

March 28, 1950

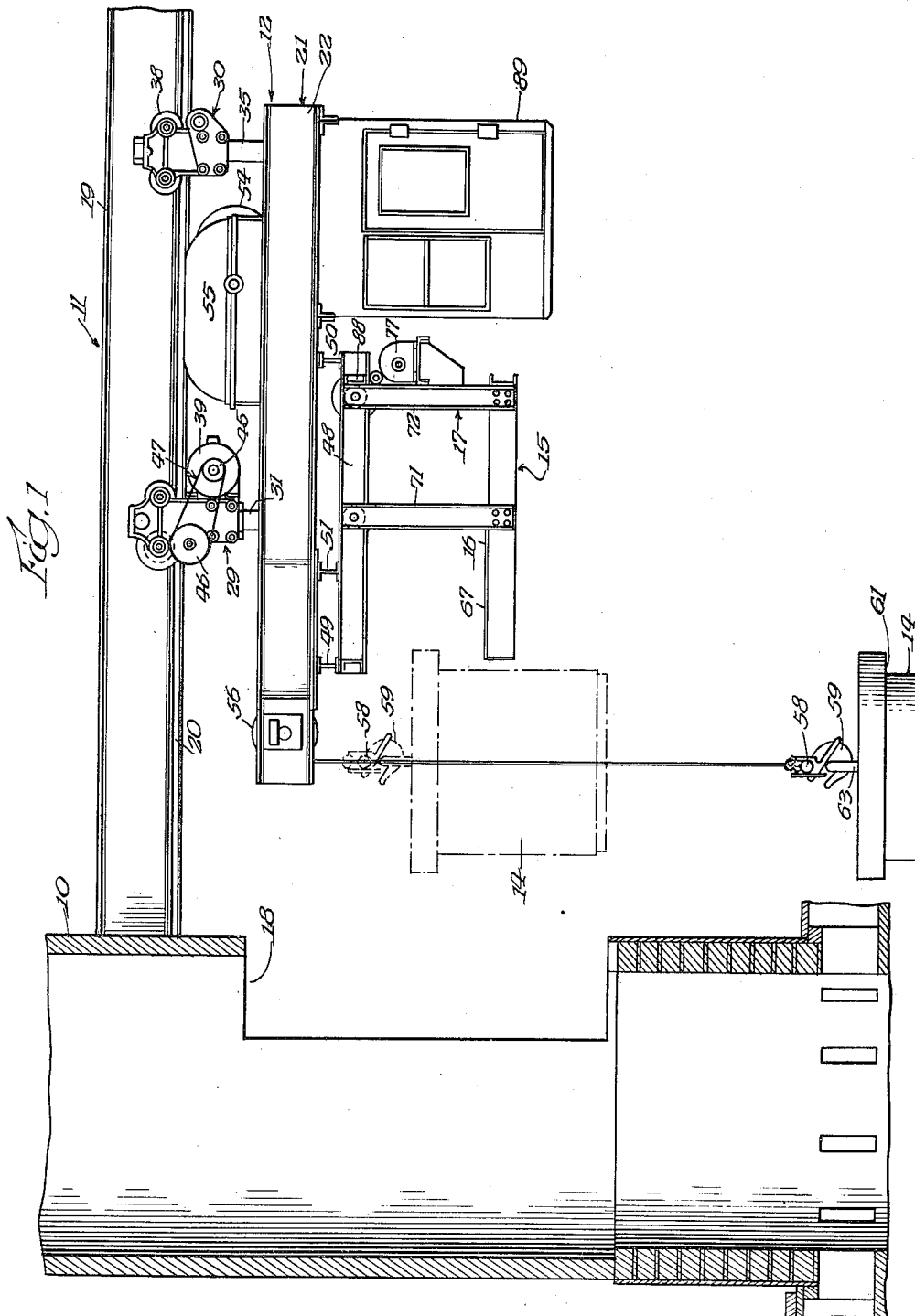
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2,501,768

CUPOLA CHARGING APPARATUS

Filed April 10, 1948

6 Sheets-Sheet 1



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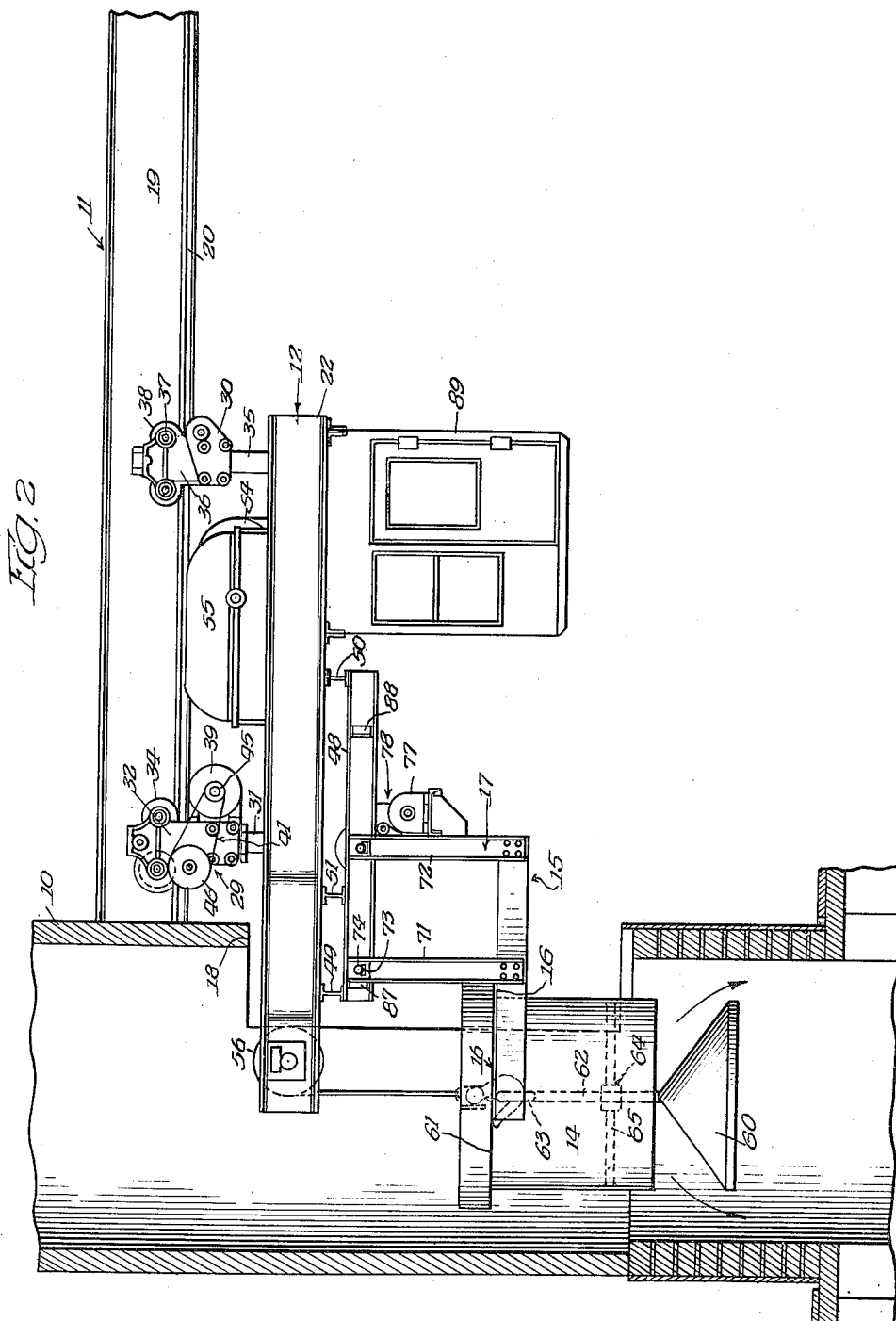
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CUPOLA CHARGING APPARATUS

