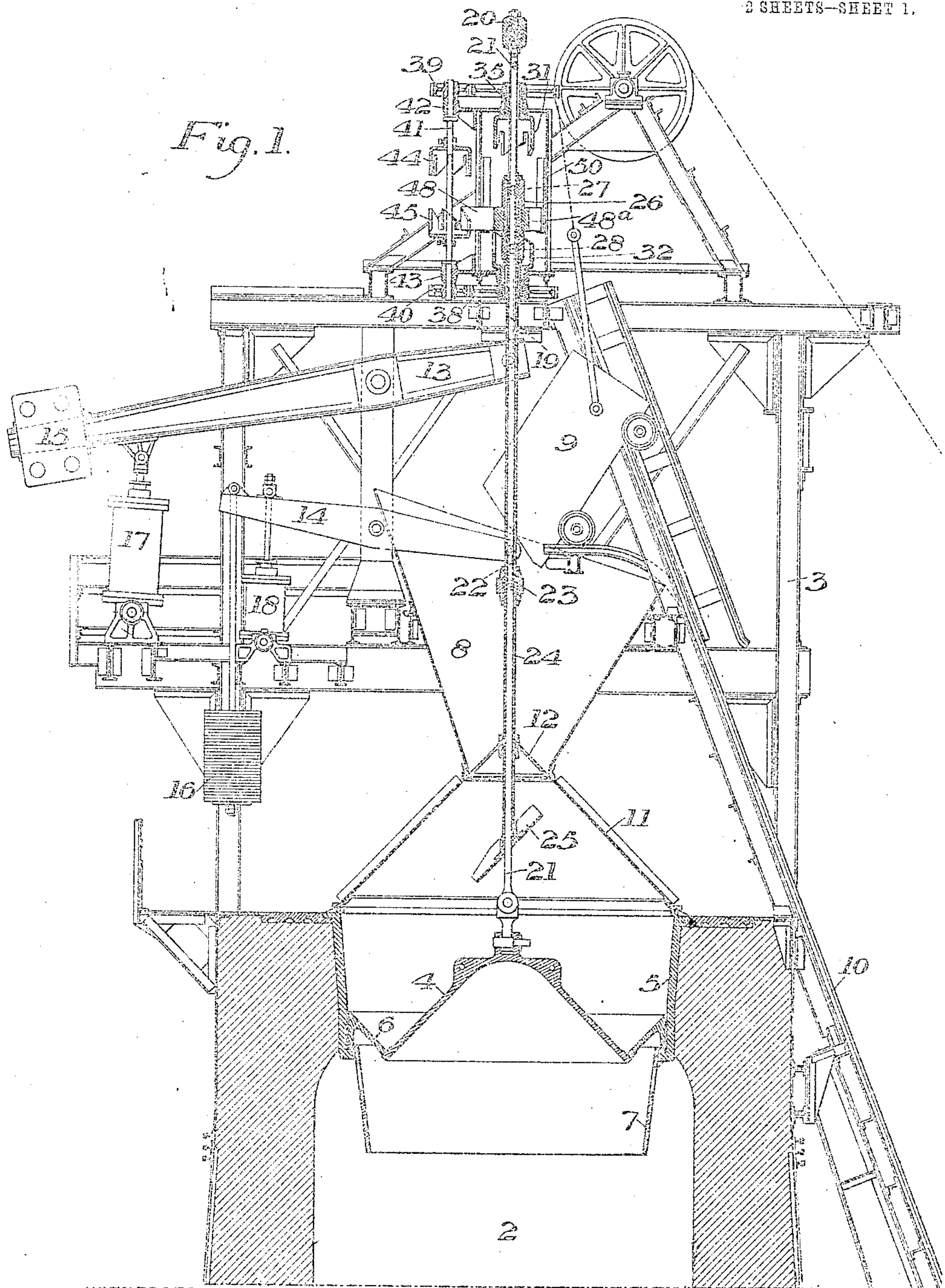


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BLAST FURNACE CHARGING APPARATUS.  
APPLICATION FILED APR. 25, 1907.

898,818.

Patented Sept. 15, 1908.

