Oct. 18, 1955 L. A. GIONET 2,721,073

SEALED CUPOLAS AND CHARGING APPARATUS THEREFOR

Filed Oct. 17, 1952 3 Sheets-Sheet 1

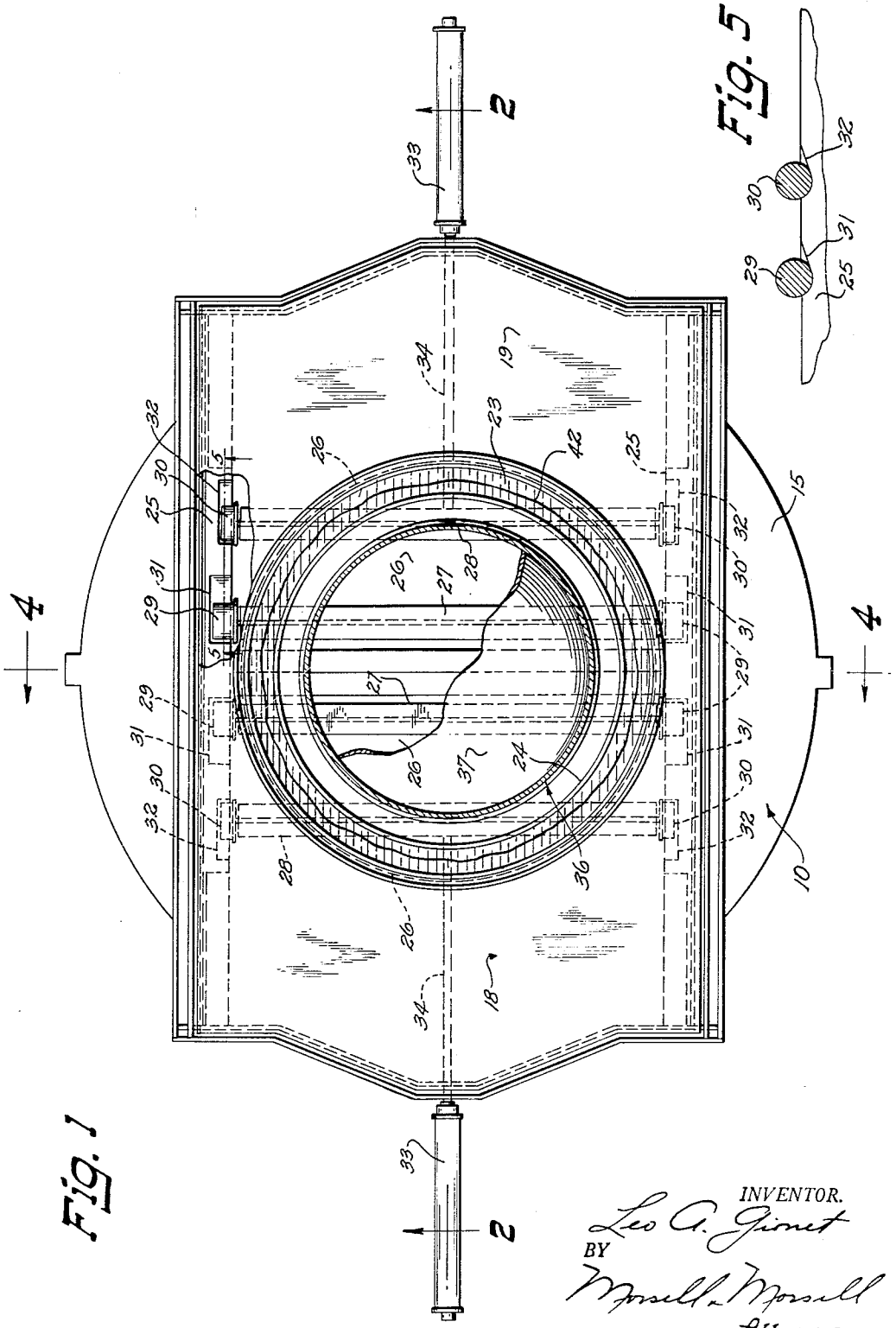


Fig. 1

Fig. 5

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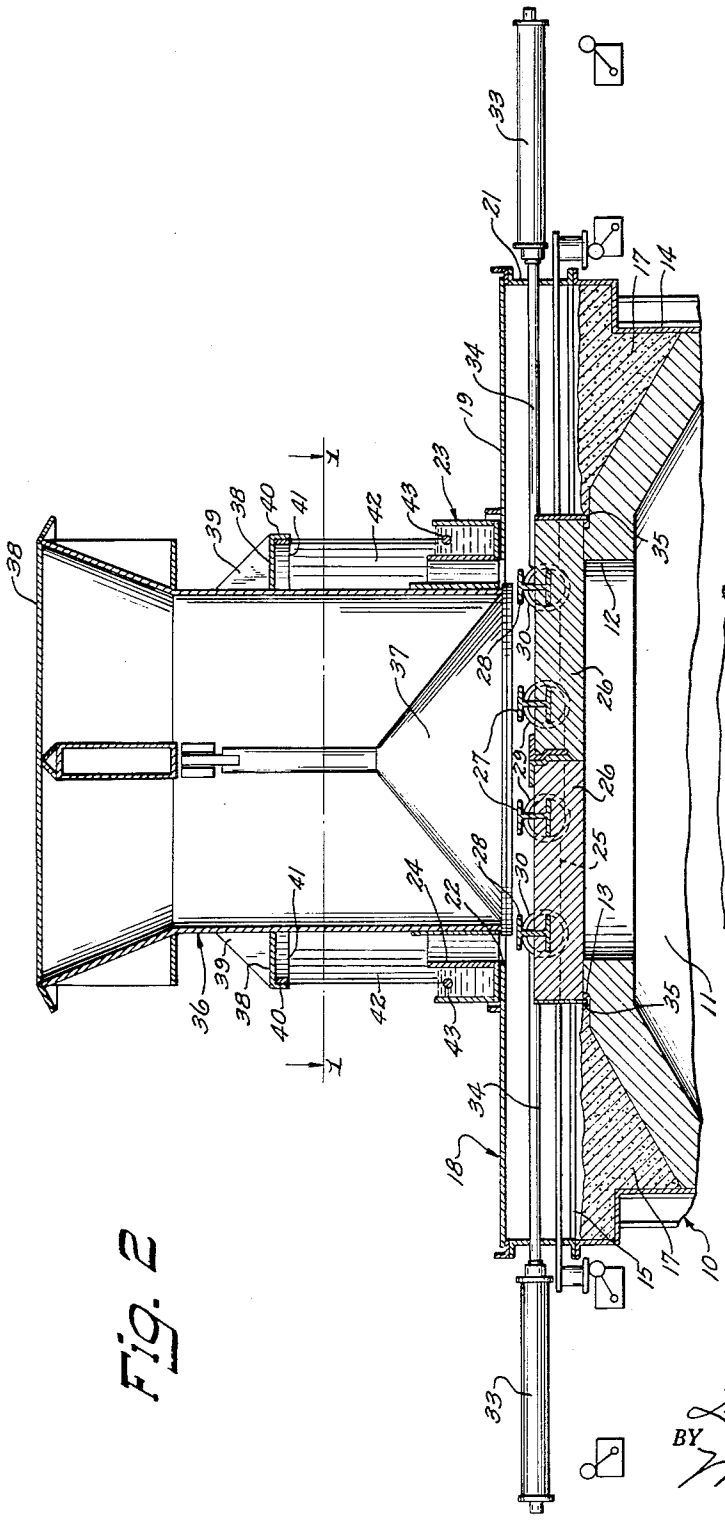