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6 Sheets-Sheet 2



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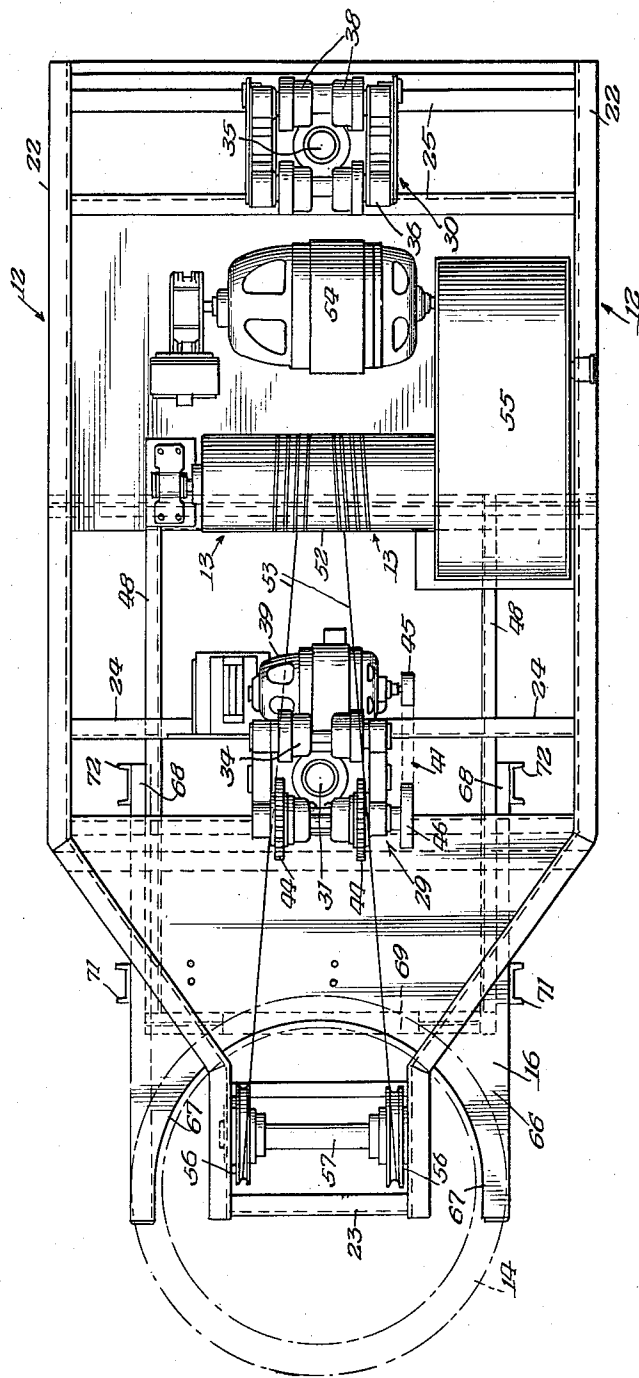
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CUPOLA CHARGING APPARATUS

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6 Sheets-Sheet 4

FIG. 4



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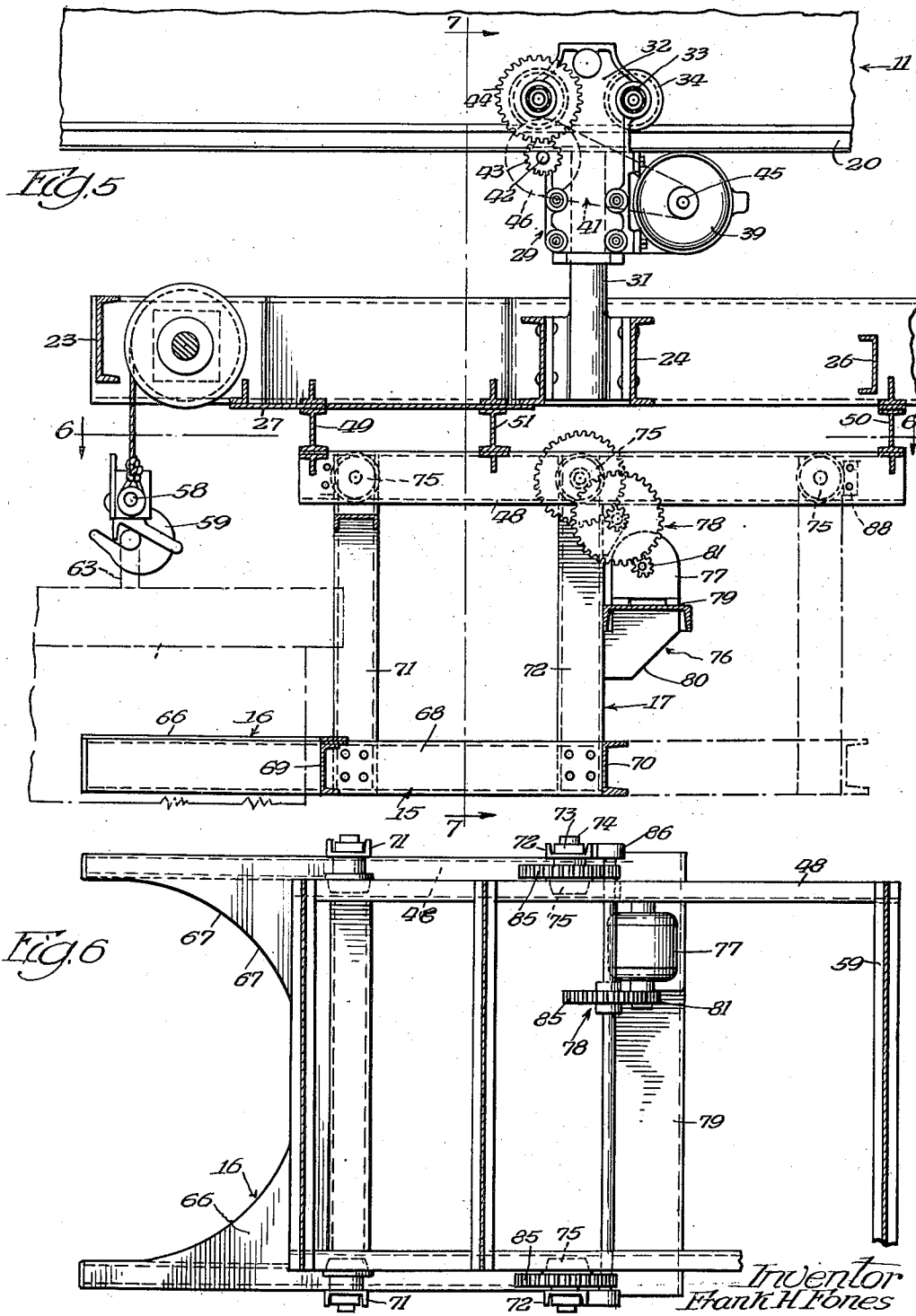
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CUPOLA CHARGING APPARATUS

