CONE BOTTOM CHARGING BUCKET FOR CUPOLAS

Fig. 3

Fig. 4

Fig. 5

Fig. 6

INVENTOR.
Frank H. Fones

BY

ATTORNEY
My invention is directed to cupola charging devices and particularly to an improved form of cone bottom charging bucket which may be supported upon trunnions and raised to cupola charging level by a skip hoist or the like.

There have been several types of devices proposed for charging cupolas, many of which have proven to be quite satisfactory. One of the most popular forms is known as the skip hoist type wherein an inclined runway is pivotally supported at its lower end and raises a bucket containing the charging material to the cupola charging level. This runway may be turned on its pivot to serve several cupolas, which are customarily arranged in arcuate formation along the path of movement of the swinging end of the runway. This type of charging device, however, has in the past utilized a bucket provided with either single or double doors across its bottom for discharging the contents of the bucket at the proper moment, whereas other systems, such as the monorail type, have employed cone bottom buckets, which are considered preferable inasmuch as the contents of the bucket are discharged more slowly and tend to fall nearer the walls of the cupola than is the case with a single or double door type bucket, thus improving draft and cupola operation.

Cone bottom buckets normally include a shell closed at its lower end by an upright cone and are supported by a rod extending from the cone upwardly through the shell and into engagement with a hoisting block or cable. These buckets, therefore, require some form of support in the cupula, such as a wishbone or a yoke, for holding the shell stationary while the bottom is allowed to drop by slacking the lifting cable. These wishbones or yokes are subject to severe treatment and high temperature.

One of the primary objects of my invention is to provide a skip hoist type of cupola charging system utilizing a cone bottom charging bucket.

Another important object of my invention is to provide a cone bottom charging bucket adapted for support by trunnions fixed to the sides of the bucket and provided with automatic release mechanism for discharging the contents of the bucket at the proper moment.

Other objects of my invention include the provision of a device of the type described having an automatic lifting mechanism for the cone, which requires no supporting structure for the bucket within the cupula, which incorporates means for retarding the rate at which the bucket is raised to permit a plurality of cupolas, which is durable and efficient in operation.

Other objects, as well as further marked advantages of my invention will be disclosed in the course of the following detailed description and in the appended drawings in which:

Fig. 1 is a schematic partially sectioned elevation of a skip hoist type of cupola charging system;
Fig. 2 is a diagrammatic, partially sectioned view of the device shown in Fig. 1, illustrating the disposition of cupolas with respect to the charging apparatus;
Fig. 3 is a partially sectioned plan view of my charging bucket;
Fig. 4 is a partially broken away and sectioned elevation of Fig. 3;
Fig. 5 is a partially broken away elevation taken along the lines 5-5 of Fig. 3;
Fig. 6 is a cross section of the cone bottom for the bucket;
Fig. 7 is a partially elevation of the latching mechanism;
Fig. 8 is a schematic elevation of a modified form of my invention illustrating a release mechanism.

Fig. 9 is a plan view of the device illustrated in Fig. 8.
Fig. 10 is a partial schematic elevation of a preferred form of bottom retarding device.
Fig. 11 is a plan view of the piston utilized in the device shown in Fig. 10 illustrating the positions of the relief ports.
Fig. 12 is a section taken along the line 12-12 of Fig. 11; and
Fig. 13 is a partial elevation taken along the line 13-13 of Fig. 11.

The general arrangement of my skip hoist charging device is shown in Figs. 1 and 2 wherein I have illustrated a pair of identical cupolas 10 and 11 of conventional design disposed near each other and on an arc of a circle having its center at a predetermined point, indicated at 12. Each of the cupolas 10 and 11 incorporates a charging opening 15 disposed above a melting section 14 and below a stack section 16. Usually, a charging floor 17 or other suitable support structure extends between the cupolas and supports a curved rail 18, which follows a regular arc about the center 12, and at a level somewhat below that of the charging openings 13. Wheels 19 mounted on the rails 18 moveably support a frame 21 to which inclined opposed curvilinear channels 22 are secured. The frame 21 is supported at its lower end by a turn-table or bed 23 having a central pivot 24 on the center 12, as well as stabilizing peripheral surfaces 26, thus permitting the frame 21 and the opposed channels 22 to swing with the bed 23 about the center 12 and serve either of the cupolas 10 or 11.

