

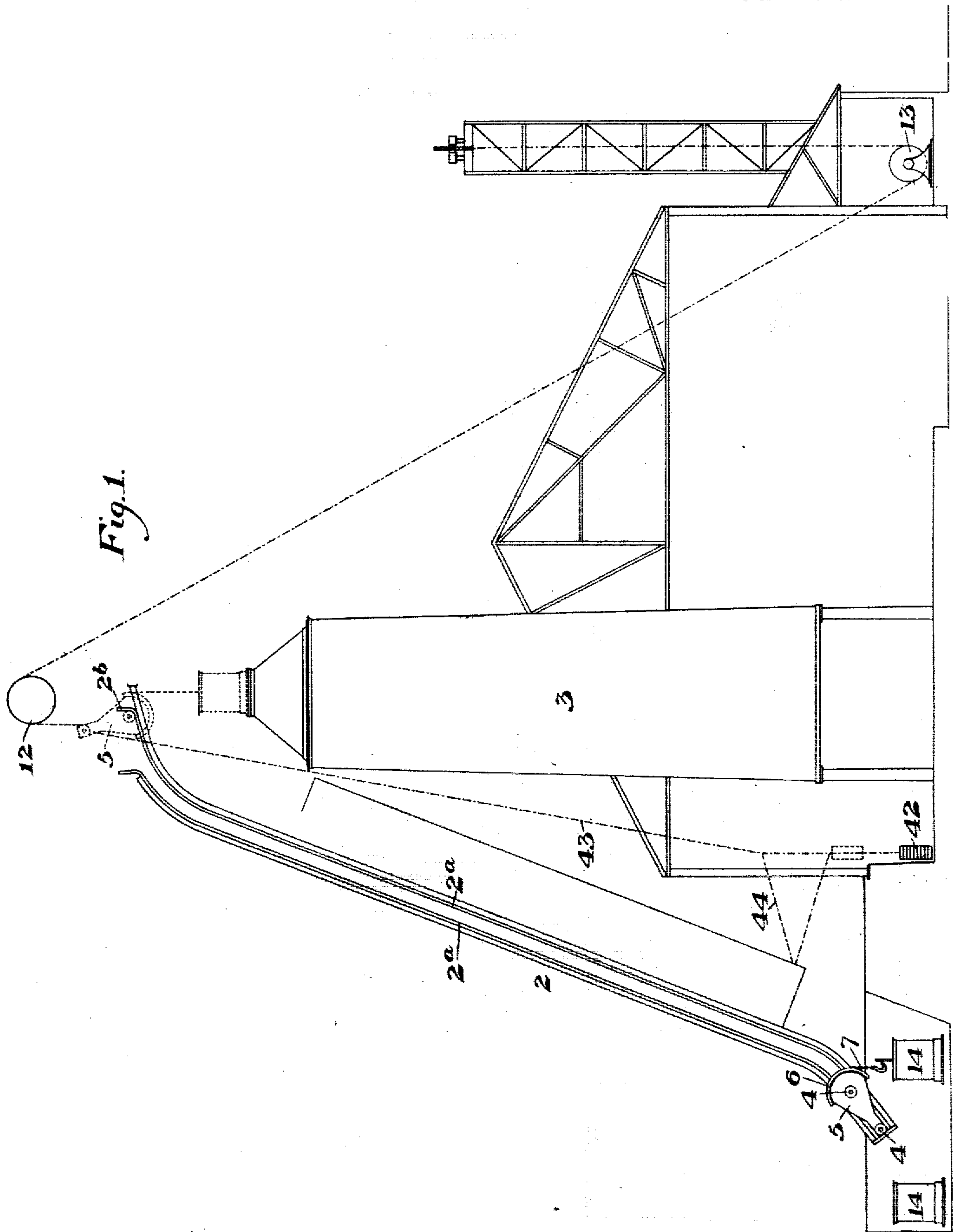
No. 825,643.

PATENTED JULY 10, 1906.

E. L. FORD & C. F. PARKS.  
BLAST FURNACE CHARGING APPARATUS.

APPLICATION FILED DEC. 28, 1906.

6 SHEETS—SHEET 1



WITNESSES

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R. A. Balderson.