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6 Sheets-Sheet 5



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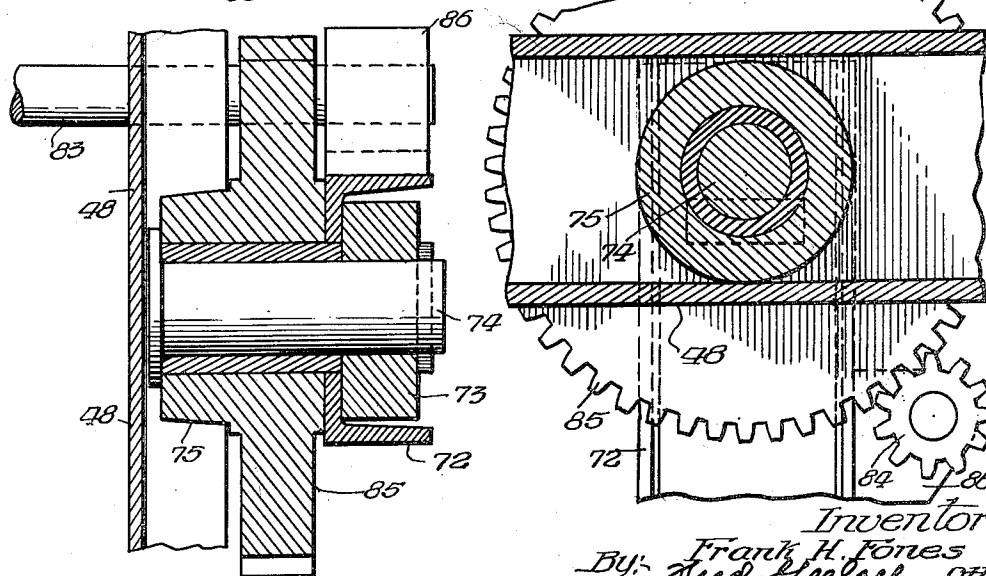
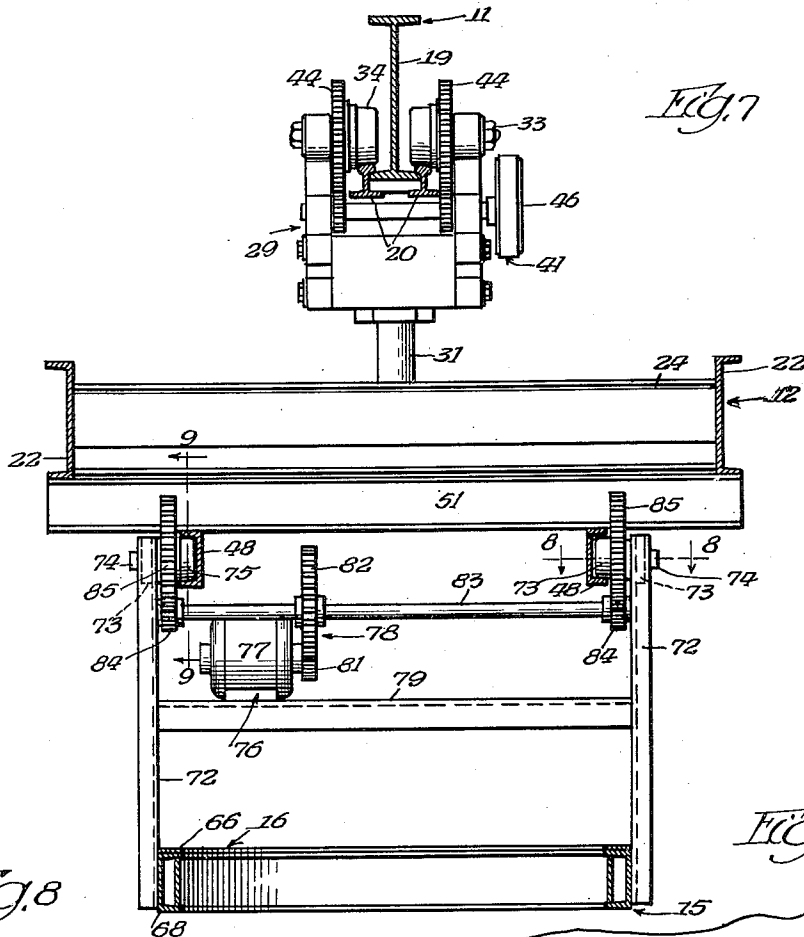
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CUPOLA CHARGING APPARATUS

Filed April 10, 1948

6 Sheets-Sheet 6



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UNITED STATES PATENT OFFICE

2,501,768

CUPOLA CHARGING APPARATUS

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Application April 10, 1948, Serial No. 20,312

