April 14, 1964 H. W. SCHWENGEL 3,128,891

CUPOLA CHARGING APPARATUS

Filed Oct. 15, 1962 3 Sheets-Sheet 1

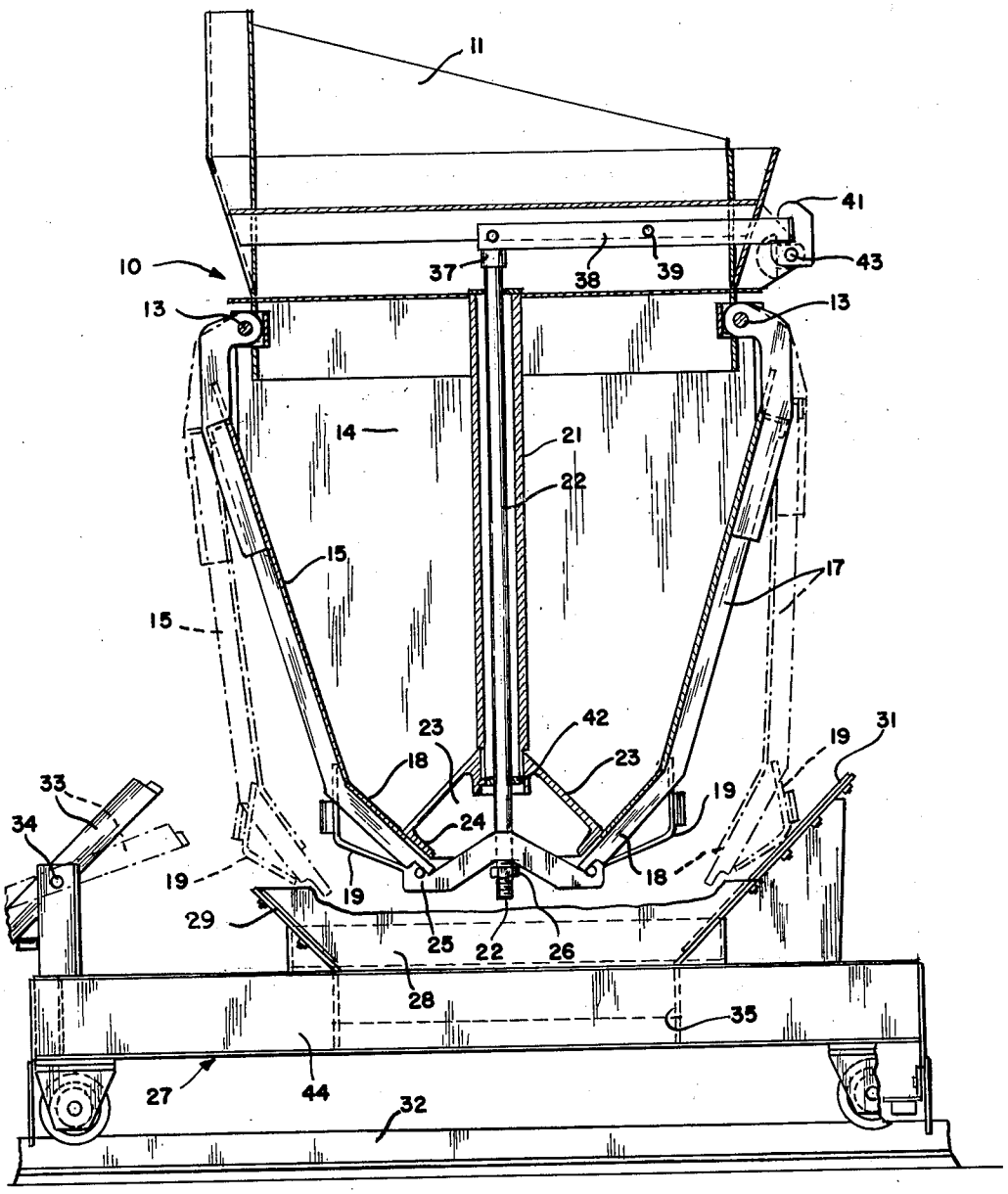


FIG. 1

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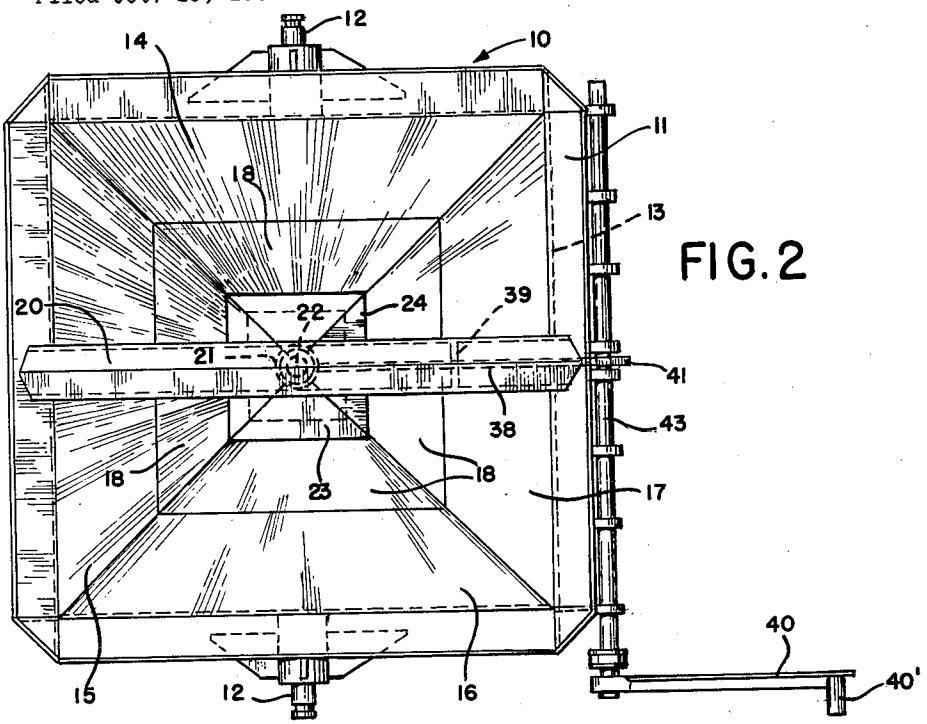