2 SHEETS—SHEET 1.



WITNESSES

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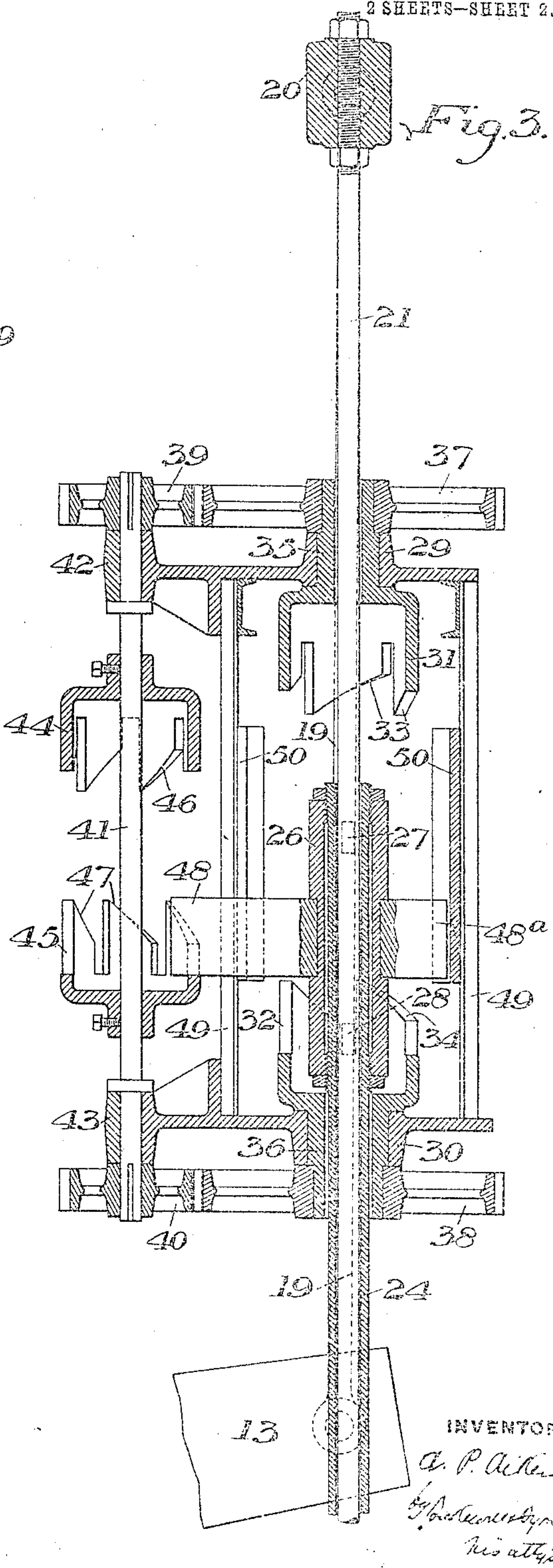
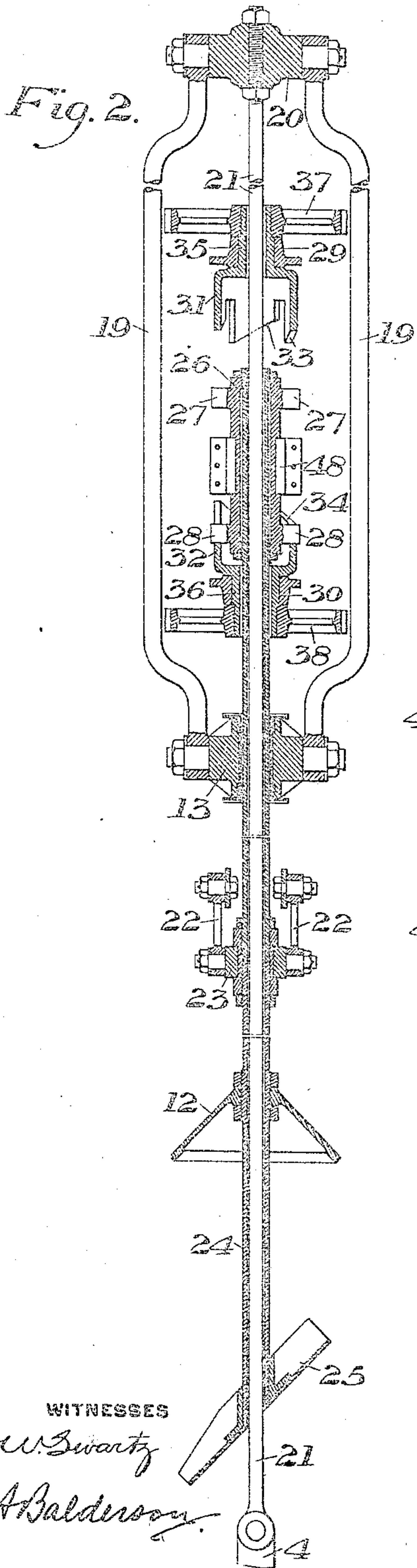


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# UNITED STATES PATENT OFFICE.

