F. A. HINKEY.

CLEAN-OUT APPARATUS FOR ZINC FURNACES.

APPLICATION FILED JUNE 16, 1913.

1,178,518.

Patented Apr. 11, 1916.

4 SHEETS—SHEET 1.

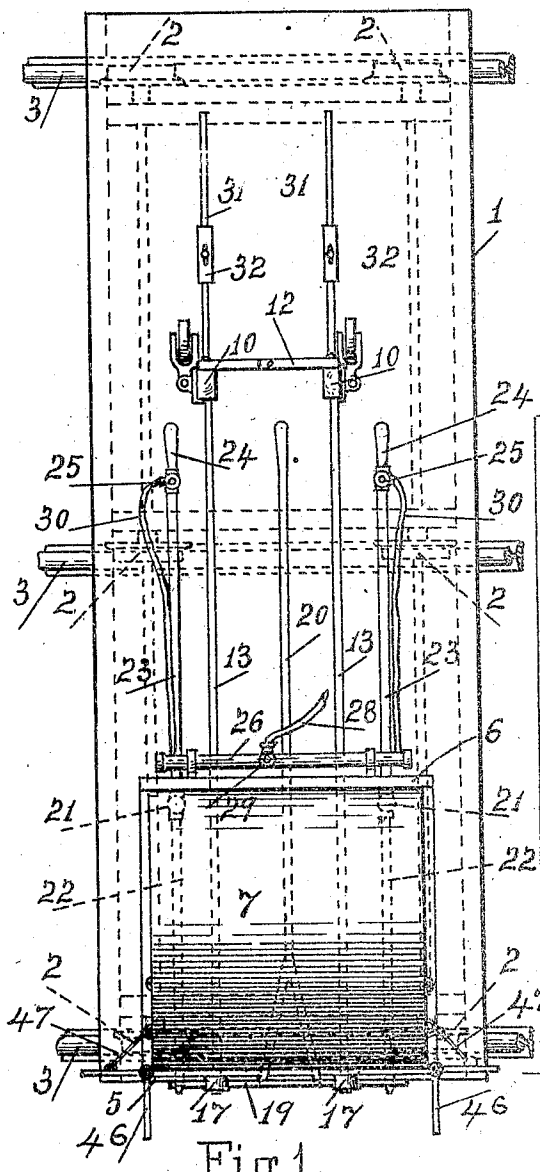


Fig. 1.

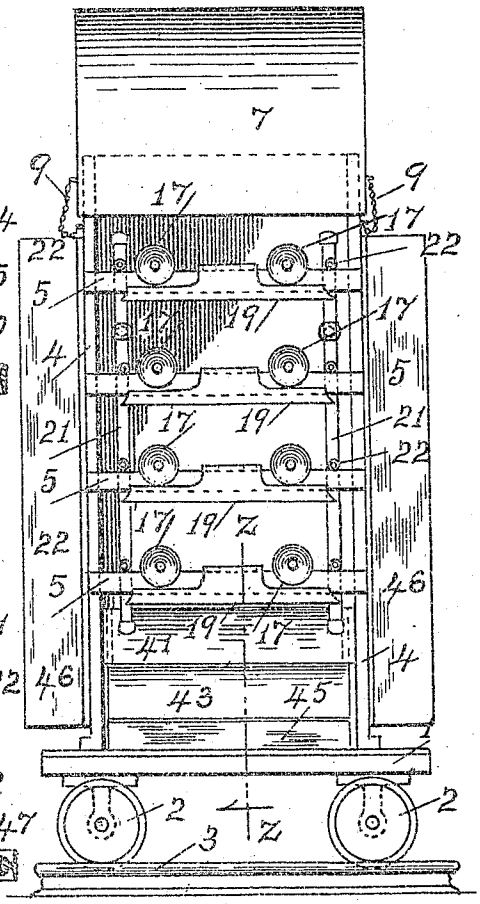


Fig. 2.

Witnesses.

W. L. Frazee.

J. A. Coates

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by Atty's Dewey Bros.