FIG. 2

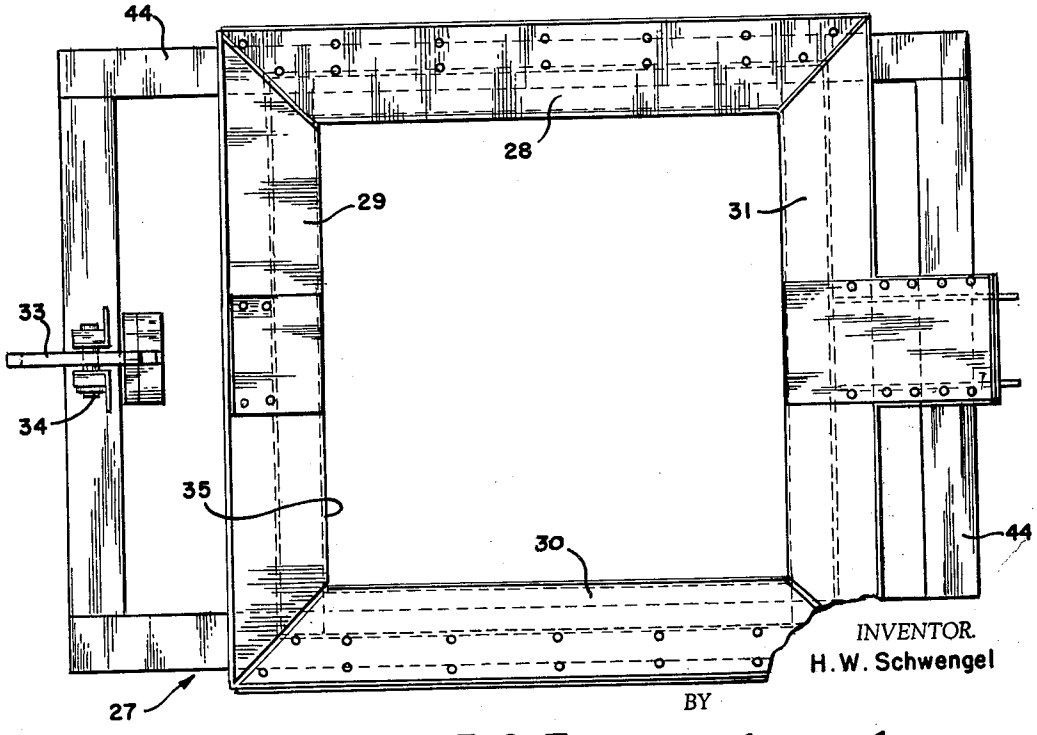


FIG. 3

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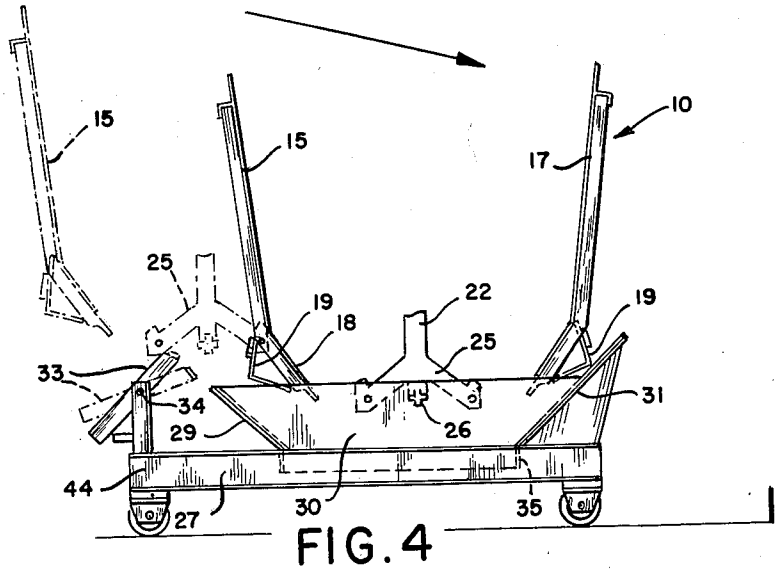