8 Claims. (Cl. 214—18)

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In general the present invention relates to apparatus for charging cupolas with openings in the sides thereof. More particularly the invention relates to that type of cupola charging apparatus which, as its principal components or parts, comprises: (1) a trolley which has power actuated hoisting mechanism thereon and is mounted or supported to travel back and forth between an operative position wherein the front end thereof extends into the cupola through the side openings therein and an inoperative position wherein it is disposed away from, or wholly exteriorly of, the cupola; and (2) a cylindrical bucket which is provided with a vertically movable or drop variety cone bottom, embodies an outwardly extending rim at the top thereof, has its bottom operatively connected to the hoisting mechanism on the trolley and is adapted when the trolley is in its inoperative position to be lowered by the hoisting mechanism to a loading station and then, after loading, raised, and when the trolley is in its operative position wherein the front end thereof is disposed within the cupola to have the cone bottom lowered so as to effect introduction into the cupola of the material with which the bucket was loaded at the loading station.

It has heretofore been proposed to utilize in a cupola charging apparatus of this type a wishbone variety or C-shaped support which is mounted in the cupola adjacent the side opening and serves, when the hoisting mechanism on the trolley is initially actuated or driven for lowering purposes, to receive and support the rim on the top of the bucket to the end that further actuation of the hoisting mechanism results in lowering or dropping of the cone bottom into its open position wherein it permits the material within the bucket to drop into the cupola. In practice it has been found that a wishbone variety support which is mounted within the cupola is subject to the objection that, due to high heat conditions within the cupola, it warps to such an extent that it is not useable for its intended purpose and hence must be frequently replaced.

One object of the invention is to provide a cupola charging apparatus which is an improvement upon, and eliminates the objections to, previously designed apparatuses, especially those having fixedly mounted wishbone variety bucket receiving supports within the cupolas.

Another object of the invention is to provide a cupola charging apparatus in which the wishbone variety support is located beneath, and suspended from, the trolley, is mounted to move in a horizontal plane lengthwise of the trolley and is adapted,

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when the trolley is in its inoperative position, to be shifted rearwards with respect to the trolley in order to permit of lowering and raising of the bucket and when the trolley is in its operative position to be shifted forwards with respect to the trolley into a position wherein it is operative in connection with initial lowering actuation of the hoisting mechanism to receive and support thereon at the top of the bucket.

Another object of the invention is to provide a cupola charging apparatus of the type and character last mentioned in which the trolley has suspended therefrom a pair of spaced apart, parallel, longitudinally extending, horizontal tracks and the wishbone variety support is fixedly connected to a rearwardly extending frame which embodies at the sides thereof uprights with track engaging wheels at their upper ends.

A further object of the invention is to provide a cupola charging apparatus of the type and character under consideration in which the assembly of wishbone variety support and frame has associated with it motor operated mechanism for shifting it forwards and backwards relatively to the trolley.

A still further object of the invention is to provide a cupola charging apparatus which is generally of new and improved construction, effectively and efficiently fulfills its intended purpose and embodies a novel arrangement of parts.

Other objects of the invention and the various advantages and characteristics of the present cupola charging apparatus will be apparent from a consideration of the following detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by claims at the conclusions hereof.

In the drawings which accompany and form a part of this specification or disclosure and in which like numerals of reference denote corresponding parts throughout the several views:

Figure 1 is a side elevation of a cupola charging apparatus embodying the invention, showing the trolley in its inoperative position and also showing the assembly of wishbone variety support and frame in its retracted or rearwardly shifted position wherein it permits the bucket to be lowered to, and raised from, the loading station by the hoisting mechanism on the trolley;

Figure 2 is a side elevation showing the trolley in its operative position and the assembly of wishbone variety support and frame shifted forwards so that the support, in connection with initial lowering actuation of the hoisting mechanism, is

in a position to receive and support the rim at the top of the bucket;

Figure 3 is an enlarged side view of the apparatus, certain parts being broken away and other parts being shown in section for purposes of illustration;

Figure 4 is an enlarged plan view of the trolley, illustrating in detail the design and construction of the frame structure of the trolley and the construction and manner of mounting the hoisting mechanism for the bucket;

Figure 5 is a vertical longitudinal section of the assembly of wishbone variety support and frame and the front end or portion of the trolley;

Figure 6 is a horizontal section on the line 6—6 of Figure 5;

Figure 7 is a vertical transverse section on the line 7—7 of Figure 5;

Figure 8 is an enlarged horizontal section of one of the motor driven wheels on the frame of the assembly of wishbone variety support and frame; and

Figure 9 is a side elevation of the parts that are shown in Figure 8.

The apparatus which is shown in the drawings constitutes the preferred form or embodiment of the invention. It is designed and adapted for use in charging a cupola 10 and comprises a monorail 11, a trolley 12, hoisting mechanism 13 on the trolley, a bucket 14, and an assembly 15 in the form of a wishbone variety support 16 and a frame 17. The cupola 10 is of standard or conventional construction and embodies in the upper portion of its side an opening 18 whereby the bucket 14, in connection with charging of the cupola, may be introduced into, and removed from, the cupola interior.

The monorail 11 serves as a medium or instrumentality for supporting the trolley 12 so that it is capable of traveling horizontally to and from the cupola. It extends horizontally and consists of an I-beam 19 and a pair of rails 20. The I-beam is arranged so that the web thereof extends vertically. The rails 20 are disposed in laterally spaced and parallel relation and extend lengthwise of the I-beam 19. They are disposed at opposite sides of the bottom flange of the I-beam and have the webs thereof welded to the side margins of such flange in order that they are in fixed relation with the I-beam. The inner portions of the heads of the rails 20 overlie and rest on the side margins of the bottom flange of the I-beam. The monorail 11 extends radially with respect to the cupola. It is supported in any suitable manner and has the front or inner end thereof connected to the cupola at a point directly above the side opening 18.