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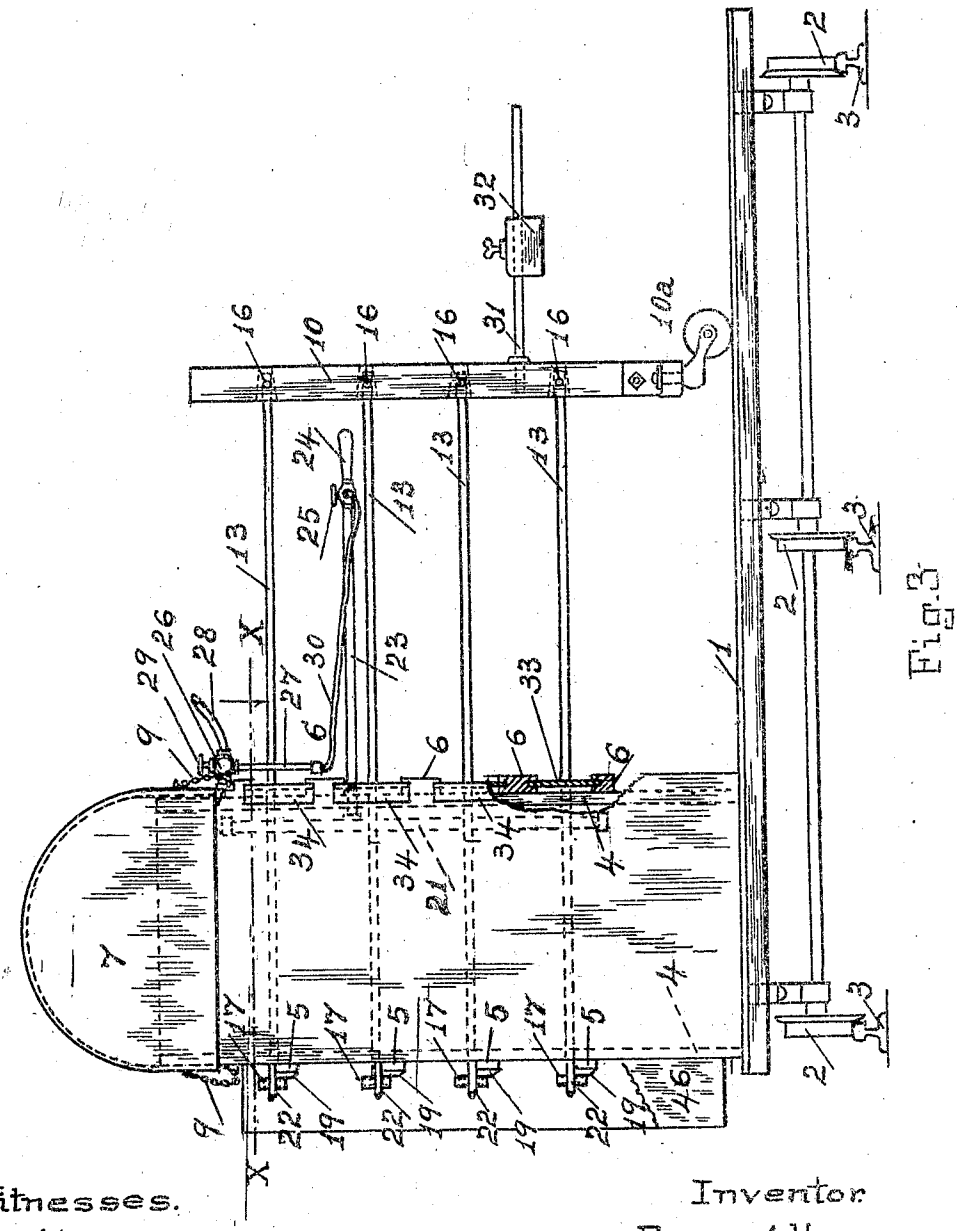


Fig. 3.

Witnesses.