FIG. 4

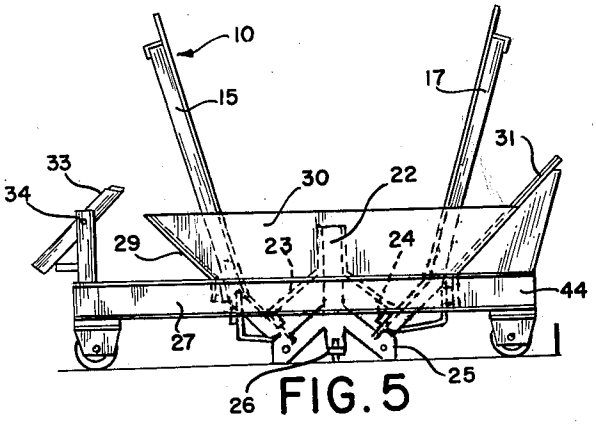


FIG. 5

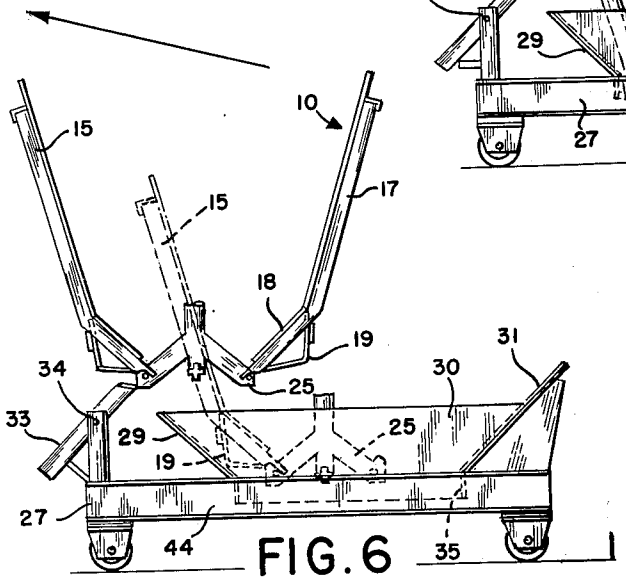


FIG. 6

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United States Patent Office 3,128,891 Patented Apr. 14, 1964

3,128,891

CUPOLA CHARGING APPARATUS

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4 Claims. (Cl. 214—19)

This invention relates to an improved cupola charging apparatus.

So-called charging buckets are used in foundries to deliver quantities of pig iron, coke and lime to the cupola, and are ordinarily transported from the loading pit to the cupola by means of a skip-carriage or by an overhead carrier, there being bottom opening means associated with said buckets for discharging their contents into the cupola. The charging bucket employed in the present invention is generally similar to those disclosed in Kaiser Patents Nos. 2,602,000 and 2,824,762, and Richardson No. 2,860,791, which prior patents are also owned by the assignee of the present application, this invention being an improvement on said earlier devices.

The type of charging bucket herein concerned is provided with a relatively small, inverted cone-shaped bottom member, and a plurality of side wall or door segments which are pivotally connected to the bucket along their top edges and which can be swung outwardly and away from said bottom member to permit the charge material to fall from the bucket. In prior buckets of this type said wall segments normally return by their own weight to a closed position after the load has been discharged, there being latching means to secure the same against the bottom member. In the use of such buckets, however, it is not infrequent that a lump of the charge material becomes lodged between one of said doors and said bottom member during the closing operation, thus wedging said door section open, and preventing the complete closing of the bucket. With this in mind, one of the important objects of the aforementioned Kaiser Patent No. 2,824,762 was to provide a bucket of the type described wherein the doors are so mounted that they hang in an open condition after the load is discharged, in order to ensure that all of the charge material is evacuated from the bucket prior to the closing of the doors, and there being means in the loading pit designed to automatically engage and close said doors before the bucket is refilled. Unfortunately, however, it has been found that the door-closing mechanism characterizing the Kaiser apparatus is not entirely satisfactory for its intended purpose, and it is with the improvement of this critical feature that the present invention is primarily concerned.

A more specific object of the present invention is to provide a cupola charging apparatus including a bucket having top hinged side wall or door segments which are designed to normally hang in an open position, to ensure the complete evacuation of the charge material, and which apparatus includes a novel movable carriage device in the loading pit adapted to automatically engage the empty bucket on its return from the cupola and to close and latch said door members prior to refilling.

Further objects of the present invention are to provide an improved charging apparatus as described which is efficient and reliable in operation, which is durable, which is relatively inexpensive in design and construction, and which is otherwise particularly well adapted for its intended purposes.

With the above and other objects in view, which other objects and advantages of the present structure will become apparent hereinafter, the invention consists of the improved cupola charging apparatus, and all of its parts

and combinations, as set forth in the claims, and all equivalents thereof.