The trolley 12 underlies the monorail 11 and embodies a horizontally elongated frame structure 21. The latter extends lengthwise of the monorail 11 and consists of a pair of laterally spaced side beams 22, a cross beam 23, a pair of crossbeams 24, a pair of crossbeams 25, and a pair of crossbeams 26. The side beams 22 of the frame structure 21 are in the form of channel beams and are arranged so that the webs thereof extend vertically and their flanges project outwards. They are fixedly connected together by the aforementioned crossbeams and have the front ends thereof bent inwards and then outwards in order that the front end of the frame is of less width than the central portion and rear end and is capable of entering the cupola interior through the side opening 18. The crossbeams 23, 24, 25 and 26, like the side beams 22,

are in the form of channel beams and are arranged so that their webs extend vertically. The crossbeam 23 extends between, and has its ends welded to, the extremities of the inwardly and outwardly bent front ends of the side beams. The crossbeams 24 are disposed in parallel and laterally spaced relation. They have their ends welded to the central portions of the side beams 22 and are arranged so that the flanges thereof extend away from one another. The crossbeams 25 are disposed in parallel and laterally spaced relation. They have their ends welded to the rear ends of the side beams 22. Like the crossbeams 24 the crossbeams 25 are arranged so that the flanges thereof project or extend away from one another. The crossbeams 26 are disposed in parallel and laterally spaced relation. They are positioned between the crossbeams 24 and the crossbeams 25 and have their ends welded or otherwise fixedly secured to the side beams 22. In addition to the parts heretofore mentioned the frame structure 21 of the trolley comprises a pair of horizontally extending plates 27 and 28. The plate 27 underlies and extends across the front ends of the side beams 22 and has its side margins welded to the lower flanges of the side beams. The other plate, i. e., the plate 28, extends between the rear ends of the side beams 22 and rests on, and is secured to, the upper flanges of the crossbeams 26. A front truck 29 and a rear truck 30 serve so to mount the trolley 12 with respect to the monorail 11 that it is capable of travelling back and forth between an operative position wherein the front end thereof extends into the cupola 10 through the side opening 18 and an inoperative position wherein it is disposed away from the cupola and overlies a bucket loading station (not shown). The front truck 29 comprises a standard 31 and a tubular bracket 32 and is disposed midway between the central portions of the side bottoms 22 of the trolley frame 21. The lower end of the standard 31 is rectangular in cross section and fits between, and is riveted, bolted or otherwise fixedly secured to, the central portions of the crossbeams 24. The lower end of the bracket 32 extends around, and is clamped to, the upper end of the standard 31. The upper end of the bracket is bifurcated. It is arranged in straddled relation with the lower portion of the monorail 11 and has at its corners four horizontally extending stub axles 33 which extend transversely of the monorail. The inner ends of the axles overlie the side margins of the bottom flange of the I-beam 19 and support rotatably four wheels 34 which rest on, and are adapted to travel along the heads of, the rails 20 of the monorail. The rear truck 30 is disposed midway between the rear ends of the side beams 22 and consists of a standard 35 and a tubular bracket 36. The lower end of the standard 35 is polygonal in cross section and fits between, and is suitably secured to, the central portions of the webs of the crossbeams 25. The lower end of the bracket 36 of the rear truck extends around, and is clamped to, the upper end of the standard 35 and the upper end of the bracket is bifurcated and straddles the lower portion of the monorail. At its upper corners the bracket 36 of the rear truck is provided with four horizontal, inwardly extending stub axles 37, the inner ends of which overlie the bottom flange of the I-beam 19 and support rotatably four wheels 38. Such wheels rest on, and are adapted to travel along, the heads of the rails 20 of the monorail 11. The trolley 12 is

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propelled back and forth between its operative and inoperative positions by power means in the form of a reversible electric motor 39 and speed reducing gearing 40. The motor 39 is mounted on the rear portion of the lower end of the bracket 32 of the front truck 29 and is arranged so that the armature shaft thereof extends horizontally and also transversely of the monorail. As best shown in Figures 3 and 5, the motor 39 is located directly beneath the monorail 11. The speed reducing gearing 40 consists of a pulley and belt connection 41, a horizontal shaft 42, a pair of pinions 43, and a pair of gears 44. The pulley and belt connection 41 consists of a pulley 45 on one end of the armature shaft of the reversible electric motor 39, a pulley 46 on one end of the shaft 42, and an endless belt 47 around the two pulleys. The shaft 42 is disposed beneath and transversely of the monorail and is suitably journaled on the front central portion of the bracket 32. The pinions 43 are keyed to the shaft 42 and mesh with, and serve to drive, the gears 44. The latter are formed integrally with the outer portions of the front wheels of the truck 29. When the electric motor 39 is driven in one direction it operates through the medium of the speed reducing gearing 40 to drive in one direction the front wheels of the truck 29 and causes the trolley 12 to travel in one direction along the monorail 11. Reverse drive of the electric motor 39 operates reversely to drive the front wheels of the truck 29 and causes the trolley to travel in the opposite direction along the monorail. It is contemplated that the electric motor 39 will have associated with the circuit thereof limit switches whereby the trolley when propelled towards the cupola will automatically stop as soon as it reaches its operative position wherein the front end thereof projects into the cupola and when driven away from the cupola will automatically stop when it reaches its inoperative position wherein it overlies the aforementioned bucket loading station. In addition to the parts heretoforementioned the trolley 12 comprises a pair of spaced apart, parallel, longitudinally extending, horizontal tracks 48. These tracks are disposed a small distance below the trolley frame structure 21 and are suspended therefrom by way of three I-beams 49, 50 and 51. As shown in the drawings, the tracks 48 are in the form of I-beams which are arranged so that the webs thereof extend vertically and the flanges project outwards. The I-beams 49, 50 and 51 are disposed in parallel, laterally spaced relation and extend transversely of the trolley frame structure 21. The I-beam 49 is disposed beneath, and fixedly secured to, the plate 27 and has its ends connected to the front ends of the tracks 48. The I-beam 50 is disposed beneath, and is suitably connected to, the central portions of the side beams 22 of the trolley frame structure 21 and has its ends welded or otherwise connected to the rear ends of the tracks 48. The I-beam 51 is positioned between the I-beams 49 and 50. It is disposed beneath, and connected to, the rear portion of the plate 27 and has its ends suitably secured to the central portions of the tracks 48.