INVENTORS

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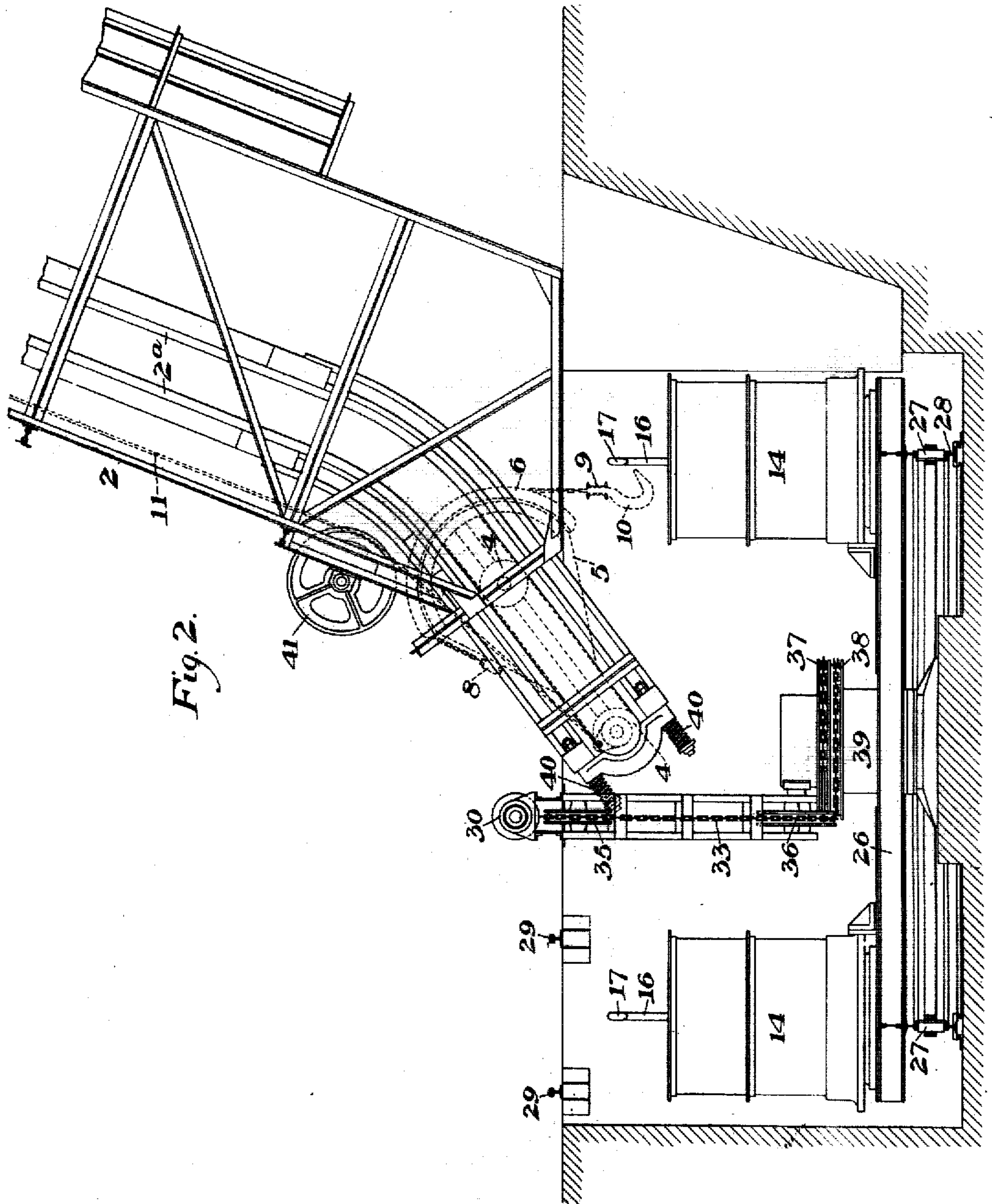
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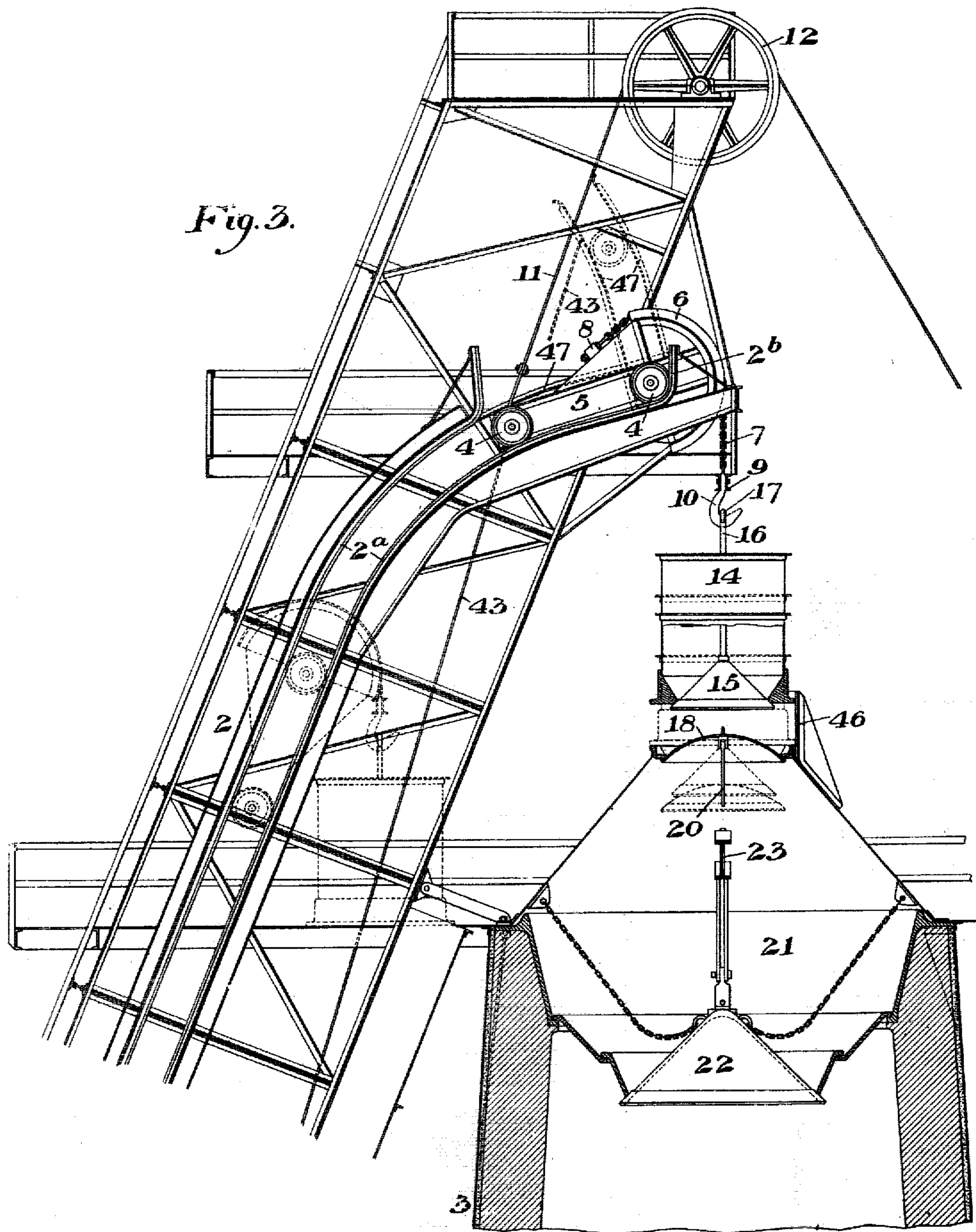
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6 SHEETS—SHEET 3.