N. S. Prague.

J. W. Crowder

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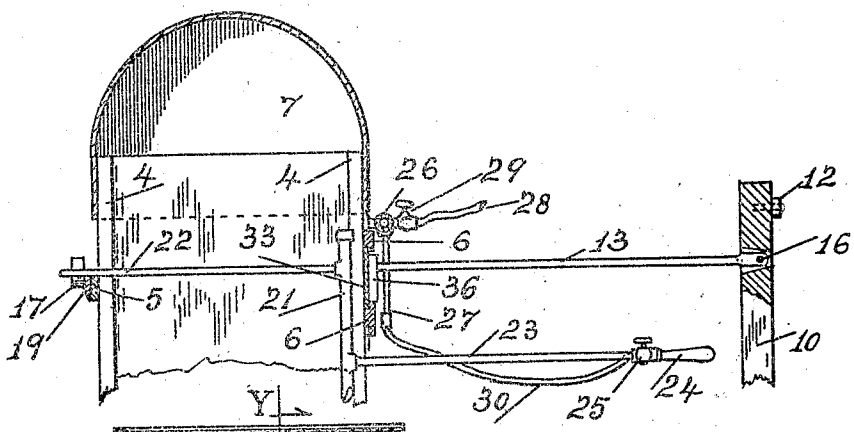


Fig. 6.

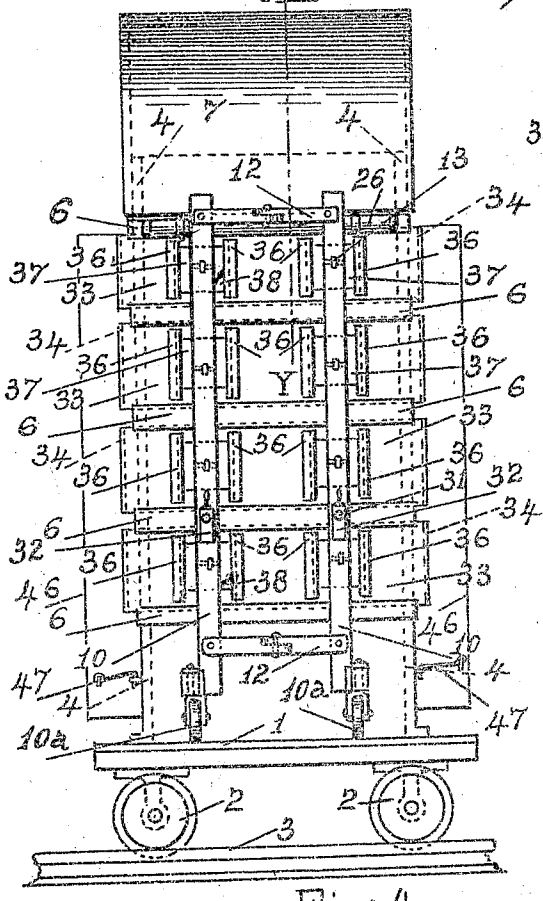


Fig. 4.

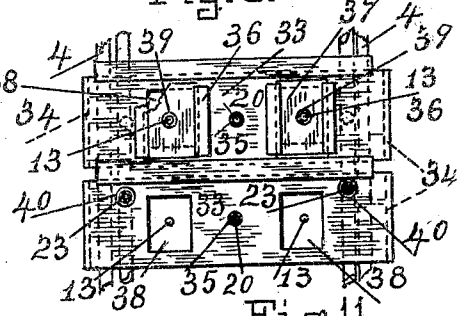


Fig. 11.

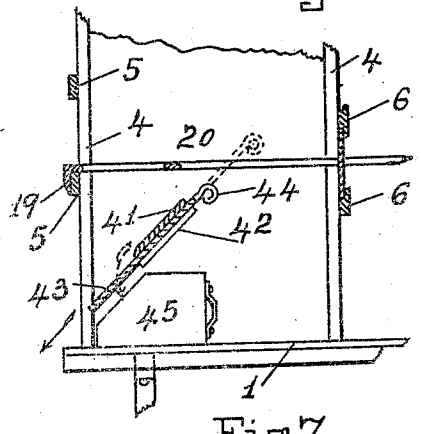


Fig. 7.

Witnesses.

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4 SHEETS—SHEET 4.