The hoisting mechanism 13 on the trolley 12 operates to lower and raise the bucket 14 and consists of a horizontal rotatably mounted drum 52 and a pair of cables 53. The drum 52 overlies the plate 28 and extends transversely of the trolley frame structure 21. It is located between the front and rear trucks 29 and 30

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and is driven in one direction or the other by power actuated mechanism in the form of a reversible electric motor 54 and a gear type speed reducing unit 55. The motor 54 is mounted on the rear portion of the plate 28 and is arranged so that the armature shaft thereof extends transversely of the trolley frame structure. The speed reducing unit 55 is mounted on the plate 28 and is connected for drive by the armature shaft of the motor 54 and has a driven shaft which extends through, and is keyed to, the drum 52. The cables 53 of the hoisting mechanism have certain ends thereof anchored to, and wrapped around, the drum 52. From the drum the cables 53 extend forwards in a horizontal plane and then extend downwards over a pair of coaxial, laterally spaced sheaves 56. The sheaves are mounted on, and keyed to, a horizontally extending shaft 57, the ends of which are journaled in bearings on the front ends of the side beams 22 of the trolley frame structure 21. As best shown in Figure 4, the shaft 57 is disposed directly rearwards of the crossbeam 23. The free ends of the cables 53 depend from the sheaves and are connected to a horizontally extending rod 58, from the central portion of which is suspended a hook 59. When the drum 52 of the hoisting mechanism 13 is driven in one direction the cables 53 are caused to wind around the drum and effect raising of the hook 59. Reverse drive of the drum 52 operates to pay out the cables 53 and effect lowering of the hook.

The bucket 14 is of conventional construction and embodies as a part thereof a vertically movable or drop variety cone bottom 60. It is cylindrical and has at the upper end thereof a fixed outwardly extending annular rim 61. The diameter of the bucket is materially less than the internal diameter of the cupola in order that the bucket is capable of being inserted into, and removed from, the cupola through the side opening 18. The cone bottom 60 is provided at the apex part thereof with an upstanding rod 62 which extends centrally and longitudinally through the bucket and has at its upper end an eye 63 for the hook 59. The central portion of the rod is slidably mounted in a pair of coaxial, vertically spaced sleeves 64. The latter are disposed in the central portion of the bucket 14 and are secured in place by radially extending arms 65, the outer ends of which are welded or otherwise fixedly secured to the bucket. The bucket is supported within the cupola by the wishbone variety support 16 as hereinafter described. When the hook 59 on the free ends of the cables 53 is lowered in connection with lowering actuation of the hoisting mechanism 13, the bottom 60, as shown in full lines in Figure 2, drops downwards into an open position and permits the material with which the bucket 14 is loaded to drop into the cupola. When the hook 59 is raised the cone bottom 60 moves upwards into its closed position wherein it closes the lower end of the bucket. It is contemplated in connection with a cupola charging operation that the trolley 12 will first be propelled into its inoperative position wherein it overlies, as hereinafore described, the loading station. As soon as the trolley is in its inoperative position the bucket is lowered to the station and is then filled. After filling the bucket is raised to a point directly beneath the front end of the trolley frame structure 21 and thereafter the trolley is propelled towards the cupola 10 into its operative position.

The assembly 15 consisting of the wishbone variety support and the frame 17 is disposed beneath and suspended from the trolley 12. It is of unitary character and is mounted as hereinafter described more in detail to move bodily lengthwise of the trolley. The purpose of the assembly is to support the bucket 14 after shift of the trolley into its operative position wherein the front end of the frame structure thereof is disposed within the cupola. The assembly is shiftable back and forth between an operating position wherein the wishbone variety support 16 directly underlies the front end of the trolley frame structure and is adapted to receive and support the bucket and an inoperative or retracted position wherein the support is disposed rearwards of the front end of the trolley frame structure and permits lowering and raising of the bucket with respect to the loading station. It is contemplated that after the trolley is propelled into its operative position the assembly 15 will be shifted into its operating position (see Figure 2) and after the trolley is propelled rearwards into its inoperative position the assembly will be shifted rearwards into its retracted position (see Figure 1). The wishbone variety support 16 consists of a flat horizontally extending plate 66 and this has in the front portion thereof a substantially semi-circular cutout 67. The latter has a slightly greater diameter than the external diameter of the bucket 14 and is adapted to receive the bucket when the assembly 15 is shifted horizontally into its operating position. When the assembly is in such position and the cables 53 of the power actuated hoisting mechanism 13 are initially paid out the bucket 14 moves downwards until it is arrested as the result of its rim 61 being brought into engagement and supported relation with the cutout defining portion of the plate 66. Further paying out of the cables results in the cone bottom 60 moving downwards relatively to the bucket into its open position. The cutout 67 in the plate 66 constituting the wishbone variety support 16 extends through an arc of slightly more than 180° in order that the bucket when supported by the support 16 is properly supported. The frame 17 of the assembly 15 consists of a pair of spaced apart, parallel, horizontal side beams 68, a pair of crossbeams 69 and 70, a pair of front uprights 71, and a pair of rear uprights 72. The side beams 68 are in the form of channel beams and are arranged so that the webs thereof extend vertically and their flanges project inwards. They are disposed in parallel relation with the tracks 48 and are slightly less in length than the latter. The plate 66 constituting the wishbone variety support 16 extends across and rests on the front ends of the side beams 68. The side margins of the plate 66 are welded, riveted or otherwise fixedly secured to the front ends of the upper flanges of the side beams 68. The crossbeams 69 and 70, like the side beams 68, are in the form of channel beams and are arranged so that the webs thereof extend vertically. The crossbeam 69 extends between, and has its ends fixedly connected to, the central portions of the side beams 68. The upper flange of the crossbeam 69 underlies, and is suitably connected to, the rear margin of the plate 66. The other crossbeam, i. e., the crossbeam 70, extends between, and has its ends fixedly connected to, the rear ends of the crossbeams 68. The uprights 71 and 72 are in the form of channel beams and are arranged so that the flanges thereof project outwards. The lower ends