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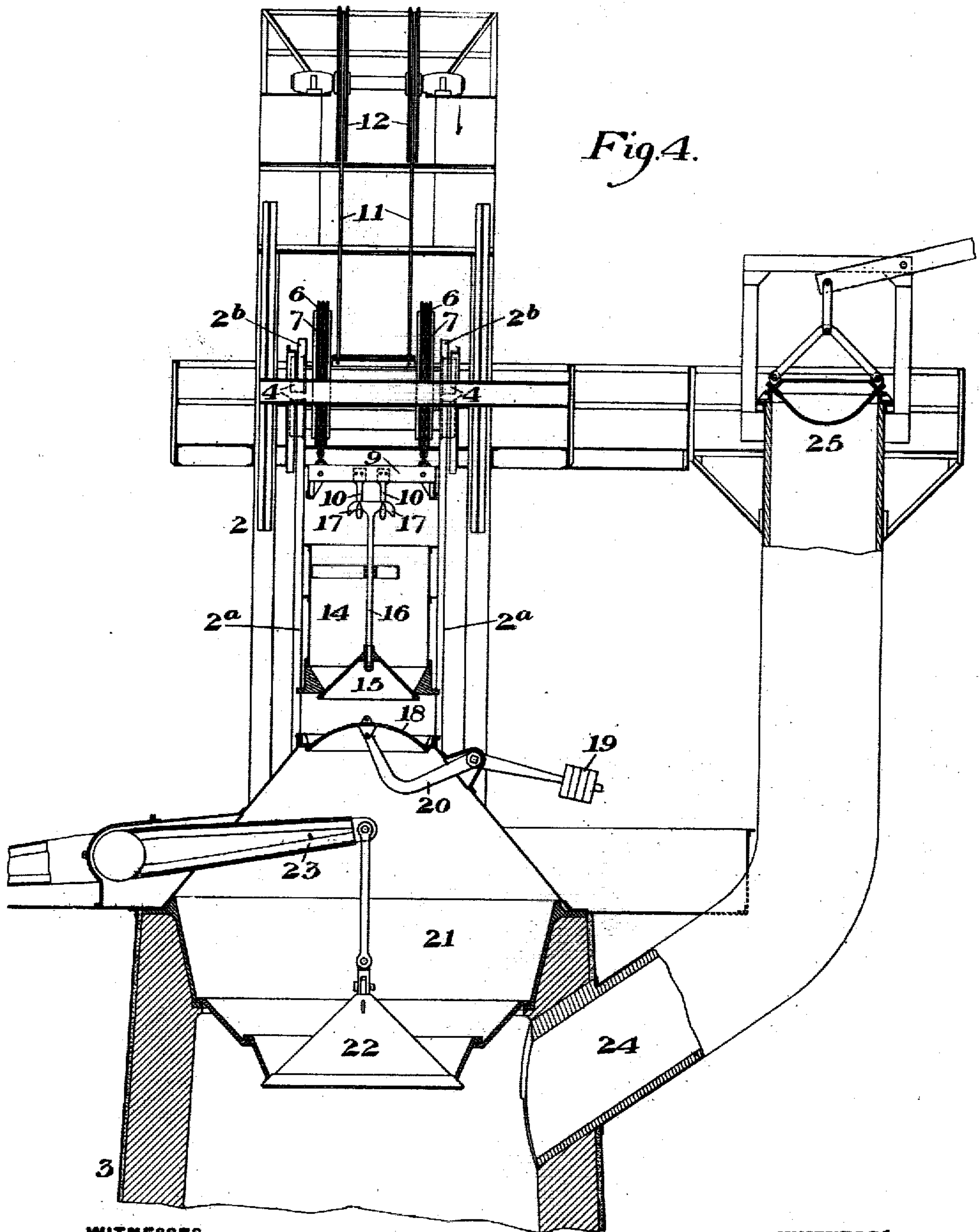
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8 SHEETS—SHEET 4.