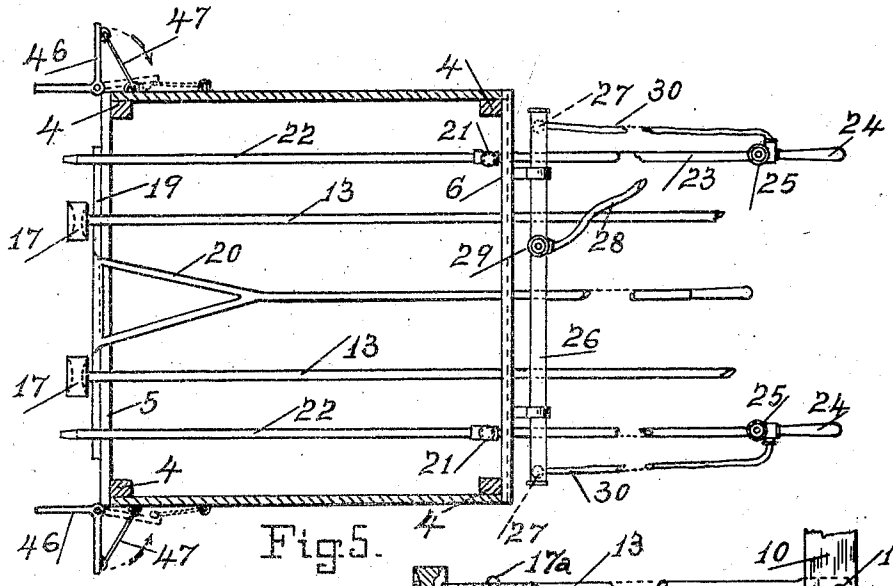


Fig. 5.

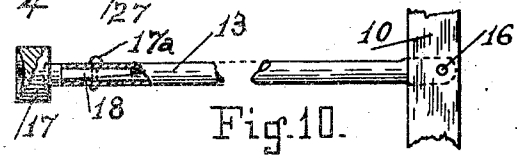


Fig. 10.

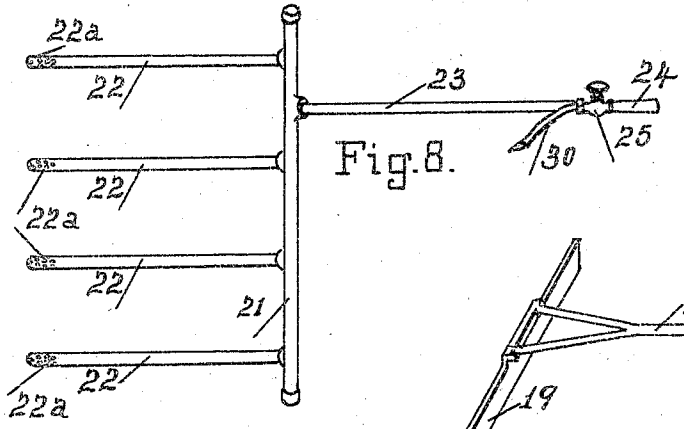


Fig. 8.

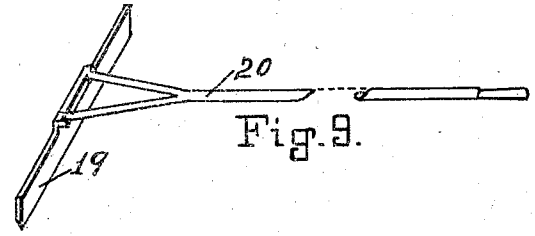


Fig. 9.

Witnesses.
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J. W. Crowder

Inventor
FRANK A. HINKEY.
by Atty N. DuBois.

UNITED STATES PATENT OFFICE.

FRANK A. HINKEY, OF SPRINGFIELD, ILLINOIS.

CLEAN-OUT APPARATUS FOR ZINC-FURNACES.

1,178,518. Specification of Letters Patent. Patented Apr. 11, 1916.

Application filed June 16, 1913. Serial No. 773,898.

To all whom it may concern:

Be it known that I, FRANK A. HINKEY, a citizen of the United States, residing at Springfield, in the county of Sangamon and State of Illinois, have invented a new and useful Clean-Out Apparatus for Zinc-Furnaces, of which the following is a specification.