of the front uprights are disposed outwards of, and fixedly connected to, the central portions of the side beams 68 and the lower ends of the rear uprights 72 are disposed outwards of, and are fixedly connected to, the rear ends of said side beams. The upper ends of the front and rear uprights of the frame 17 have fixedly connected thereto externally disposed bearing blocks 73 and these carry or support inwardly projecting, horizontal stub axles 74, on the inner ends of which are rotatably mounted wheels 75. The latter rest on, and are adapted to travel along, the lower flanges of the tracks 48 on the under side of the trolley frame structure 21. The assembly 15 is shifted back and forth between its operating and retracted positions by motor operated mechanism 76 consisting of a reversible electric motor 77 and speed reducing gearing 78. The motor 77 is positioned so that the armature shaft thereof extends horizontally and transversely of the tracks 48. It rests on, and is fixedly secured to, an elongated, horizontally extending platform 79 which is located rearwards of the central portions of the rear uprights 72 and has its ends fixedly secured to said portions of the rear uprights by way of vertically extending brackets 80. The speed reducing gearing 78 of the motor operated mechanism 76 consists of a pinion 81, a gear 82, a horizontal shaft 83, a pair of pinions 84 and a pair of gears 85. The pinion 81 is fixedly connected to one end of the armature shaft of the reversible electric motor 77 and meshes with, and serves to drive, the gear 82. The latter is fixedly mounted on the central portion of the shaft 83. Such shaft is located directly beneath, and extends transversely of, the tracks 48 and has its ends journaled in bearings 86 which are fixedly connected to the upper ends of the rear uprights 72. The pinions 84 are mounted on the shaft 83 directly inwards of the bearings 86 and mesh with, and serve to drive, the gears 85. The latter are formed integrally with the outer ends of the track engaging wheels 75 at the upper ends of the rear uprights 72. When the electric motor 77 is driven in one direction it operates through the medium of the speed reducing gearing 78 to propel the assembly 15 forwards into its operating position wherein, as previously pointed out, the wishbone variety support 16 is disposed under the front end of the trolley frame structure 21. Reverse drive of the electric motor 77 results in rearward shift or propulsion of the assembly into its retracted position. A pair of outwardly projecting angle brackets 87 on the front ends of the tracks 48 coast with the wheels on the upper ends of the front uprights 71 to limit forward sliding movement of the assembly 15 with respect to the trolley and outwardly extending angle brackets 88 on the rear ends of the tracks 48 coast with the wheels at the upper ends of the rear uprights 72 to limit rearward shift of the assembly 15 relatively to the trolley.

A cab 89 for the operator of the cupola charging apparatus is connected to, and depends from, the rear end of the frame structure 21 of the trolley 12. In this cab are mounted suitable controls for the reversible electric motor 54 of the hoisting mechanism 13, the electric motor 39 of the mechanism for propelling the trolley along the monorail 11, and the electric motor 77 of the mechanism 76 for propelling the assembly 15 back and forth with respect to the trolley.

The operation of the apparatus is as follows:

When it is desired to charge the cupola 10 the trolley 12 is propelled rearwards until the bucket

14 overlies the loading station. As soon as the trolley stops, the hoisting mechanism 13 is actuated so as to lower the bucket 14 to the station. After filling or loading the bucket is raised until the rim at the top thereof is disposed above the wishbone variety support 16. In connection with lowering and raising of the bucket the assembly 15 is retained in its retracted position. In such position the support 16 is disposed rearwards of the bucket so that it does not interfere with lowering and raising of the bucket. After raising of the loaded bucket to the front end of the frame structure of the trolley the trolley is propelled forwards into its operative position. As soon as the trolley reaches such position the assembly 15 is propelled forwards relatively to the trolley into its operating position. After the assembly reaches such position the hoisting mechanism 13 is actuated so as to pay out the cables 53. In connection with initial paying out of the cables the bucket 14 lowers until it is supported as the result of the rim 61 being brought to rest on the cutout defining portion of the plate 66. Further paying out of the cables results in the cone bottom dropping into its open position with resultant discharge of the material into the cupola. After discharge of the material the hoisting mechanism 13 is actuated so as to wind up the cables 53. In connection with initial winding of the cables the cone bottom 60 is raised into its closed position. In connection with further winding up of the cables the bucket is raised out of engagement with the wishbone variety support 16.

The herein described cupola charging apparatus effectively and efficiently fulfills its intended purpose and is characterized by the fact that the wishbone variety support 16 does not remain at all times in the cupola.

Whereas the apparatus has been described as being adapted to charge a cupola it is to be understood that it may be utilized to effect charging of any other metallurgical furnace having a side opening therein. It is also to be understood that the invention is not to be restricted to the details set forth since these may be modified within the scope of the appended claims without departing from the spirit and scope of the invention.

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

1. An apparatus adapted to charge a cupola with a side opening therein, and comprising a trolley mounted to travel back and forth between an operative position wherein its front end extends into the cupola through the side opening and an inoperative position wherein it is disposed away from the cupola, power actuated hoisting mechanism mounted on the trolley and embodying a flexible element depending from said front end of the trolley and adapted to be paid out or taken up in response to actuation of the mechanism, a bucket provided with a drop variety cone bottom, having its bottom connected to the lower end of the flexible element, and embodying an outwardly extending rim at the top thereof, and a frame located beneath, and suspended from, the trolley, provided at the front end thereof with a horizontal wishbone variety support, mounted to move forwards and backwards relatively to the trolley, and adapted when the trolley is in its operative position and the bucket is fully raised to be shifted forwards into a position wherein the support is operative,

in connection with initial paying out of the flexible element, to receive the rim and support the bucket and when the trolley is in its inoperative position to be shifted backwards into a retracted position wherein the support is away from the bucket and the latter is free to be lowered and raised by the hoisting mechanism.

2. An apparatus adapted to charge a cupola with a side opening therein, and comprising a trolley supported from above to travel horizontally back and forth between an operative position wherein its front end extends into the cupola through the side opening and an inoperative position wherein it is disposed away from the cupola, power actuated hoisting mechanism mounted on the trolley and embodying a flexible element depending from said front end of the trolley and adapted to be paid out or taken up in response to actuation of the mechanism, a bucket provided with a drop variety cone bottom, having its bottom connected to the lower end of the flexible element, and embodying an outwardly extending continuous rim at the top thereof, and a frame located beneath, and suspended from, the trolley, provided at the front end thereof with a horizontal wishbone variety support, mounted to move horizontally forwards and backwards relatively to the trolley, and adapted when the trolley is in its operative position and the bucket is fully raised to be shifted forwards into a position wherein the support is operative, in connection with initial paying out of the flexible element, to receive the rim and support the bucket and when the trolley is in its inoperative position to be shifted backwards into a retracted position wherein the support is away from the bucket and the latter is free to be lowered and raised by the hoisting mechanism.

3. An apparatus adapted to charge a cupola with a side opening therein, and comprising an elongated trolley supported from above to travel horizontally and longitudinally back and forth between an operative position wherein its front end extends into the cupola through the side opening and an inoperative position wherein it is disposed away from the cupola, and provided on the underside thereof with horizontal longitudinally extending track forming means, power actuated hoisting mechanism mounted on the trolley and embodying a flexible element depending from said front end of the trolley and adapted to be paid out or taken up in response to actuation of the mechanism, a bucket provided with a drop variety cone bottom, and having its bottom connected to the lower end of the flexible element, and a frame located beneath the trolley, provided at the front end thereof with a support, having wheels on the track forming means whereby it is mounted to move forwards and backwards relatively to the trolley, and adapted when the trolley is in its operative position and the bucket is fully raised to be shifted forwards into a position wherein the support is operative, in connection with initial paying out of the flexible element, to support the bucket and when the trolley is in its inoperative position to be shifted backwards into a retracted position wherein said support is away from the bucket and the latter is free to be lowered and raised by the hoisting mechanism.