Fig. 2

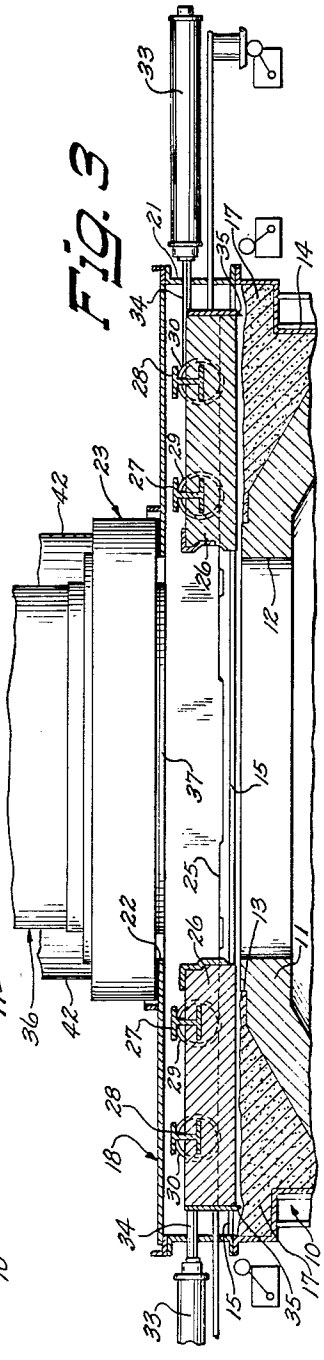


Fig. 3

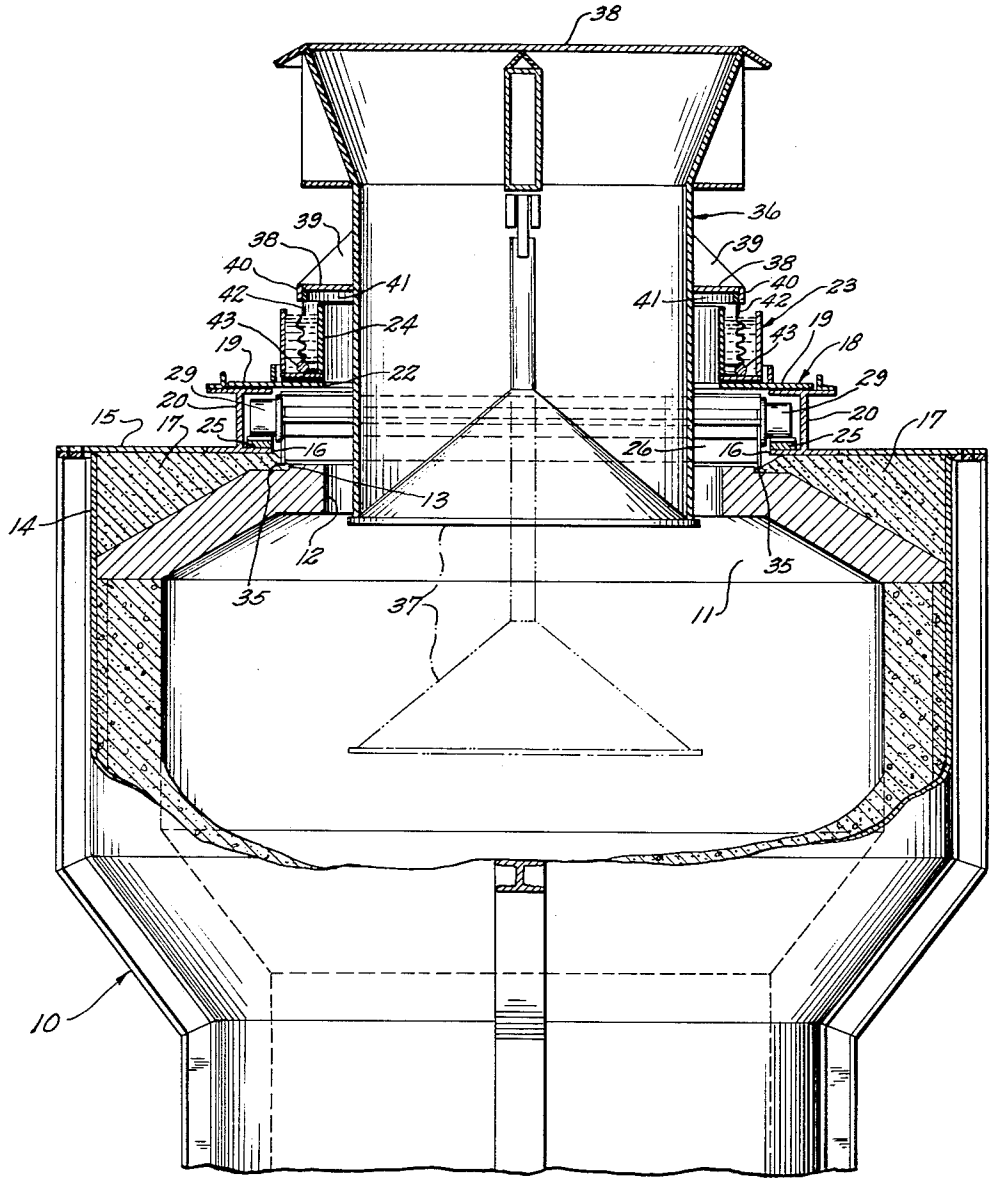
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Fig. 4



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SEALED CUPOLAS AND CHARGING APPARATUS THEREFOR

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Application October 17, 1952, Serial No. 315,368

9 Claims. (Cl. 266—27)

This invention relates to improvements in sealed cupolas and charging apparatus therefor.