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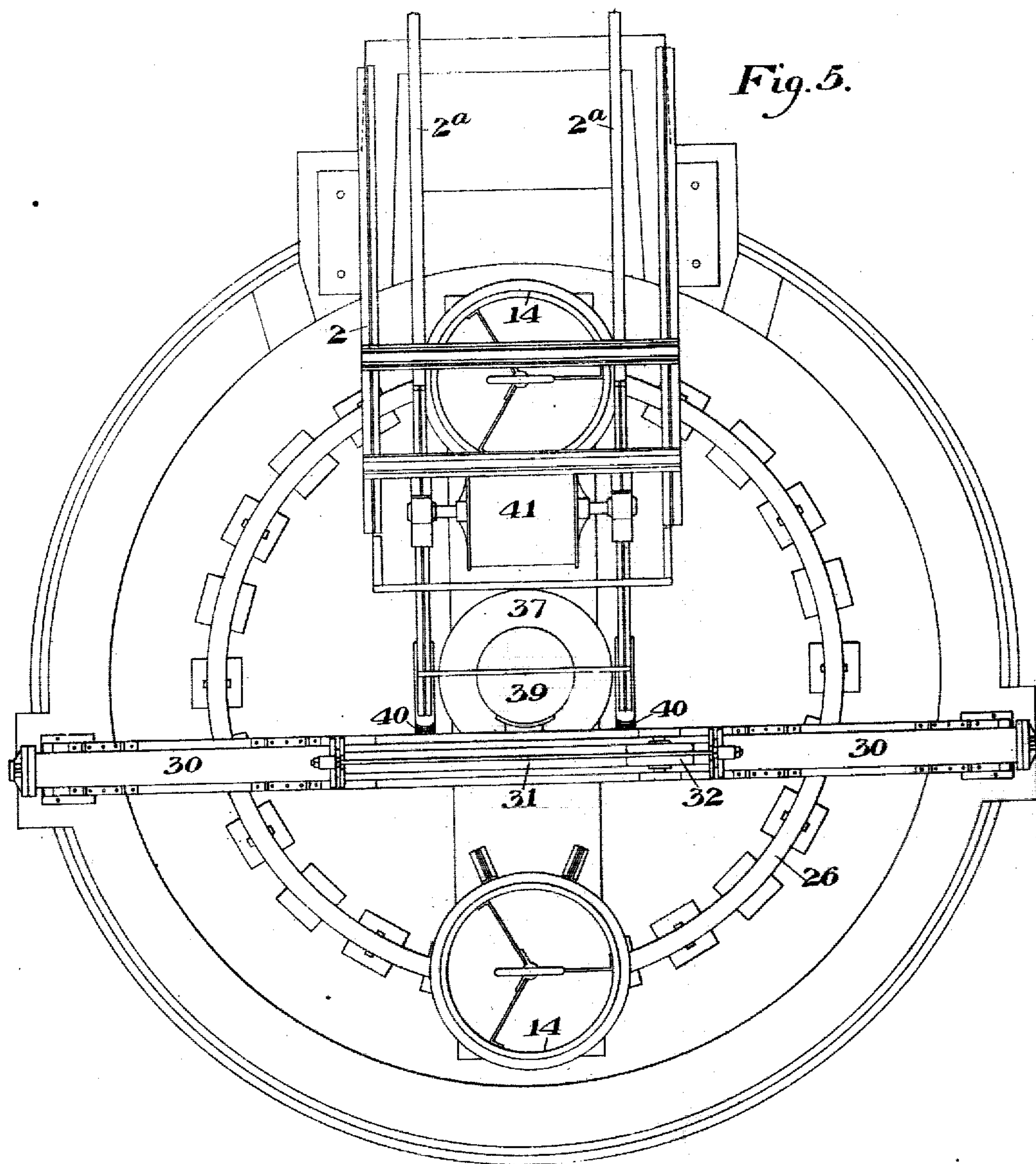
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6 SHEETS—SHEET 5.