ALBION P. AIKEN, OF BRADDOCK, PENNSYLVANIA, ASSIGNOR OF ONE-THIRD TO JOHN F. LEWIS AND ONE-THIRD TO MICHAEL KILLEEN, OF BRADDOCK, PENNSYLVANIA.

## BLAST-FURNACE-CHARGING APPARATUS.

No. 898,818.

Specification of Letters Patent.

Patented Sept. 15, 1908.

Application filed April 25, 1907. Serial No. 370 217.

*To all whom it may concern:*

Be it known that I, ALBION P. AIKEN, of Braddock, Allegheny county, Pennsylvania, have invented certain new and useful Improvements in Blast-Furnace-Charging Apparatus, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a vertical sectional view of the top portion of a blast furnace equipped in accordance with my invention; Fig. 2 is a detail view on a larger scale showing one way of connecting the upper bell and the deflector with the turning mechanism; and Fig. 3 is a detail view on a larger scale showing the turning mechanism forming part of my invention.

The invention relates to apparatus employed in charging stock from the skip cars into blast furnaces and it more particularly relates to the bell and hopper type of charging apparatus, and the object of the invention is to provide improved means whereby an equal and uniform distribution of the stock in the blast furnace is secured, the formation of scaffolds is prevented and hanging of the stock is avoided.

A further object of the invention is to provide improved means by which the distributing mechanism is operated and means by which large pieces of stock may be charged into the furnace.

The invention consists in providing novel means for depositing the stock in the hopper around the axis of the bell and hopper and in the improved mechanism for rotating the deflector by which the stock is distributed.

It further consists in the novel arrangement and location of the parts as more fully described hereinafter.

In the drawings, 2 represents the top of a blast furnace and 3 the superstructure for carrying the bells and bell-beams and the bell-operating mechanism. The furnace is provided with the usual bell 4 and hopper 5 and with a hopper extension 6. The furnace as shown is also provided with a distributing ring 7 by which the stock is directed as it is discharged from the hopper 5 into the furnace 2. Above the bell 4 and hopper 5 and carried on the superstructure 3 is a supple-

mental hopper 8 into which the stock is discharged from the skip cars 9 which run on the inclined skip tracks 10. A hood 11 extends upwardly from the top of the hopper 5 and is connected with the supplemental hopper 8 so as to form a gas-seal for the furnace, the open lower end of the supplemental hopper 8 being closed by means of the gas-sealing bell 12. It will be noted that this bell 12 is raised in opening instead of being lowered as in the usual construction. The bells 4 and 12 are connected to bell beams 13 and 14 which are pivoted to the superstructure 3 and have the usual counterweights 15 and 16 and these beams are actuated to raise and lower the bells by means of fluid pressure cylinders 17 and 18. The bell beam 13 for the large bell 4 is connected by the links 19 to the cross head 20 and this cross head is adjustably secured to the upper end of the bell rod 21, the bell 4 being suspended to the lower end of this rod in the usual manner.

The bell beam 14 is connected by links 22 to the cross head 23, this cross head being secured to the hollow bell rod 24 at a point intermediate of its ends in such manner as will permit of the hollow rod 24 being rotated. The bell rod 21 extends through the bell rod 24 which is made hollow for this purpose. Also secured to the hollow rod 24 is the top or gas-sealing bell 12 and on the lower end of the rod 24, a deflector 25 is secured so as to be rotated within the space formed by the hopper 4 and hood 11 by this rod when the rod is revolved by the deflector turning mechanism. The mechanism for turning the deflector 25 is, as shown in the drawing, carried on the superstructure 3 and the rotary elements of this mechanism are secured to the upper end of the hollow rod 24.

The deflector turning mechanism has a sleeve or coupling 26 secured in place on the upper end of the hollow bell rod 24 so as to be raised and lowered with the rod and this coupling is provided with oppositely projecting wings or lugs 27 and 28 on each of its ends.

Mounted in bearings 29 and 30 above and below the coupling or sleeve 26 are oppositely facing turning jaws 31, 32, these jaws being provided with inclined faces 33 and 34. These inclined faces by contact with the lugs



27 and 28 on the coupling 26, rotate this coupling and through the hollow rod 24 turn the rotary deflector 25 when the rod 24 is raised and lowered by the bell-beam 14 in opening and closing the upper or gas-sealing bell 12 to permit the stock to be discharged into the hopper 4. Each of the sets of turning jaws 31, 32 are attached to hollow neck portions 35 and 36 which extend through the bearings 29 and 30.