In the accompanying drawings, illustrating a preferred embodiment of the present invention, and wherein the same reference numerals designate the same parts in all of the views:

FIG. 1 is a vertical sectional view of the improved charging apparatus comprising the invention;

FIG. 2 is a top plan view of the charging bucket;

FIG. 3 is a top plan view of the bucket door-closing mechanism incorporated in the invention;

FIG. 4 is a diagrammatic view of the apparatus during the initial stages of the bucket door-closing operation;

FIG. 5 is a diagrammatic view of said apparatus showing the bucket in its closed condition and ready to receive the charge; and

FIG. 6 is a diagrammatic view of the apparatus showing the charging bucket commencing its return trip to the cupola.

As mentioned, the function of a cupola charging bucket is to deliver quantities of pig iron, coke, and lime to the cupola, the ordinary method being to fill the bucket in the loading pit, to transport the loaded bucket up an inclined track or overhead conveyor by means of a power-driven winch or the like, and to discharge the contents into the upper portion of the cupola. With the particular type of apparatus herein concerned, the charging bucket is provided with an inverted cone-shaped bottom member of substantially smaller diameter than the bucket proper, and the side wall segments are adapted to be released and to swing outwardly away from said bottom member at the proper time to permit the charge material to drop into the cupola.

Referring now more particularly to the charging bucket 10 in the present invention, it will be seen in FIGS. 1 and 2 that said bucket comprises a hopper-like, four-sided top portion 11, and projecting from opposite sides thereof are transverse pins or arms 12 for attachment to an overhead conveyor or the like. Hingedly connected to said upper portion 11 as at 13 (FIG. 1), and depending therefrom, are side wall segments or doors 14, 15, 16 and 17, said doors forming the sides of the bucket. Each of said wall segments or doors 14–17 includes a relatively long upper portion which extends downwardly and inwardly at an angle from the bucket top 11, and an integral lower portion 18 which is deflected inwardly at an obtuse angle relative to said upper portion. Formed externally on said door lower portions 18 are wedge-shaped bumpers 19, the function of which will be described. Said doors 14–17 in the present bucket are designed to normally hang in the open position shown in broken lines in FIG. 1, but they are swingable inwardly to a closed position against the bottom member, as will be seen, and wherein their side edges substantially abut.

Spanning the open top portion 11 of the bucket is a relatively narrow, elongated housing 20 (FIG. 2), and depending therefrom and centered in the bucket is an elongated vertical tube 21 (FIG. 1) which extends downwardly the entire depth of the bucket, there being a rod 22 vertically-movably carried within said tube and extending a short distance therebelow. Mounted on and surrounding the lower portion of said rigid tube 21 is a hollow, pyramid-shaped element 23 which forms the bottom member in the present bucket. The lower portion of said bottom member 23 is square in cross section, having four downwardly and outwardly slanting sides, and the lower portions 24 of said sides are beveled downwardly and inwardly at the same angle as the lower portions 18 of the bucket doors 14–17 when the latter are in their closed position. The width of said bottom member is substantially smaller than that of the bucket proper so

that there is ample space for the charge material to fall through the bucket when the doors are open.

Mounted on the lower end of the vertically-movable rod **22**, immediately below the bottom member **23**, is a locking spider **25**, there being a nut **26** threaded onto the rod end to maintain said spider thereon. Said spider **25** is provided with a plurality of lateral arms, there being one positioned below each of the swingable door segments **14–17**, and each of said spider arms has an upwardly bent flange at its outer end having an inclined inner face corresponding to the angled lower door portion **18**. When said vertically-movable rod **22** is in its raised position (FIG. 1) said spider bears against the door portions **18** and maintains the same in firm engagement with the beveled faces **24** of the bucket bottom member, thus locking said bucket in a closed condition. When said rod **22** and spider **25** are in a lowered position, the bucket doors are free to swing to their normal, open condition.

