R. H. LEE & W. P. MARTIN.

BLAST FURNACE CHARGING APPARATUS.

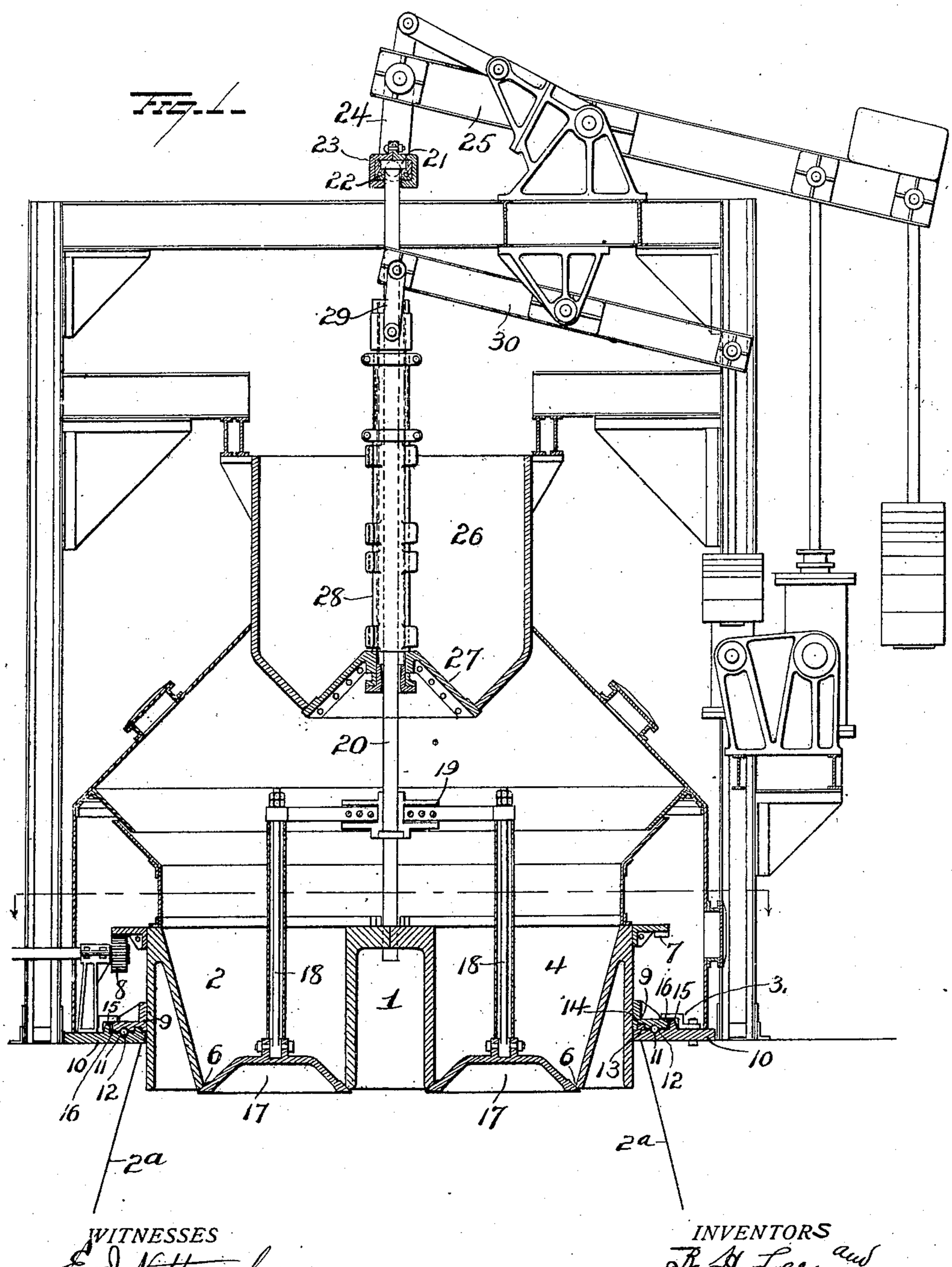
APPLICATION FILED AUG. 28, 1908.

914,432.

Patented Mar. 9, 1909.