Keyed or otherwise secured to the outer ends of the necks 35 and 36 are turning gears 37 and 38 and these gears are in mesh with gears 39 and 40 which are on the ends of the vertical shaft 41 which is mounted in the bearings 42, 43. Also mounted on the shaft 41 are oppositely facing turning jaws 44 and 45 having inclined faces 46 and 47 and these jaws by contact with the lug 48 on the sleeve or coupling 26 on the bell rod 24, are rotated as the coupling 26 and rod 24 are raised and lowered in operating the bell and through the gears 37, 39 and 38, 40 rotate the turning jaws 31 and 32. The bearings 29, 30 and 42, 43 are secured together by uprights 49 and vertical guides 50 are provided on these uprights which by contact with the lugs 48, 48<sup>a</sup> prevent turning of these lugs, when the sleeve 26 is rotated.

In the operation of my improved apparatus, the stock is hoisted in the skip cars 9 on the skip track 10 and is dumped into the supplemental hopper 8. The upper bell 12 is then raised through the bell beam 14 and the connecting mechanism by the bell actuating cylinder 18 and the stock in the hopper 8 is discharged in the hopper 5. As the bell 12 is raised the stock in the hopper 8 is directed inwardly toward the axis of the hopper by the sloping sides of the hopper 8 and strikes upon the inclined deflector or chute 25 which is secured to the lower end of the hollow bell rod 24, and is directed by this deflector to one side of the hopper 5. The bell 12 is then lowered to close the mouth of the supplemental hopper 8 and more stock is dumped into this hopper by the skip cars 9. The bell 12 is again raised and the stock is again discharged upon the deflector 25 and is directed by this deflector to one side of the hopper 5. Successive charges of stock are delivered into the hopper 8 and it is discharged from the hopper 8 into the hopper 5 until the desired amount of material is in the lower hopper 5. The large bell 4 closing the lower end of the hopper 5 is then lowered and the charge of stock is delivered into the interior 2 of the furnace.

The operation of raising and lowering the top bell 12 also rotates the deflector 25 through a part of a revolution, as shown being slightly more than one quarter turn, and in this way, the successive skip loads of stock are distributed around the axis of the lower

hopper in such manner as will equally distribute the coarse and fine materials within the interior of the furnace.

The above described operation is repeated as often as is necessary to keep the stock at the desired height within the furnace chamber 2. When the bell 12 is raised and lowered by means of the bell operating mechanism, the sleeve or coupling 26 on the upper end of the bell rod 24 is also raised and lowered and when this coupling is so actuated the oppositely facing lugs or projections 27 and 28 on the opposite ends of the coupling contact with the inclined faces 33 and 34 on the turning jaws 31 and 32 and are turned through a part of a revolution and through the rod 24, turn the inclined deflector 25 on the lower end of this rod.

As shown in the drawings there are four projecting jaws 31, 32 on each of the necks 35 and 36 and these jaws are rotatably mounted in the bearings 29 and 30. The ends of the necks 35 and 36 are provided with the gear wheels 37, 38 by means of which the jaws 31, 32 are rotated. The gears 37, 38 mesh with similar gears 39 and 40 which are mounted upon the opposite end of the vertical shaft 41, this shaft being carried in the bearings 42 and 43. Adjustably secured on the shaft 41 are turning jaws 44 and 45 and the inclined faces 46, 47 of these jaws by contacting with the finger 48 forming part of the cross head and which is raised and lowered by the opening and closing of the small bell 12, are turned on their axis and through the meshing gear wheels rotate these wheels and the projecting turning jaws 31, 32.

As shown in Fig. 3, the turning jaws 31, 32 each have four inclined faces 33 and 34 while the turning jaws 44, 45 each have six turning faces 46, 47. By gearing the turning mechanism as shown, each time the bell 12 is lifted the bell rod 24 and deflector 25 are turned one-eighth ( $\frac{1}{8}$ ) of a revolution by the lugs 27 contacting with the inclined faces 33 on the turning jaws 31 and when the bell rod 24 and inclined chute or deflector 25 is lowered, the lug 28 on the lower end of the sleeve 26 contacts with and is turned by the inclined faces 34 on the turning jaws 32. The raising and lowering movement of the sleeve 26 through the lug 48 also turns the shaft 41 through the inclined faces 46, 47 on the turning jaws 44 and 45 and this shaft rotates the gears 37, 38 through a part of a revolution and the gears 37, 38 rotate the turning jaws 31 and 32.

It will be seen that by the above described operation that in addition to the amount the turning jaws 31, 32 cause the inclined chute 25 to be rotated, the inclined jaws 44, 45, turn the chute 25 an additional amount which will vary depending upon the ratio of



the gears on the vertical shaft 41 with those on the necks 35 and 36.