This invention relates to means for removing the material called "blue powder" from the ends of the retorts and from the retort plates, and removing the residuum from the retorts and retort plates and scraping the inside of the retorts and bumping the open ends of the retorts.

The general purpose of the invention is to provide an apparatus of relatively low first cost, of simple construction and effective for the purposes stated, and capable of easy and rapid operation, thereby minimizing the labor required and correspondingly reducing the cost of extracting the metal from the ore.

More specific purposes of the invention are; to provide a movable main structure equipped with all the tools necessary for taking the sample from the retorts, scraping the retort plates and cleaning out at each setting of the apparatus, all the retorts of a half-section of a zinc furnace, or a like number of retorts in different sections; to provide means for centering and alining the tools relative to the retorts immediately in front of the apparatus; to provide means for supporting the tools which are not in use in such position that they will not interfere with the manipulation of the tools which are in use; to provide means for convenient disposal of the blue powder; to provide means for final disposal of the residuum taken from the retorts and retort plates; to provide means to protect the operator of the machine from the extreme heat of the furnace and from the hot residuum blown from the retorts; to provide means to prevent displacement of the apparatus by the explosions occurring during the "blowing-out" of the retorts; to provide a self-sharpening bumper head; and to provide other new and useful features of construction, as will hereinafter more fully appear.

With these ends in view this invention consists in the new and useful combinations of parts and details of construction shown in the annexed drawings to which reference is hereby made, and hereinafter particularly described and finally recited in the claims.

Figures 1, 2, 3, and 4 are respectively a top plan, a front elevation, an end elevation, and a rear elevation of the apparatus. Fig. 5 is an enlarged horizontal transverse section on the line X. X. of Fig. 3; Fig. 6 is a partial vertical section on the line Y. Y. of Fig. 4; Fig. 7 is a partial vertical section on the line Z. Z. of Fig. 2; Fig. 8 is an isometric view of one set of blow pipes, detached; Fig. 9 is an isometric view of one scraper; Fig. 10 is an enlarged detail of one bumper head and connections, and Fig. 11 illustrates details of the shield and connections.

Similar reference characters designate like parts in the different views.

A zinc smelting furnace of common construction comprises a plurality of sections and each section commonly comprises sixteen retorts arranged in four vertical series, each series comprising four retorts. The present apparatus is adapted to operate on the eight retorts of one half-section at each setting of the apparatus. The retorts are fire-clay cylinders having their inner ends closed. In the front end of each retort is a condenser, also of fire clay, which extends forwardly beyond the front wall of the furnace. The condensers are held in place by loam tamped around the parts of the condensers extending into the mouths of the retorts, and the outer ends of the condensers are sealed with loam plugs having vent openings. In practice a suitable quantity of pulverized ore and pulverized coal mixed in proper proportions, will be placed in each retort, and the condensers will be connected with the retorts and sealed. The fire will then be started and the retorts will be heated to a degree sufficient to volatize the zinc, which will pass to the condensers.

The condensers are exposed to the atmosphere and cooler than the retorts, consequently the vaporized zinc will be condensed to a molten metal state in the condensers, to be subsequently removed therefrom. There are horizontal plates under the outer ends of the retorts. During the operation of smelting, a deposit called "sample" accumulates at the front ends of the retorts and on the hearth under the front ends of the retorts. This "sample," or "blue-powder," contains a considerable percentage of zinc which it is desirable to save.

The process of smelting is progressive, hence the retorts of some sections must be cleaned out and re-charged while the smelting is progressing in the previously charged retorts in other sections; and in order to properly time the several stages of the operation and in order to economize in fuel, after the withdrawal of the zinc; the cleaning out and re-charging of the retorts must be done quickly and while all the retorts are very hot.

The present apparatus is designed specially for operating on the hot retorts.