2 SHEETS—SHEET 1.

FIG. 1.



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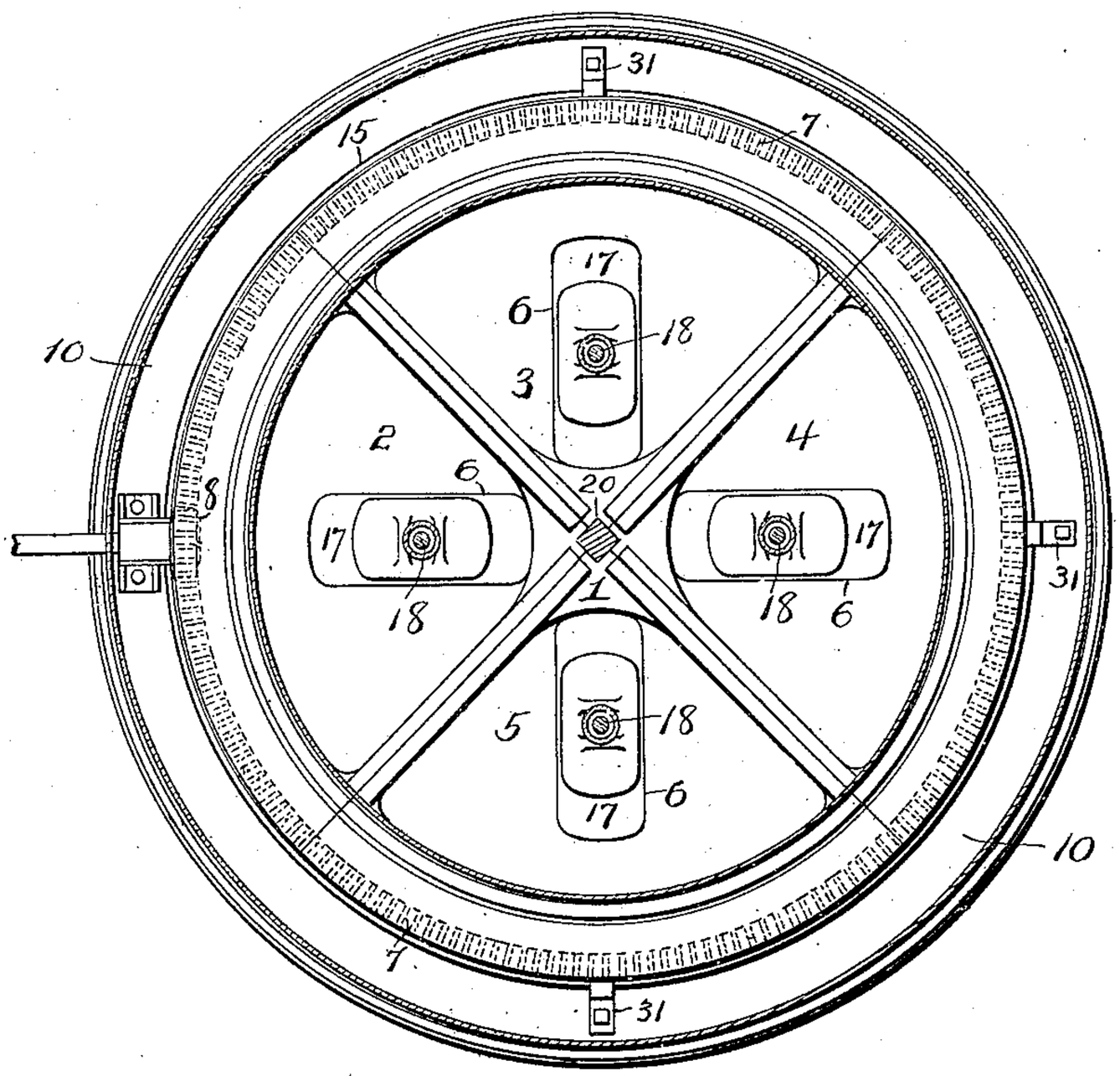
2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

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BLAST-FURNACE-CHARGING APPARATUS.

No. 914,432. Specification of Letters Patent. Patented March 9, 1909.