The particular mechanism employed in the present structure for lowering the rod and spider at the proper time, and thus opening the bucket doors, is not critical to the invention inasmuch as such mechanisms are well known in the art. In the illustrated charging bucket the elongated rod **22** extends through the tube **21**, as described, and has its extreme upper end projecting into the transverse housing **20** at the top of the bucket. In this location it fits within a clevis **37** pivotally carried on the inner end of a lever **38** (FIG. 1). The latter is pivoted within said housing **20** on a pin **39**, and its outer end projects from the bucket and is engaged by a pivotal latch or trip lever **41** when the rod **22** is in its raised position. Said latch is mounted on a rotatable shaft **43**, and also mounted on and projecting from said shaft is an elongated handle **40** having a transverse lug **40'** which is positioned to engage a trip member on the conveyor track (or an impingement member within the cupola) when the bucket is in discharge position to cause temporary rocking of the latch **41** and release of the outer end of the lever **38**, thus allowing the rod **22** and spider **25** to drop to their lowered position. A similar arrangement is disclosed in the Richardson Patent No. 2,602,000. Carried on the lower portion of said rod **22** is a suitable stop lug **42** which is adapted to abut a portion of the bottom member **23** to limit the downward movement of said rod and locking spider.

One of the essential features of the present charging bucket, as hereinabove mentioned, is that the design and mounting of the bucket doors **14–17** is such that said doors hang in an open condition after the charge has been deposited in the cupola, thus ensuring that all of the charge material will be evacuated from the bucket before the doors are closed, and preventing lumps of said material from becoming wedged between said doors and the bottom member **23**, as frequently occurs with buckets having doors which are pushed open by the charge and which return by gravity to their closed position. The present bucket is similar in this respect to the device disclosed in the Kaiser Patent No. 2,824,762. What is new in the present apparatus, however, is the combination of said bucket with the novel automatic door-closing means which will now be described.

As is shown in FIG. 1 of the drawings, the complete charging apparatus comprising the present invention includes a wheeled carriage or cart **27** which is mounted on parallel, horizontal tracks **32** on the floor of the loading pit. Said carriage includes a frame **44** on which are mounted four inwardly and downwardly angled walls **28, 29, 30** and **31**, the latter wall being substantially higher than the others, and which walls define a square bottom opening **35**. Said walls **28–31** are beveled downwardly and inwardly at the same angle as the lower portions **18** of the bucket doors, and are designed to guide said doors into their closed position as the bucket is lowered into said carriage. The tracks **32** on which said carriage rides are positioned below and in alignment with the track or conveyor rail or the like on which the bucket **10** travels, said conveyor being inclined substantially relative to said carriage tracks. Mounted on the forward end of the carriage **27** is a pivotal arm **33** which is counterweighted or spring-mounted to normally assume the generally upright position shown in full lines in FIG. 1, but which arm may be temporarily pivoted rearwardly and downwardly about the transverse pin **34** to the lowered position shown in broken lines.

In the use of the novel charging apparatus comprising the present invention, and referring now more particularly to FIGS. 4, 5 and 6 of the drawings, showing the operational sequence in diagrammatic form, when the bucket **10** has been emptied into the cupola or other receptacle and is being returned on the overhead conveyor rail (or by means of a skip carriage or other carrier) for refilling, it approaches the carriage **27** therebelow at an acute angle. Said bucket is in an open condition, as described, and when it reaches the carriage (the broken line position of FIG. 4) the depending spider **25** thereon strikes the arm **33** on the forward end of said carriage and causes said arm to pivot to its lowered (broken line) position, thus allowing the descending bucket to move downwardly to a centered position over said carriage. As the bucket moves rearwardly and downwardly its hanging rear door **17** engages against the beveled rear wall **31** of the carriage, as shown in full line position in FIG. 4, causing said carriage to be pushed rearwardly with said bucket while the latter is simultaneously being lowered within said carriage.