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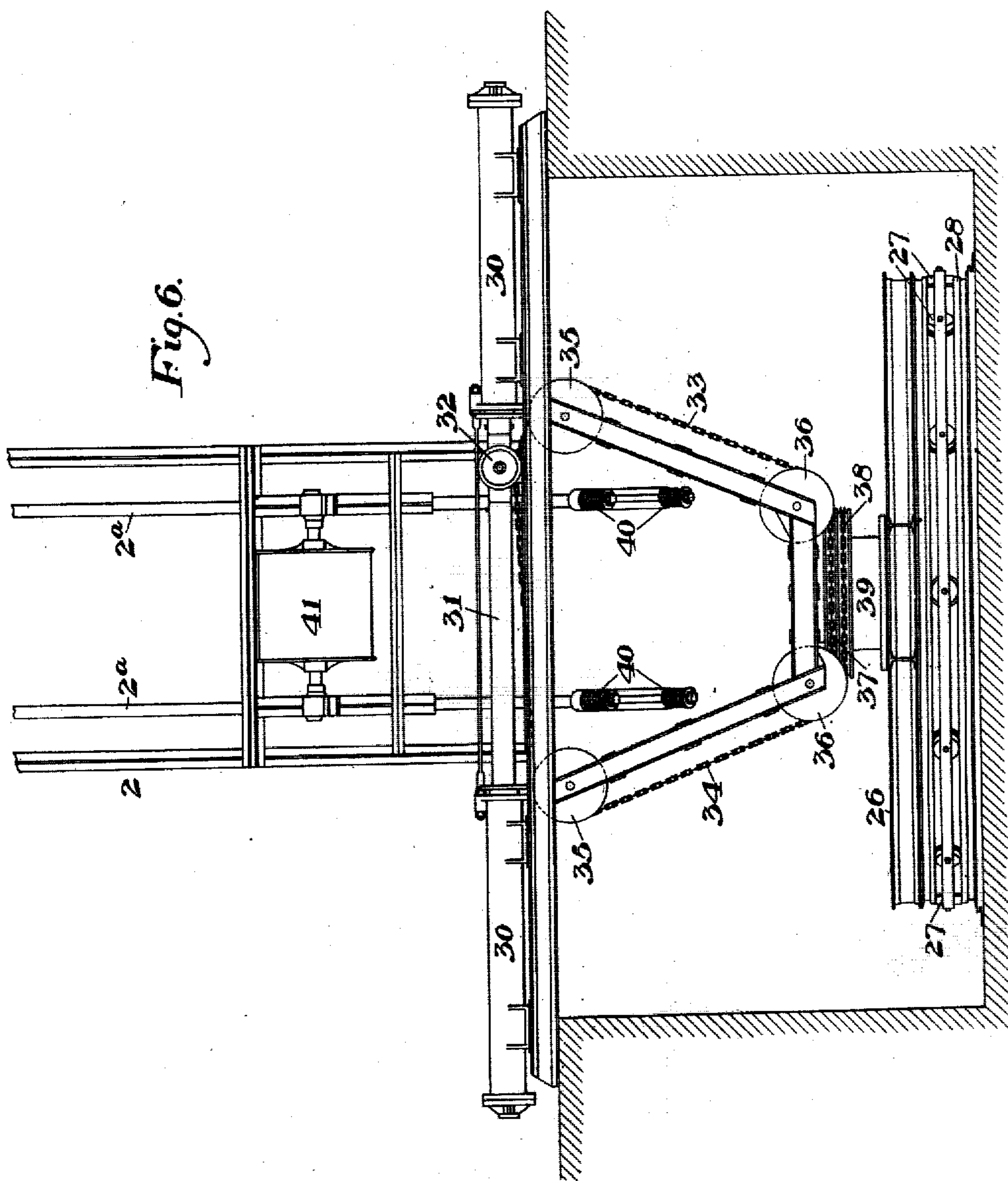
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6 SHEETS—SHEET 6.