A carriage 27 is provided with four or more spaced wheels 28 engaging the channels 22. Arms 29 project forwardly from the carriage 27 and are shaped to receive trunnions 31 secured to the sides of a charging bucket, generally designated 32. The upper ends of the channels 22 are provided with stops 33 for limiting the uppermost position of the carriage 27 to which it is raised by a winch 34 and cable 36. When the carriage 27 is against the stops 33, the arms 29 project inwardly approximately to the centerline of the cupula 11 and support the charging bucket 32 in the desired position in the charging opening 13.

The charging bucket 32 includes a generally cylindrical shell 37 reinforced at its lower end by a circumferential band 38. The upper end of the shell 37 is provided with an outwardly flaring portion 39 reinforced by gusset plates 41 and with a lip 42 extending upwardly on the upper edge of the portion 39. The opposed trunnions 31, which are supported by the arms 29 of the carriage 27, are secured as by welding to the shell 37 near the outwardly flaring portion 39 and are diametrically opposed. A support member 43, reinforced by lateral gussets 44, extends across the top of the bucket 32 transversely to the axis of the trunnions 31 and is secured as by welding to the shell 37 and portion 39. A joint 46 is pivotally secured to the center of the support bar 43 as by a pin 47 generally parallel to the axis of the trunnions 31. The lower end of the joint 46 is notched...
as at 48 and provided with a pin 49 disposed transversely to the rod 47 for receiving a support rod 51 of either round or polygonal cross section to which a cone bottom, generally designated 52 may be secured.

The cone bottom 52 which may have an apex angle of about 90° is of sufficient diameter at its base to close the bottom of the shell 37 and is preferably truncated near the periphery, or if desired, a peripheral lip 53 may extend outwardly from the base of a conical body section 55 for engagement with the bottom of the shell 37 and the band 38, thus forming a tight seal. A cylinder 54 extends axially through the cone 52 and is secured thereto, as by welding. The rod 54 projects downwardly through a suitable opening in the upper end of the cylinder 54 and is threaded at its lower end to receive a nut 56 and washer 57. A relatively short spring 59 and a relatively long spring 59 are mounted in the cylinder 54 to bear against the upper end of the cylinder and the washer 57 when the bottom 52 is open. Preferably the long spring is of such length that in its extended position approxi- mately six inches will remain between the upper end of the spring and the upper end of the cylinder 54 when the bucket is closed.

Latch bars 61 are secured to the bottom of the cone 52 as by welding and project outwardly beyond the periphery of the cone 52 a distance sufficient to engage latch arms 62 pivotally secured to opposite sides of the shell 37. Preferably the shell 37 and the band 38 are notched as at 63 to receive the latch bars 61 which are diametrically opposed and approximately aligned with the axis of the transmitters 31. The latch arms 62 include relatively long heavy upper arms 66 extending diagonally upwardly from pivots 65 to an interconnecting yoke 66 upon which may be mounted a roller 67. The latch bars 62 also include relatively short lower arms 68 which are subjoined 52 vertical when the cone 52 is locked to the shell 37 by the latch arms 62. The latch bars 61, which are preferably of upwardly tapering cross section, are held in closed position by a projecting hook or lip integral with the arms 68 and having a flat upper surface 70 for engagement with the under side of the latch bars 61.