4. An apparatus adapted to charge a cupola with a side opening therein, and comprising an elongated trolley mounted to travel horizontally and lengthwise back and forth between an operative position wherein its front end extends into

the cupola through the side opening and an inoperative position wherein it is disposed away from the cupola, and provided on the under side thereof with horizontal longitudinally extending track forming means, power actuated hoisting mechanism mounted on the trolley and embodying a flexible element depending from said front end of the trolley and adapted to be paid out or taken up in response to actuation of the mechanism, a bucket provided with a drop variety cone bottom, having its bottom connected to the lower end of the flexible element, and embodying an outwardly extending continuous rim at the top thereof, and a frame located beneath the trolley, provided at the front end thereof with a horizontal wishbone variety support, having wheels on the track forming means whereby it is mounted to move forwards and backwards relatively to the trolley and adapted when the trolley is in its operative position and the bucket is fully raised to be shifted forwards into a position wherein the support is operative, in connection with initial paying out of the flexible element to receive the rim and support the bucket and when the trolley is in its inoperative position to be shifted backwards into a retracted position wherein said support is away from the bucket and the latter is free to be lowered and raised by the hoisting mechanism.

5. An apparatus adapted to charge a cupola with a side opening therein, and comprising an elongated trolley mounted to travel horizontally and lengthwise back and forth between an operative position wherein its front end extends into the cupola through the side opening and an inoperative position wherein it is disposed away from the cupola and provided on the under side thereof with a pair of horizontal, parallel, spaced apart, longitudinally extending tracks, power actuated hoisting mechanism mounted on the trolley and embodying a flexible element depending from said front end of the trolley and adapted to be paid out or taken up in response to actuation of the mechanism, a bucket provided with a drop variety cone bottom and having its bottom connected to the lower end of the flexible element, and a horizontally elongated frame located beneath the trolley, provided at the front end thereof with a horizontal support, having at the sides thereof uprights with track engaging wheels at their upper ends whereby it is mounted to move forwards and backwards relatively to the trolley and adapted when the trolley is in its operative position and the bucket is fully raised to be shifted forwards into a position wherein the support is operative, in connection with initial paying out of the flexible element to support the bucket, and when the trolley is in its inoperative position to be shifted backwards into a retracted position wherein said support is away from the bucket and the latter is free to be lowered and raised by the hoisting mechanism.

6. An apparatus adapted to charge a cupola with a side opening therein, and comprising a trolley mounted to travel back and forth between an operative position wherein its front end extends into the cupola through the side opening and an inoperative position wherein it is disposed away from the cupola, power actuated hoisting mechanism mounted on the trolley and embodying a flexible element depending from said front end of the trolley and adapted to be paid out or taken up in response to actuation of the mechanism, a bucket provided with a drop variety cone bottom, having its bottom connected

to the lower end of the flexible element, and embodying an outwardly extending rim at the top thereof, a frame located beneath, and suspended from, the trolley, provided at the front end thereof with a horizontal wishbone variety support, mounted to move forwards and backwards relatively to the trolley, and adapted when the trolley is in its operative position and the bucket is fully raised to be shifted forwards into a position wherein the support is operative, in connection with initial paying out of the flexible element, to receive the rim and support the bucket and when the trolley is in its inoperative position to be shifted backwards into a retracted position wherein the support is away from the bucket and the latter is free to be lowered and raised by the hoisting mechanism, and mechanism on the frame for shifting the frame forwards and backwards with respect to the trolley.

7. An apparatus adapted to charge a cupola with a side opening therein, and comprising an elongated trolley mounted to travel horizontally and lengthwise back and forth between an operative position wherein its front end extends into the cupola through the side opening and an inoperative position wherein it is disposed away from the cupola, and provided on the under side thereof with horizontal longitudinally extending track forming means, power actuated hoisting mechanism mounted on the trolley and embodying a flexible element depending from said front end of the trolley and adapted to be paid out or taken up in response to actuation of the mechanism, a bucket provided with a drop variety cone bottom, having its bottom connected to the lower end of the flexible element, and embodying an outwardly extending continuous rim at the top thereof, a frame located beneath the trolley, provided at the front end thereof with a horizontal wishbone variety support, having wheels on the track forming means whereby it is mounted to move forwards and backwards relatively to the trolley and adapted when the trolley is in its operative position and the bucket is fully raised to be shifted forwards into a position wherein the support is operative, in connection with initial paying out of the flexible element to receive the rim and support the bucket and when the trolley is in its inoperative position to be shifted backwards into a retracted position wherein said support is away from the bucket and the latter is free to be lowered and raised by the hoisting mechanism, and mechanism operative to shift the frame forwards and backwards with respect to the trolley and consisting of a reversible electric motor on the frame and speed reducing gearing between the motor and certain of the wheels.

8. An apparatus adapted to charge a cupola with a side opening therein, and comprising an elongated trolley mounted to travel horizontally and lengthwise back and forth between an operative position wherein its front end extends into the cupola through the side opening and an inoperative position wherein it is disposed away from the cupola and provided on the under side thereof with a pair of horizontal, parallel, spaced apart, longitudinally extending tracks, power actuated hoisting mechanism mounted on the trolley and embodying a flexible element depending from said front end of the trolley and adapted to be paid out or taken up in response to actuation of the mechanism, a bucket provided with a drop variety cone bottom and having its bottom connected to the lower end of the flexible

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element, a horizontally elongated frame located beneath the trolley, provided at the front end thereof with a horizontal support, having at the sides thereof uprights with track engaging wheels at their upper ends whereby it is mounted to move forwards and backwards relatively to the trolley and adapted when the trolley is in its operative position and the bucket is fully raised to be shifted forwards into a position wherein the support is operative, in connection with initial paying out of the flexible element to support the bucket, and when the trolley is in its inoperative position to be shifted backwards into

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a retracted position wherein said support is away from the bucket and the latter is free to be lowered and raised by the hoisting mechanism, and mechanism operative to shift the frame back and forth between its aforesaid positions and consisting of a reversible electric motor supported by certain of the uprights, and speed reducing gearing between the motor and certain of the wheels.

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No references cited.