Application filed August 28, 1908. Serial No. 450,723.

To all whom it may concern:

Be it known that we, RICHARD H. LEE and WILLIAM P. MARTIN, of Lebanon, in the county of Lebanon and State of Pennsylvania, have invented certain new and useful Improvements in Blast-Furnace-Charging Apparatus; 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.

Our invention relates to an improvement in blast furnace charging apparatus of which the following is a specification.

In ordinary practice a single charging bell is employed for regulating and distributing the charge of fuel, ore and fluxes in a blast furnace. In the event a small bell is used, it will operate to direct the material toward the vertical center of the furnace and form vertical draft channels at or near the sides of the furnace, while on the other hand if a large bell is used, it will operate to direct the discharge of the material at the sides of the furnace with the result that a draft channel will be formed at the center of the furnace. These channels serve as gas flues and permit an undue proportion of gas to flow upwardly and escape through them, and thereby prevent a portion of the ore from being properly acted upon by the reducing gases. The result is that the ore which has not been sufficiently acted upon must be reduced by the solid carbon in the lower part of the furnace, which results in robbing the hearth and melting zone of an undue proportion of its heat, and such loss of heat must be compensated for by the use of extra fuel.

The object of our invention is to provide a blast furnace charging apparatus of such construction that it will insure a uniform distribution of material within the furnace and thereby obviate the formation of channels, and compelling the ascending gases to penetrate uniformly the entire body of material and thus cause it to be evenly acted upon with the result that much fuel is saved and better results are attained.

With this object in view our invention consists in certain features of construction and combination of parts as will be hereinafter described and pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical section of the upper portion of a blast furnace provided with one embodiment of our improvement, and Fig. 2 is a plan view of our improved rotary hopper.

1 represents the lower and distributing hopper which is preferably located above the top of the furnace 2^a to permit it to be air cooled, although when it is desired to apply the hopper to a furnace having a skip hoist and double bell, the upper bell and hopper need not be changed, and the lower and distributing hopper may be located partly or wholly below the floor level of the top of the furnace.

Hopper 1 is made of four detachable hopper sections 2, 3, 4 and 5, which are bolted or otherwise secured together. The object in making the hopper in sections is to permit of its being readily and cheaply repaired and renewed in the event any one of the hopper sections should become damaged so as to render it unfit for use. Each one of the hopper sections is constructed with a rectangular or oblong discharge opening 6 which is arranged with its longer axis located radially with respect to the center of the hopper frame in order to insure a uniform distribution of material over the entire area within the furnace. While we have shown four such hopper-sections, it is evident that a lesser or larger number might be employed. Hopper 1 is provided at its upper portion with an outwardly projecting annular flange, which is preferably made up of four sections and each is removable to permit of their being readily renewed if necessary. The underside of these sectional flanges is provided with a segmental rack 7 which constitutes when the several sections are assembled, a circular gear with which meshes a driving pinion 8 by means of which the hopper is rotated at a point below the circular rack. The hopper is provided with an annular supporting flange 9 which is supported upon an annular bed plate 10 mounted on the top of the furnace. The supporting flange 9 and bed plate 10 are each provided with an annular groove 11 which register one with the other and serve as a runway for ball bearings 12 which materially minimizes the friction between the parts. Instead of ball bearings, we might of course substitute anti-friction rollers of any desired form and construction. The supporting flange and bed plate are constructed with an interlocking tongue and groove 13, 14, which serve as an annular guide for the parts, and also as a dust guard

to protect the ball bearings against the entrance of dust or other foreign matter which might obstruct their free operation. The bed plate is provided with a vertical annular flange 15 which engages the outer edge 16 of the supporting flange and thereby serves as an annular guide and also as a dust guard to protect the ball bearings. While we have illustrated the annular rack and pinion as being located above the supporting flange and bed plate, it is evident that these parts might be reversed, if desired.