The lower portion of the hooks 69, which are normally held by the weight of the upper arms 64 in the path of the locking bars 61 are tapered, as shown in Fig. 5 at 65, in such manner that as the locking bars 61 are forced upwardly, the arms 62 will be forced to rock about pivots 65 as the bars 61 continue their upward movement, the lower surface of the bars will clear the hook, allowing the arms 68 to swing to vertical position and thus engage the flat surfaces 70 of the hooks 69 with the under side of the locking bars 61. Stops, such as pins 75, may be provided for limiting movement of the arms 62.

To provide for adequate opening, as well as sufficient room for the springs 58 and 59, the cylinder 54 will usually project downwardly beyond the conical section 54 of the cone 52. I, therefore, prefer to provide spaced parallel series of supporting rollers 60 on the bed 23 to engage the bottom of the cone 52 as the carriage is dropped, the lower end of the cylinders 22, the space between the rollers 60 being sufficient to permit passage of the depending portion of the cylinder 54. As the bucket 32 is lowered, it may be seen that the rollers 60 will engage the lower surface of the cone 52 and force the latch bars 61 upwardly past the lip 69. The weight of the cone 52 is sufficient to move the latch arms 62 in a clockwise direction as viewed in Fig. 7, thus permitting the latch bars to pass the lip 69. The material to be charged, such as coke, iron, or limestone, is then added to the bucket 32 and the carriage 27 hoisted by the winch 34 and cable 36 along the tripping bars 79, thus pivoting the arms 71 about their respective pivots 72 and causing the hooks 74 to be withdrawn at the proper moment from beneath the locking bars 61. The angle of the tripping bars 79 is such that the carriage 27 completes its movement into contact with the stops 33, the rollers 78 will be forced upwardly along the tripping bars 79, thus pivoting the arms 71 about their respective pivots 72 and causing the hooks 74 to be withdrawn at the proper moment from beneath the locking bars 61. The angle of tripping mechanism offers several advantages over the previously described inasmuch as the shock to the cupola is greatly reduced and the point of release more easily determined and adjusted.

My hydraulic cylinder, generally designated 81 is illustrated in Figs. 10-13, inclusive, and may be substituted for the cylinder 54 as desired. The hydraulic cylinder 81 includes a cylinder 82 enclosed at its upper end by a plate 83 having an opening therein for a piston rod 84 and sealed by a packing gland 86. The piston rod 84 is secured at its upper end to the joint 46 by pin 49 and is threaded at its lower end to receive a split nut 87. The lower end of the cylinder 81 is connected by plate 88 which may be provided with a plug 89. A piston, generally designated 91, is secured to the lower end of the rod 84 by nut 87 and includes a pair of opposed cup leathers 92 disposed between upper and lower washers 93 and
an intermediate washer 94. The intermediate washer 94 is provided with a plurality of metering orifices 96 extending through the washer generally parallel to its axis. Set screws 97 extend inwardly from the periphery of the washer 94 to intersect the metering orifices 96, thus controlling the rate of flow through the orifices. Similar orifices of somewhat larger dimensions are provided in the upper and lower washers 93. The washers 93 and 94 are also provided with diametrically opposed openings, indicated at 98, for valves 99, which permit the relatively free passage of fluid from the upper portion of the cylinder through the piston. The valves 99 are preferably of a design and are seated by gravity in known manner. Guides 101 may be secured to the washers 93 to prevent cocking and cooperate with washers 102 secured to the valves 99 to prevent excessive displacement of the valve.

Washers 93 and 94 are also provided with diametrically opposed openings 103 through which guide rods 104 extend. These rods are secured to the upper cap 83 and the lower plate 88 and prevent twisting of the cylinder 82 with respect to the piston 91. A spring 106 may be telescoped over the guide rods and serves to cushion the terminal downward movement of the cone 52 which is fastened to the cylinder 82. Preferably the length of the spring 106 is considerably less than the overall length of the cylinder 82.