The advantages of my invention are many. The inclined chute 25 is in the space between the upper and lower bells, in this way permitting larger pieces of stock to be charged than is possible with the throat construction heretofore used.

By locating the inclined chute 25 at a point between the upper and lower bells the fall of the stock is retarded and in this way breakage of the coke is reduced.

By means of the turning mechanism for the chute 25, the stock is charged into the hopper 5 and each charge is deposited in such manner that the chute 25 does not discharge in the same position in the hopper until after a large number of skip car loads or charges have been deposited in the hopper.

The stock is distributed around the axis of the bells and furnace so as to equally distribute the coarse and fine materials in the stock in layers within the furnace.

Modifications in the construction and arrangement of the parts may be made and other than the turning mechanism shown may be used without departing from my invention.

I claim:—

1. Apparatus for charging blast furnaces comprising a bell and hopper discharging into the furnace, a stationary supplemental hopper discharging radially inward above the first hopper, an inclined distributing chute or deflector between said hoppers and mechanism for rotating said distributing chute or deflector; substantially as described.

2. Apparatus for charging blast furnaces comprising a bell and hopper discharging into the furnace, a supplemental bell and hopper discharging radially inward above the first hopper, said supplemental hopper being stationary, an inclined deflector between said hoppers, and mechanism for rotating said deflector; substantially as described.

3. Apparatus for charging blast furnaces comprising a bell and hopper discharging into the furnace, a supplemental bell and hopper discharging radially inward above the first hopper, said supplemental hopper being stationary, a hood connecting said hoppers to form a gas seal, an inclined deflector between said hoppers and mechanism for rotating said deflector; substantially as described.

4. Apparatus for charging blast furnaces comprising a bell and hopper discharging into the furnace, a supplemental bell and hopper discharging into the first hopper, means for opening and closing said bells, an inclined deflector between said hoppers and mechanism adapted to rotate said deflector when said supplemental bell is actuated; substantially as described.

5. Apparatus for charging blast furnaces comprising a bell and hopper discharging into the furnace, a stationary supplemental hopper discharging radially inward above the first hopper, a rotating deflector or distributing chute located below the supplemental hopper and mechanism for turning the rotary deflector to distribute the stock to varying points about the axis of the bell and hopper; substantially as described.

6. Apparatus for charging blast furnaces comprising a bell and hopper opening into the furnace, a supplemental bell and hopper above the first bell and hopper, means for vertically moving said bells in opening and closing the mouths of said hoppers, a deflector or chute rotatably mounted between the bells and adapted to move vertically with the supplemental bell and mechanism for rotating said chute about the axis of said bells when said supplemental bell is raised and lowered; substantially as described.

7. Apparatus for charging blast furnaces comprising a bell and hopper opening into the furnace, a supplemental bell and hopper above the first bell and hopper, means for vertically moving said bells in opening and closing the mouths of said hoppers, a deflector or chute rotatably mounted between the bells and adapted to move vertically with the supplemental bell when said bell is raised to open the supplemental hopper and mechanism for rotating said chute when said supplemental bell is raised; substantially as described.

8. In blast furnace charging apparatus, the combination of a vertically movable bell rod having a coupling or sleeve, lugs on said sleeve and turning jaws having inclined faces adapted to contact with said lugs and rotate the bell rod; substantially as described.

9. In blast furnace charging apparatus, the combination of a vertically movable bell rod having a coupling or sleeve, lugs on said sleeve and oppositely facing turning jaws having inclined faces adapted to contact with said lugs and rotate the bell rod; substantially as described.

10. In blast furnace charging apparatus, the combination of a vertically movable bell rod having a coupling or sleeve, lugs on said sleeve, rotatable turning jaws having inclined faces adapted to contact with said lugs and rotate the bell rod, a non-rotatable lug on said sleeve and a second set of rotatable turning jaws having inclined faces adapted to contact with the non-rotatable lug and rotate the first set of turning jaws; substantially as described.

11. In blast furnace charging apparatus, the combination of a vertically movable bell rod having a coupling or sleeve, lugs on said sleeve, oppositely facing rotatable turning jaws having inclined faces adapted to con-

tact with said lugs and rotate the bell rod, a  
non-rotatable lug on said sleeve and a second  
set of oppositely facing rotatable turning  
jaws having inclined faces adapted to con-  
5 tact with the non-rotatable lug and rotate  
the first set of turning jaws; substantially as  
described.

In testimony whereof, I have hereunto set  
my hand.

ALBION P. AIKEN.

Witnesses:

G. E. F. GRAY,  
FRANK A. POWER.