The apparatus as a whole comprises a movable platform, a housing on the platform, a variety of tools supported in the housing and means for manipulating the tools. The platform 1 is mounted on wheels 2 which travel on rails 3 parallel to the front of the furnace. The platform will be moved along the track to bring the housing in position immediately facing the series of retorts which are to be operated upon. The housing is a box-shape metal structure, preferably covered with sheet iron plates, with asbestos board between the plates for insulation, and having upright end plates 4, horizontal cross bars 5 and horizontal channeled guides 6. A hood 7 is fitted over and adapted to slide on the upper part of the housing, for a purpose to be hereinafter explained. Chains 9 connected with the hood 7 and the uprights 4 serve to prevent excessive upward movement of the hood 7. The bumper carriage comprises uprights 10 connected near their upper and lower ends by hinged and pivoted cross bars 12. The bumper stems 13 are connected with the uprights 10 by pivots 16. The bumper stems 13 are preferably tubular. The forward ends of the stems have sockets adapted to receive tangs 18 integral with the bumper heads 17. The bumper heads 17 are connected with the stems by detachable pins 17^a so the bumper heads may be easily removed for sharpening or for putting in other bumper heads. The bumper heads preferably have concave sides and self-sharpening edges as shown, but bumper heads of other suitable form may be used. The uprights 10 are mounted on wheels 10^a so that the carriage may be moved forwardly or rearwardly on the platform 1. Handles 31 are connected with the uprights 10 and serve to manipulate the carriage. Counter weights 32 are adjustable on the handles 31 to counter-balance the weight of the bumper heads so that the carriage may be easily moved forwardly or rearwardly on the platform. Horizontal bars 5 are rigid on and extend across the front of the housing.

There are four pairs of bumper heads connected with the carriage so that their stems 13 will slide on the cross bars 5 and the bumper heads may move inwardly or outwardly with the carriage. When in position for operation the bumper heads are in alinement with and center with respect to the retorts. The retorts are usually inclined downwardly. Pivots 16 permit the stems 13 to accommodate themselves to the inclination of the retorts. Occasionally there will be a difference between the centers of the tiers of retorts, the hinged cross pieces 12 admit of adjusting the width between the uprights 10 to correspond to the width between the centers of the tiers of retorts. Horizontal scraper blades 19 extend substantially the entire width of the tool support and are equipped with forked handles 20 which support the scrapers in a horizontal position on the cross pieces 5 respectively. The handles 20 extend rearwardly and are used to slide the scrapers forwardly and rearwardly. The scrapers may be operated independently of each other.

The apparatus comprises two sets of "blow-out" pipes. Each set comprises a vertical pipe 21, horizontal pipes 22 in communication with the pipe 21 an intake 23 and a handle 24. A header 26 is mounted in a horizontal position on the housing. A valve 29 controls admission of water or steam to the header 26. A hose 28 connects the valve 29 with the source of water or steam supply. Vertical pipes 27 communicate with the header 26. Flexible hose 30 communicate with the pipes 27 and the valves 25. Valves 25 on the pipes 23 control the admission of water or steam to the "blow-out" pipes. The forward ends of the blow-out pipes 22 are closed and adjacent to the closed end of each pipe is a series of small perforations 22^a through which water may be sprayed. The perforations are arranged to direct the spray laterally and rearwardly. When the pipes and the bumpers are retracted the bumper-heads 17 will be adjacent to the perforated parts of the pipes 22 and when desired the laterally directed spray may be caused to strike the bumper heads and cool them; and the rearwardly and laterally directed sprays may be caused to strike and cool the back and sides of the housing. Back plates 33 are mounted to slide in the

horizontal guides 6. The back plates project somewhat beyond each end of the housing and have wings 34 at right angles to the plates, which serve to shield the operator from steam or hot residuum escaping through the openings between the ends of the guides. The plates 33 have openings 38 which are covered by the doors 37; openings 35 in which the scraper handles 20 slide, and one of the plates has holes 40 in which the pipes 23 of the blow-out device slide. Vertical parallel guides 36 are fixed on the plates 33 adjacent to the openings 38. Doors 37, which slide in the guides 36 have holes 39 in which the bumper stems 13 slide.