To prevent excessive wear of the packing 86 by dirt accumulating on the piston rod 84, I provide a telescoping shield, generally designated 107 comprising an outer cup 108 and an inner sleeve 109. Cup 108 has an upper plate 111 secured to the upper portion of the rod 84 near the pin 49, and with side walls 112 which project downwardly around the sleeve 109. The sleeve 109 telescopes over the upper end of the cylinder 82 and is provided at its upper extremity with an outwardly extending peripheral flange 113 disposed in the path of an inwardly extending flange 114 secured to the lower end of the outer cup 108. The sleeve 109 is also provided with an inwardly extending peripheral flange 116 which engages the external wall of the cylinder 82, thus sealing the rod 84.

Upon release of the locking bar 61, the weight of the charge forces the cylinder 82 downwardly. This movement is retarded by the metering action of the orifices 96, the washers 93 and 94 being seated by the force of gravity. As the cylinder moves downwardly, the outer cup 108 and the inner sleeve 109 move with respect to the cylinder to maintain a closure around the rod 84. As the cone bottom approaches its lower position, the upper end of the spring 106 engages the upper closure plate 65 of the cylinder 83 and thus additionally retards the rate of movement. The carriage is lowered with its bottom 52 in a partially open position such that at the time the bottom engages the rollers 73 on the bed 23, at which time the bottom 52 is forced upwardly towards the shell 37 in a manner previously described. As the cylinder 82 moves upwardly, pressure is exerted on the fluid trapped in the cylinder below the piston 91 which forces the valves 99 into open position and permits the substantially unobstructed flow of fluid into the upper portion of the cylinder.

From the foregoing it is obvious that the many advantages of cone bottom buckets may now be realized in substantially all types of cupola charging devices, and that the use of both fixed tripping devices and bucket supports within the cupola is needless. Furthermore, the shock to the cupola and charge therein, sometimes occasioned by careless release of the load in the charging bucket, is eliminated, since the rate at which the load may be reduced is limited by my retarding mechanism. The cone bottom, being suspended in open position from the relatively short rod, which is in turn supported by a universal joint, is free to move laterally about a relatively short radius and will therefore allow the passage of relatively large objects without jamming. These, with the other advantages of my structure, not only reduce the overall cost of installation and maintenance but also increase efficiency to a substantial degree and prevent the use of relatively untrained labor without serious threat of cupola or charging apparatus damage through improper operation.

The foregoing detailed description has been made in compliance with R. S. 4888 and is intended for purposes of illustration rather than by way of limitation. I do not, therefore, limit myself to the details herein described except assofar as defined in the appended claims.

1. A charging bucket for cupolas and the like comprising a generally cylindrical shell, diametrically opposed trunnions on the shell near the upper end thereof, a cross member supported by the shell, a rod, a universal joint connecting the rod and the cross member, an upright conical bottom for the shell reciprocally mounted on the rod, a latching device on the shell for releasably holding the bottom against the shell, and means for retarding the rate at which the bottom falls from the shell when the latching device is released, said means including a cylinder around the rod fixed to the conical bottom a transverse member on the rod and means within the linder engaging the transverse member opposing rapid downward movement of the cylinder relative to the transverse member.

2. A charging bucket for cupolas and the like comprising a generally cylindrical shell, diametrically opposed trunnions secured to the shell near the upper end thereof, a member extending across the upper portion of the shell, a rod pivotally secured to said member and extending downwardly into the shell, an upright conical bottom for the shell reciprocally mounted on the rod, a gravity actuated arm pivoted to said rod and including a hook engageable with the bottom when the bottom is in closed position against the shell, and means for retarding the rate at which the bottom falls from the shell when the latching device is released, said means including a cylinder around the rod fixed to the conical bottom a transverse member on the rod and means within the linder engaging the transverse member opposing rapid downward movement of the cylinder relative to the transverse member.