WITNESSES

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# UNITED STATES PATENT OFFICE.

EDWARD L. FORD AND CHARLES F. PARKS, OF YOUNGSTOWN, OHIO.

## BLAST-FURNACE-CHARGING APPARATUS.

No. 825,643.

Specification of Letters Patent.

Patented July 10, 1906.

Application filed December 28, 1905. Serial No. 293,638.

*To all whom it may concern:*

Be it known that we, EDWARD L. FORD and CHARLES F. PARKS, of Youngstown, Mahoning county, Ohio, have invented a new and useful 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 an outline or diagrammatic view showing in side elevation the general arrangement of the apparatus embodying our invention. Fig. 2 is a side elevation, partly in section, of the apparatus at the base of the furnace. Fig. 3 is a similar view showing the apparatus at the top of the furnace in side elevation. Fig. 4 is a similar view showing the same in rear elevation. Fig. 5 is a plan view of the apparatus at the base of the furnace, and Fig. 6 is a front elevation of the same.

The object of our invention is to do away with the expensive and complicated skip operating and dumping mechanisms which are usually employed in connection with blast-furnace-charging apparatus and to provide instead a simple and practical bucket system so arranged that the buckets may be loaded and taken successively to the top of the furnace and discharged each by a single operating movement of the engine.

To this end our invention consists in the provision of an inclined frame extending to the top of the furnace-shaft and having suitable tracks, a bucket-carrier arranged to run on said tracks and to carry the buckets to the top of the furnace and discharge them by a tilting movement, together with suitable means for operating the same. We also provide a movable table or carrier arranged to bring the loaded buckets into position to be carried to the top of the furnace and to return the empty buckets to receive a fresh load.

Our invention also consists in the novel construction, arrangement, and combination of parts, all substantially as hereinafter described, and pointed out in the appended claims.

In the accompanying drawings the numeral 2 designates a suitable inclined frame leading from the base to the top of the furnace-shaft 3 and provided at each side with inner and outer rails 2<sup>a</sup>, between which are arranged to run the wheels 4 of a bucket carrier or carriage 5. This carriage consists of a

suitable frame provided at each end with the wheels 4 and having at its upper end at each side segment-shaped grooved plates 6, over which run the bucket-suspending chains 7. These chains are connected at one end with the carriage at the points 8 and at their free ends to a cross-bar 9, having hooks 10 for engagement with the buckets. The carriage is raised and lowered by means of a cable 11, which passes over a wheel or sheave above the top of the furnace, thence downwardly around the drum 13, and to the engine-shaft. The upper portions of the track-rails 2<sup>a</sup> are curved inwardly over the top of the furnace, and the inner rails are provided at their ends with the stops 2<sup>b</sup> for the front wheels 4 of the carriage 5.

The buckets 14 are formed with a bottom discharge-opening which is normally closed by a bell 15, to which is connected a lifting-rod 16, having at its upper end a T-head 17 for engagement with the hooks 10 of the bar 9.