The bumper carriage is movable forwardly, rearwardly, laterally and upwardly, and a twisting movement may be given thereto by means of the handles 31; in order that the bumpers may be positioned to simultaneously enter the respective retorts. The bumper stems 13 extend through the holes 39 in the doors 37. If the bumper carriage be lifted the stems 13 will cause the doors to slide correspondingly upward, and if the carriage be moved laterally the stems 13 will cause corresponding lateral movement of the plates 33. The pipes 23 of the blow-out devices, and the scraper handles 20, also serve to slide the plates 33 laterally in accordance with the lateral movements of the blow-out devices or scrapers, as the case may be. The plates 33 and the doors 37 together constitute a shield to protect the operator from the steam and hot residuum blown from the retorts during the operation of cleaning.

At the front of the housing and adjacent to the sides thereof are hinged box shaped wings 46 which when in use serve to stop the residuum blowing laterally and upwardly from the mouths of the retorts. When not in use the wings 46 will be turned rearwardly in a position parallel to the sides 4 and will be secured by suitable securing devices 47 which also serve as braces for the wings when the wings are in their extended position. Near the lower end of the housing is a stationary downwardly inclined bottom plate 41. Stationary guides 42 are parallel to the bottom plate. A slide 43 is adapted to slide in the guides 42 and has eyes 44 to receive hooks used to manipulate the slide. A pan 45, to receive the blue powder, rests on the platform 1 and under the bottom plate 41 and the slide 43. If the slide 43 be slid upward to uncover the pan the blue powder scraped from the retorts will fall into the pan. If the slide 43 be slid downward to cover the pan the residuum falling on the plate 41 and the slide 43 will fall into a pit (not shown) adjacent to the front of the furnace.

In practical use the apparatus will be placed adjacent to and facing the retorts to be operated upon, the bumper carriage being first moved rearwardly to the full extent and adjusted to dispose the bumper heads adjacent to the end of the retorts respectively, and the slide 43 will then be moved upward to uncover the pan 45. The bumper carriage will then be moved forward a short distance to cause the bumper heads to enter the retorts to an extent sufficient for removing the "bluepowder" or "sample" as it is variously called. The carriage will then be moved alternately forwardly and rearwardly to cause the bumper heads to detach the accretion adhering to the mouths of the retorts and scrape the detached accretion outward through the mouths of the retorts and deposit it on the retort plates. The carriage will then be moved laterally to move the bumper heads laterally away from the retorts. The scrapers 19 will then be moved in succession forwardly above the respective retort plates and will then be lowered and moved rearwardly to scrape the blue powder from the retort plates and cause it to fall into the pan 45, to be afterward replaced in the retorts and again smelted to extract the zinc. The slide 43 will then be pushed downward to cover the pan. One blow-out device will then be placed in alinement with one tier of retorts and will be pushed forwardly to cause the pipes 22 to move into the retorts a suitable distance to be determined by the operator according to circumstances. The valve 25 will then be opened to admit water or steam, as the case may be, into and through the pipes 23, 21 and 22 into the interiors of the retorts respectively and afterward the other blow-out device will be placed in proper alinement and will be operated in like manner. Water is preferably used in the blow out devices. When the water (or steam) strikes the hot inner walls of the retorts it disintegrates the residuum and blows it out of the retorts and the residuum falls on the inclined bottom plate 41 and then slides downwardly on the slide 43 and falls into the cellar-chute, or pit, not shown. The explosion in the retorts is violent and the residuum is thrown outwardly with such force that it would injure the operator if he were not protected by the plates 33 and the doors 37. The pressure of the steam emerging from the retorts tends to overturn the apparatus or move it rearwardly; to prevent displacement of the apparatus the hood 7 is adapted to move upward to facilitate expansion of the steam in immediate contact with the face of the apparatus and relieve the pressure against the front of the apparatus. After the blowing-out is completed the bumpers will again be introduced full length, into the retorts and again withdrawn to scrape out any residuum which may be in

the retorts, and the scrapers will again be used to scrape the residuum from the retort plates; and this operation will be repeated for each half-section of the furnace, or for each equivalent number of contiguous retorts in one or more sections.

The expression "a flexible carriage" means a carriage which is not rigid and which comprises main members—preferably vertical,—connected by transverse members having hinge connections with each other, to admit of moving the main members toward or away from each other, to vary the width of the carriage to correspond to the width between the tiers of retorts, said main members being also provided with pivots for connecting the bumper stems with the main members to permit the bumper stems to oscillate in the planes of the main members to aline the bumper stems with the axes of the retorts arranged in rows.