As the bucket **10** rides downwardly on the carriage walls **28–31**, the inclined nature of said carriage walls causes the bucket doors to be wedgingly urged inwardly toward each other, and toward the bucket bottom member **23**. When said bucket approaches its fully lowered position (FIG. 5), the external protrusions or bumpers **19** on the doors pass through the marginal portions of the carriage walls, and through the center opening **35** defined by said walls, thus pushing said doors tightly against the lower side faces **24** of the bottom member. Simultaneously, the vertical rod **22** strikes the floor or bottom of the pit, thus preventing further downward movement of the same and causing the spider **25** thereon to be brought into engagement with said bucket doors to maintain the same in their closed position, the lever **38** and latch **41** automatically locking said rod **22** in its raised position until released by a suitable tripping mechanism, as described. Thus there is provided a simple and effective mechanism for closing the bucket doors substantially simultaneously, and readying the bucket for refilling.

After the bucket **10** has been filled with a charge and it is desired to return the same to the cupola, the bucket overhead conveyor or skip carriage is actuated to move said bucket upwardly on its inclined path. As illustrated in broken lines in FIG. 6, when said bucket commences moving forwardly and upwardly its leading wall **15** rides up the beveled face of the carriage forward wall **29**, thus pulling the wheeled carriage forwardly with the forwardly and upwardly moving bucket. As said bucket wall **15** clears the carriage wall, as shown in full lines, the spider **25** catches on the upright arm **33** and pulls said carriage forwardly still further, until said upwardly-moving spider clears said arm. At this point the forward travel of the carriage stops, leaving said door-closing carriage in exactly the proper position to receive the empty charging bucket on its return from the cupola, whereupon the entire operation is repeated. Thus the present invention provides a charging apparatus wherein the bucket doors normally hang in an open condition, to ensure the complete evacuation of the charge material, and wherein simple but reliable means are provided for automatically closing said doors prior to the refilling of the bucket in the loading pit.

It is to be understood, of course, that the apparatus comprising the present invention is not to be limited to a structure identical in all respects to that illustrated and hereinabove described, nor is it necessarily confined to use as a means for charging cupolas. It is intended, on the contrary, that the present invention include not only the illustrated embodiment, but also any and all structural modifications or changes therein, and including such other uses to which the device might be advantageously applied, as may come within the spirit of said invention and within the scope of the following claims.

What I claim is:

1. In combination with a cupola charging bucket adapted to be transported in an inclined path from a loading area to a cupola, said bucket having an upper portion, having a relatively small bottom member, and having a plurality of doors hinged to and depending from said upper portion, said doors being swingable from a normal hanging position spaced laterally from said bottom member to a closed position against said bottom member, a door-closing apparatus comprising: a movable carriage positionable below said charging bucket; means on said carriage adapted to engage the open hanging doors of the empty bucket as the latter moves downwardly and rearwardly on its inclined path, and to urge said doors into their closed position against the bucket bottom member as said carriage moves rearwardly with said descending bucket; means on said bucket and operatively associated with said carriage adapted to engage and lock said bucket doors in their closed position; and means on said carriage engageable by the closed charging bucket as the latter commences its upward and forward travel to the cupola whereby said bucket will pull said carriage forwardly to a point where the latter is properly positioned to receive the empty bucket upon its return from the cupola.

2. The combination recited in claim 1, wherein said movable carriage is mounted on tracks.

3. The combination recited in claim 1, wherein said bucket includes a depending, vertically movable locking spider having portions positioned beneath and in alignment with said bucket doors, and said spider being movable from a position spaced below the bucket doors to a position releasably lockingly engaging said doors when the latter are in their closed position.

4. The combination recited in claim 3, wherein said carriage is provided with downwardly and inwardly inclined walls adapted to engage the open doors of said bucket and to wedgingly guide the same into their closed position as the carriage moves rearwardly with said descending bucket, and there being means associated with said carriage adapted to move said spider upwardly into locking engagement with said bucket doors when the latter are in a closed condition.

References Cited in the file of this patent

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2,602,000	Richardson	July 1, 1952
2,626,828	Morgan	Jan. 27, 1953