18 designates an upper vertically-movable bell or gas seal at the top of the furnace, which is normally held in closed position by a counterweight 19, acting through a lever 20.

21 is the receiving-hopper, which is closed by the usual lower or main bell 22, which is raised and lowered by the usual lever mechanism, (shown at 23.)

24 designates one of the furnace relief-pipes, closed by the valve 25.

26 is a horizontal turn-table which is located in a pit at the base of the furnace adjacent to the stock-bins and below the lower end of the inclined frame 2. The table 26 is suitably mounted upon rollers 27, which travel on a track 28, and is arranged to have a reciprocating rotary movement through an arc of about one hundred and eighty degrees for the purpose of bringing the loaded buckets into position to be engaged by the hooks 10 and to return the empty buckets into position to receive a fresh load, as shown at the left-hand side of Fig. 2 and at the bottom of Fig. 5.

29 designates tracks upon which the cars or frames carrying the stock can be run over the pit for the purpose of filling the buckets.

The table 26 may be actuated by any suitable means. We have shown two hydraulic cylinders 30, having their plungers connected by rod 31, upon which is mounted a grooved wheel or pulley 32. Chains 33 and 34 extend from this wheel 32 around the idle wheels 35 and 36 and are connected thence to the re-



spective drums 37 and 38, which are secured to a central upwardly-extending shaft 39 on the table 26. Through these connections the alternate operation of the two cylinders 30 effects the reciprocating rotary movement of the table 26 to move the buckets from one position to the other in the manner above described.

40 designates suitable stop or buffer springs which are arranged to stop the carriage 5 in its descent.

41 is a guide-wheel for the cable 11, which is attached to the carriage 5 at a point near its lower end.

42 is a counterweight connected to a rope or cable 43, which is attached to the frame of the carriage 5 for the purpose of returning it to its proper position after it has been raised or tilted to discharge the buckets in the manner hereinafter described.

44 is a stay connection for the rope or cable 43.

The operation is as follows: The table 26 is actuated to move a loaded bucket 14 into position to be engaged by the hook 10 of the carriage 5, which at the same time returns an empty bucket into position to receive another load. The engine is then operated to raise the carriage 5 by means of the cable 11 to the top of the furnace. The front end of the carriage strikes the stop projections 2<sup>b</sup> and the track of the inner track-rails 2<sup>a</sup>, and continued pull on the cable 11 causes the carriage to turn on the axis of its front wheels as centers into the position shown in dotted lines in Fig. 1. This tilting movement of the carriage lowers the chains 7 and bar 9 to bring the bucket to rest upon the top of the furnace in the manner shown in dotted lines in Fig. 3, the guide 46 being provided to properly center the bucket as it comes to rest. As soon as the bucket comes to rest upon the top of the furnace the continued slacking of the chains 7 lowers the bell 15 and discharges the stock upon the upper bell or gas seal 18. The weight of the stock on this bell overcomes the action of the counterweight 19, and the bell lowers and discharges the stock into the hopper 21, upon the lower bell 22. The engine is now reversed, the counterweight 42 acts to return the carriage 5 to its normal position on the tracks 2<sup>a</sup>, and the carriage descends to the base of the furnace for another bucket. The position of the buckets on the turn-table 26 is such as to bring the T-heads 17 of the rods 16 slightly above and forward of the hooks 10 when the carriage is in its lowered position, so that as the carriage starts to rise the hooks will automatically engage with the buckets.

The counterweighted cable 43 may be connected directly to the frame of the carriage 5; but in order to make it unnecessary for this cable to rise and fall with the carriage we prefer to provide tilting guides or receivers

47 at the top of the tracks 2<sup>a</sup>. These guides or receivers are shown in tilted position in Fig. 3 and consist each of a slotted frame, with track-surfaces into which the wheels 4 run and which can be tilted upwardly with the carriage and to which the cable 43 is attached.

The advantages of our invention result from the simplicity of the apparatus and from the rapid manner in which the buckets may be loaded and raised to the top of the furnace and discharged by a single operating movement of the engine.

Various changes may be made in the details of construction and arrangement of the several parts without departing from our invention, since

What we claim is—

1. The combination with a blast-furnace having an inclined track leading to its top, of a carriage movable upon the track, said carriage having bucket engaging and supporting means, and means for tilting or raising the lower end of the carriage away from the track when it reaches the top of the furnace to thereby lower its bucket-supporting portion; substantially as described.