Each one of the hoppers is provided with a bell 17, made rectangular or oblong in shape to fit the discharge opening of one of the hopper sections 2, 3, 4 and 5. Owing to the shape of these bells they may be readily replaced as by turning them side-wise they can be lifted through the discharge openings in the hoppers. The four small bells 17 are rigidly connected with and suspended by rods 18 from a spider 19, which is firmly attached to a square or angular rod 20 and the lower end of which extends downwardly through a square or angular opening in the center of the hopper 1. The upper end of rod 20 is provided with a circular head 21, which is supported upon ball bearings 22 mounted in a housing 23 connected by a link 24 to one end of a lever 25. This construction permits the rod 20 to be raised and lowered by means of lever 25, and thereby operate to simultaneously raise and lower the several bells 17, and also allows the rod 20 to freely rotate with the hopper 1.

Above the hopper 1, is located a small hopper 26, which is provided with a bell 27 for regulating and governing the discharge of material therefrom into the several sections of the lower hopper. The bell 27 is secured in any desired manner to a sleeve 28 which surrounds the rod 20, the upper end of the sleeve being connected by means of a link 29 to the operating lever 30. It will thus be observed that the bell 27 of the upper hopper, and the lower hopper and its bells may be independently operated. Safety catches or hooks 31 may be secured to the annular bed plate and arranged to extend over the annular flange surrounding the hoppers and serve to prevent the displacement of the hoppers in the event of an explosion of gases in the furnace.

In the operation of the charging apparatus, half a charge of coke is discharged from the upper hopper into the several lower hoppers, which is discharged therefrom into the furnace and falls in four radial layers extending from the furnace wall to the vertical axis of the furnace. The lower hopper is then rotated one eighth of a circle, and the remaining half of the charge of coke is then discharged from the upper hopper into the several lower hoppers, and from thence it is discharged and fills the four radial spaces between the previously made layers, and thereby forms a level and uniform layer of coke. Upon this layer of coke, the ore and flux or stone are dropped in a similar manner, either in two discharges or some multiple of two, with the result that each one of the charges will be practically level and of uniform density over the entire inner surface of the furnace, and as a result, the gases will pass uniformly through the mass of stock, and thereby permit of the use of a considerably lighter and hotter air blast and a consequent saving of fuel, and also of the wear and tear of the blowing engines.

Having fully described our improvement what we claim as new and desire to secure by Letters-Patent, is,—

1. A charging apparatus for blast furnaces, comprising a series of rotatable hoppers, each hopper being provided with a bell for controlling its discharge of material directly into the furnace, substantially as set forth.

2. A charging apparatus for blast furnaces comprising a series of rotatable hoppers, each provided with an opening adapted to discharge directly into the furnace, the discharge openings of the hoppers being arranged radially with respect to the interior of the furnace.

3. A charging apparatus for blast furnaces comprising a series of rotatable hoppers and a bell for each hopper to regulate the discharge of material therefrom directly into the furnace, said hoppers having elongated discharge openings having their longer axes arranged radially to the vertical axis of the furnace, substantially as set forth.

4. A charging apparatus for blast furnaces comprising a series of rotatable hoppers each having an elongated discharge opening, and a vertically adjustable bell of elongated form adapted to open and close said discharge opening, substantially as set forth.

5. A charging apparatus for blast furnaces comprising a series of hoppers, means for rotating them simultaneously, in combination with a series of bells for opening and closing the discharge openings of the latter, and means for simultaneously raising and lowering them.

6. The combination with a blast furnace, of a series of rotatable hoppers adapted to discharge directly into the furnace, and an upper hopper arranged to have its contents discharged into said series of hoppers, substantially as set forth.

7. The combination with a blast furnace, a series of hoppers and means for simultaneously rotating said hoppers, of a series of bells adapted to rotate in unison with the

hoppers for opening and closing the discharge openings of the latter, and means for simultaneously raising and lowering said bells.

8. The combination with a blast furnace, of a rotatable frame comprising an annular series of hoppers, and a series of vertically adjustable bells for opening and closing the discharge outlets of said hoppers, of an upper hopper and a bell for regulating the discharge of its contents, substantially as set forth.

In testimony whereof, we have signed this specification in the presence of two subscribing witnesses.

RICHARD HENRY LEE.
WILLIAM P. MARTIN.

Witnesses:
EUGENE E. MOYER,
DAWSON W. LIGHT.