The expression "variably movable", as applied to the carriage, means that the carriage is adapted to be moved forwardly, rearwardly, laterally and upwardly relative to the front of the furnace and is capable of a twisting movement in order that the tools and appliances supported on the carriage may be positioned to enter the respective retorts arranged in rows and tiers, and also means that the main or vertical members of the carriage are capable of movement toward or away from each other to aline the blow-out devices with the mouths of the respective retorts arranged in tiers.

Having fully described my invention what I claim as new and desire to secure by Letters Patent is:

1. In an apparatus of the class described, the combination of a movable platform; a housing stationary on the platform; a flexible carriage variably movable relative to the housing; and a plurality of series of bumpers flexibly connected with said carriage.

2. In an apparatus of the class described, the combination of a movable platform; a box-shape housing stationary on the platform; cross bars stationary on the front of the housing; a flexible carriage variably movable relative to the housing; bumpers flexibly connected with the carriage and variably movable on said cross bars; handles for manipulating said carriage; and weights adjustable on said handles to counterbalance said bumpers.

3. A bumper carriage comprising vertical side pieces, casters supporting said side pieces, hinged cross pieces pivotally connected with said side pieces, and handles connected with said side pieces; in combination with a box-shape housing, cross bars at the front of said housing, horizontal guides at the back of said housing, back plates mounted to slide in said horizontal guides and provided with openings; vertical guides on said back plates; perforated doors adapted to slide in said vertical guides; and bumpers movable on said cross bars at the front of the housing and having stems extending through the perforations of said doors and pivotally connected with the side pieces of said carriage.

4. In an apparatus of the class described, the combination of a box-shape housing, horizontal guides at the back of the housing, perforated back plates adapted to slide in said guides, blow-out pipes adapted to slide in the perforations of said back plates, a vertical pipe connecting and communicating with said blow-out pipes, an intake pipe communicating with said vertical pipe, and a valve controlling the supply of fluid to said intake pipe.

5. In an apparatus of the class described, in combination with blow-out devices employing liquid to blow the residuum from hot retorts; a box-shape housing adapted to face the retorts being cleaned, and a hood adapted to slide on said housing to permit expansion of gases within the housing.

6. In an apparatus of the class described, in combination with scrapers adapted to scrape blue powder from retort plates, and blow-out devices effective to blow residuum from retorts; a box-shape housing having an inclined bottom plate; guides parallel to said bottom plate; a slide adapted to slide in said guides; and a box below the bottom plate and the slide, said slide being capable of retraction to permit the deposit of the blue powder in the box, and being effective, when extended, to cover the box and guide to the place of final disposal, the residuum blown out by said blow-out devices.

7. In an apparatus of the class described, the combination of a box-shape housing; a header mounted on the housing; means for controlling a supply of fluid to the header; a plurality of series of blow-out devices movable forwardly and rearwardly in said housing; and means for supplying fluid from the header to all the blow-out devices.

8. In an apparatus of the class described, the combination of a box-shape housing, stationary cross bars at the front of the housing and bumpers and blow-out devices supported on and adapted to slide forwardly and rearwardly on said cross bars.

9. In an apparatus of the class described, the combination of bumpers adapted to be projected and retracted; means for supporting said bumpers; and blow-out devices adapted to be projected and retracted and provided with perforations adapted to direct spray laterally onto the bumper heads to cool them while the blow-out devices and the bumpers are in their retracted positions.

10. In an apparatus of the class described, the combination of a box-shape housing, vertical box-shape wings hinged at the front

of the housing and effective to stop laterally moving and upwardly moving residuum, securing devices adjustably connecting the wings with the housing, and blow-out devices adapted to cause violent discharge of residuum through the mouths of the retorts toward the housing and the wings.

In witness whereof I have hereunto signed my name, at Springfield, Illinois, this 15th day of May, 1913.

FRANK A. HINKEY.

Witnesses:
R. W. TROXELL,
W. C. KIKENDALL.