2. The combination with a blast-furnace having an inclined track leading upwardly to the top of the furnace and carried horizontally over the furnace at its upper end, a carriage arranged to run on the track and having flexible bucket engaging and supporting means, and means for tilting the carriage to thereby lower and discharge the buckets; substantially as described.

3. In blast-furnace-charging apparatus, the combination with a track leading to the top of the furnace and having a stop at its upper end, of a carriage movable upon the track, actuating means for the carriage connected to the lower portion thereof, and a bucket engaging and supporting device carried by the upper portion of the carriage together with a bucket arranged to be engaged by and disengaged from the carriage; substantially as described.

4. In blast-furnace-charging apparatus, a bucket-elevating carriage of segmental shape at its upper end, bucket-supporting chains or the like connected thereto and passing over said ends, and means for tilting said carriage about the axis of its upper wheels; substantially as described.

5. In blast-furnace-charging apparatus, a bucket-elevating carriage having upper and lower sets of wheels, grooved segments at its upper end, bucket-elevating chains connected to the frame and carriage and passing over the segments, and means for tilting the carriage about the axis of its upper wheels; substantially as described.

6. In blast-furnace-charging apparatus, the combination of a track leading from the top of the furnace and extending forwardly



over the same, a bucket-elevating carriage movable upon the track, bucket-engaging means connected to the upper portion of the carriage, and means for moving the carriage about the axis of its upper wheels to lower the bucket-engaging means to discharge the bucket; substantially as described.

7. In blast-furnace-charging apparatus, an inclined track leading from the top of the furnace, a carriage movable upon the track, bucket engaging and supporting means connected to the carriage, means for tilting the carriage about the axis of its upper wheels to lower the bucket-engaging means, and means for returning the carriage to its normal position after tilting; substantially as described.

8. In blast-furnace-charging apparatus, an inclined track extending to the top of the furnace, a carriage movable upon said track and arranged to swing about the axis of its upper wheels, and a counterweight arranged to return the carriage after it has been tilted; substantially as described.

9. In blast-furnace-charging apparatus, an inclined track extending to the top of the furnace, a carriage movable upon the track, bucket engaging and supporting means connected to the upper portion of the carriage, means for tilting the carriage at the top of the furnace to lower the bucket-supporting means, a rest for the buckets at the top of the furnace, and a bucket provided with a bottom discharge-opening and a bell arranged to close the same and having means for engagement with the bucket-supporting means of the carriage; substantially as described.

10. In blast-furnace-charging apparatus, the combination with an inclined track leading to the top of the furnace, and a tiltable carriage movable upon the track and having bucket-supporting means, of a bucket support or rest at the top of the furnace, a bucket having a vertically-movable bell arranged to close its discharge, and provided with means for engagement with the bucket-supporting means of the carriage; substantially as described.

11. In blast-furnace-charging apparatus, the combination with an inclined track leading to the top of the furnace, and a bucket elevating and discharging carriage movable thereon, of a turn-table at the base of the furnace, and means for actuating the table to

bring the buckets into and out of position for engagement by the carriage; substantially as described.

12. In blast-furnace-charging apparatus, the combination with a track leading to the top of the furnace, and a bucket elevating and discharging carriage movable thereon, of a turn-table at the bottom of the furnace, and means for reciprocating the table to bring the loaded buckets in position to be engaged by the carriage and to return the empty buckets for a new load; substantially as described.

13. In blast-furnace-charging apparatus, the combination with an inclined track leading to the top of the furnace, a bucket elevating and discharging carriage movable on the track, bottom discharge-buckets adapted to be engaged by and disengaged from the carriage, and means for effecting the discharge of the buckets at the top of the furnace without separate motion of the engine and means for delivering the buckets to and supporting them in position to be engaged by the carriage at the base of the furnace; substantially as described.

14. In blast-furnace-charging apparatus, the combination with an inclined track leading to the top of the furnace, a bucket elevating and discharging carriage movable on the track, bottom discharge-buckets, and means for effecting the discharge of the buckets at the top of the furnace, with one continuous motion of the hoisting-engine; substantially as described.

15. In blast-furnace-charging apparatus, the combination with an inclined track leading to the top of the furnace, a bucket elevating and discharging carriage movable on the track, bottom discharge-buckets adapted to be carried by the carriage, and means for effecting the discharge of the buckets at the top of the furnace by a continuous motion of the hoisting-engine and without separate motion of the engine or auxiliary means; substantially as described.

In testimony whereof we have hereunto set our hands.

EDWARD L. FORD.  
CHARLES F. PARKS.

Witnesses:

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D. G. KING.