points, means operated by the motor to close the circuits to the magnets and thereby break the circuit to the motor.

9. In a furnace charging device, the combination with a rotatable stock receptacle; of a stock carrier discharging always at the same point and in the same direction and means to selectively rotate the receptacle through different lengths of arc with respect to the point of discharge of the stock carrier, the angle of rotation of the receptacle being independent of the movement of the carrier.

10. In combination, a rotatable stock receptacle, a skip or hoist, a motor for rotating the receptacle, an electric contact device operated by the movement of the skip or

hoist to control the supply of current to the motor, and means operated by the motor to cut off the supply of electric current.

11. In combination with a main charging bell and a receiving hopper and bell above the same; means to rotate the receiving hopper and bell, a skip, and means to alter the extent of the successive angular movements of the receiving hopper and bell, said means controlled from the skip.

12. In combination, a rotatable receptacle, a motor to drive the same always in the same direction, means to direct motive power to and through the motor by any one of a number of circuits, a circuit breaker in each circuit, and means common to all the circuit breakers to actuate them.

13. In combination, a rotatable receptacle, a motor to drive it always in the same direction, a stock elevating means actuated contact device to send motive power through a plurality of parallel circuits to and through the motor, a circuit breaker in each circuit, and means operated by the motor and common to all the circuit breakers to operate them to break their circuits.

14. In combination, a rotatable receptacle, a motor to drive the same, a plurality of paths through which motive power may be supplied to the motor, a stock elevating means actuated device to send motive power selectively through said paths, means in each path capable of cutting off the supply of motive power, and means common to all the cut off means to actuate them and operated from the motor.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

CHARLES P. TURNER.

Witnesses:
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H. B. HAIN.