3. A charging device for cupolas and the like comprising a generally cylindrical hollow shell, diametrically opposed trunnions on the shell near the upper end thereof, a cross member extending across the upper end of the shell, a rod, a universal joint connecting the rod and the cross member, an upright conical bottom for the shell reciprocally mounted on the rod, a pair of latch arms pivotally secured to opposite sides of the shell, the lower ends of the latch arms having projecting hook-shaped lips, the surface of each lip being relatively flat for engagement with the bottom, and thus locking the bottom to the shell, and the lower surface thereof being inclined and in the path of the bottom whereby the arms are forced from the path of the bottom as the latter approaches the shell and means between said bottom and said rod for at all times retarding opening movement of the bottom.

4. The structure defined in claim 3 wherein the latch arms are connected by a yoke disposed to arrange the arms into the path of the bottom by gravity.

5. A charging bucket for cupolas and the like comprising a generally cylindrical shell, diametrically opposed trunnions on the shell, a cross member extending across the mouth of the shell, a rod, a universal joint connecting the rod and the cross member, an upright conical bottom for the shell reciprocally mounted on the rod, latching means on the shell for releasably holding the bottom against the shell, and resilient means interposed between the rod and the bottom for continuously retarding movement of the bottom away from the shell.

6. A charging bucket for cupolas and the like compris-
ing a generally cylindrical shell, diametrically opposed trunnions on the shell, a cross member extending across the mouth of the shell, a rod freely suspended from the cross member for swinging movement toward any portion of the lower shell periphery, an upright conical bottom for the shell reciprocally mounted on the rod, releasable latching means on the shell for holding the bottom against the shell, and hydraulic means interposed between the rod and the bottom for retarding the rate of movement of the bottom away from the shell.

7. A charging bucket for cupolas and the like comprising a cylindrical shell having a mouth, diametrically opposed trunnions near the mouth, a cross member fixed with respect to the shell, a rod pivotally secured to the cross member and extending into the shell, a cylinder reciprocally telescoped over the rod, an upright conical bottom for the shell secured to the cylinder, a latching device on the shell for releasably holding the bottom against the shell, and a means continuously acting on the rod and cylinder for retarding the rate of fall of the bottom.

8. A charging bucket for cupolas and the like comprising a cylindrical hollow shell having a mouth, diametrically opposed trunnions secured to the shell near the mouth, a support member extending across the mouth of the shell, a rod freely secured at one end to the cross member for swinging movement and extending into the shell, a piston on the lower end of the rod, a hydraulic cylinder reciprocally telescoped over the rod, an upright conical bottom for the shell secured to the cylinder, and a releasable latching device on the shell for holding the bottom against the shell, said piston including orifices for retarding the flow of fluid within the cylinder in one direction.

9. A charging device for cupolas and the like comprising a hollow shell having a mouth, diametrically opposed trunnions for supporting the shell, an axially disposed rod in the shell, means fixed with respect to the shell supporting the rod for free swinging movement, a piston on the lower end of the rod, a cylinder telescoped over the piston and closed at each end, a bottom for the shell secured to the cylinder, said bottom having a generally conical cross section and extending upwardly into the shell, valve means in the piston for restricting the flow of hydraulic fluid in one direction, and latching means on the shell for holding the bottom to the shell.

10. A charging device for cupolas and the like comprising a hollow shell having a mouth, diametrically opposed trunnions for supporting the shell, a support member extending across the mouth of the shell, an upright conical bottom for the shell, latching means on the shell for releasably holding the bottom to the shell, and means for reciprocally supporting the bottom from the support member, said means including a hydraulic cylinder and piston assembly interconnected the support member and the bottom, the piston of said assembly having orifices therein for retarding movement of the bottom away from the shell and a universal joint between the rod and support member.

11. A charging bucket for cupolas and the like comprising a right cylindrical shell having open upper and lower ends, a transverse support member fixed with respect to the shell near the upper end, a universal joint on the support member, a bottom for the shell, a latch on the shell for releasably holding the bottom against the shell, and an upright hydraulic piston and cylinder assembly connecting said joint and bottom for continuously retarding downward movement of the bottom with respect to the shell.

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