Recent developments in the cupola art have shown that accurate control of the temperatures within a cupola, and hence accurate control of the quality of grey iron produced therein, can be maintained by operating the cupola in a sealed condition. When a cupola is sealed, the flow of incoming air and outgoing gases can be readily controlled, and this makes possible accurate control of the cupola temperatures.

In application of Harold W. Schwengel, Serial No. 279,877, filed April 1, 1952, one form of sealed cupola together with charging apparatus therefor is shown. The present invention relates to the same general subject matter.

It is a general object of the present invention to provide an improved sealed cupola and charging apparatus therefor wherein there are coacting means on the charging bucket and cupola for maintaining the cupola in sealed condition during a charging operation.

A further object of the invention is to provide an improved quick opening cupola door structure for normally sealing the charging opening of the cupola.

A more specific object of the invention is to provide in combination an improved cupola having an annular liquid filled trough surrounding the charging opening, and an improved charging bucket having a concentric annular flexible sleeve, sealed at its upper end to said bucket and of such diameter that when the bucket is lowered into charging position the lower end of said curtain is submerged in the liquid in said trough to maintain the sealed condition of the cupola, the flexibility of said annular sleeve permitting axial compression of said sleeve during vertical movement of the bucket, thereby maintaining the seal during such movement.

A further object of the invention is to provide an improved cupola having a pair of sliding doors normally closing the charging opening, the doors and cupola being provided with novel cooperating sealing means.

With the above and other objects in view, the invention consists of the improved sealed cupola and charging apparatus therefor, and all of the parts and combinations as set forth in the claims, and all of their equivalents.

In the drawings accompanying and forming a part of this specification, wherein one complete embodiment of the preferred form of the invention is shown, and wherein like characters of reference indicate the same parts in all of the views:

Fig. 1 is a sectional plan view of the improved cupola and charging bucket therefor taken along the line 1—1 of Fig. 2;

Fig. 2 is a fragmentary vertical sectional view of the improved cupola and charging bucket construction taken along the line 2—2 of Fig. 1 and showing the bucket in sealing position at the top of the cupola and showing the cupola doors in closed position;

Fig. 3 is a fragmentary view similar to Fig. 2 showing the doors in open position;

Fig. 4 is a vertical sectional view taken along the line 4—4 of Fig. 1 showing the doors open, and showing the bucket lowered into charging position; and

Fig. 5 is a fragmentary vertical sectional view taken approximately along the line 5—5 of Fig. 1.

Referring more particularly to the drawings, the numeral 10 indicates a cupola having a top wall 11 provided with a central opening 12. The wall 11 is formed with an upstanding annular lip 13 at the margin of the opening 12. The cupola 10 has a metal outer jacket which includes a cylindrical side wall portion 14 and a flat top wall portion 15. Said top wall portion 15 is formed with an elongated aperture 16 (Fig. 4) which extends diametrically across the top of the cupola and which has a width greater than the outer diameter of the annular lip 13. The space between the cupola lip 13 and the jacket side wall 14, which space is above the cupola top wall, forms an annular receptacle for a bed 17 of loose sand, or other suitable material, the purpose of which will be hereinafter described.

Sealingly mounted on the flat top wall portion 15 of the outer jacket is an elongated, box-like, and generally rectangular casing 18 having a flat top wall 19, vertical side walls 20, and vertical end walls 21. The top wall 19 is formed with an aperture 22 which is vertically alined with the top opening 12 of the cupola. Sealingly mounted on the top wall 19 of casing 18 is an annular trough 23 which surrounds the opening 22 and has an inner wall substantially coextensive with the margin of the opening 22. The trough 23 is normally filled with a liquid, preferably water.

Mounted on the plate 15 adjacent the margin of opening 16 and adjacent the side walls 20 of casing 18 are parallel rails 25, one on each side, forming a trackway. A pair of generally semi-circular, horizontal doors 26 is normally positioned on the cupola lip 13, and when in abutment with each other as shown in Figs. 1 and 2, serve to close the cupola opening 12. Each door 26 has a pair of parallel transverse I-beam members embodied therein and projecting from its sides. The beams which are nearest the meeting edges of doors 26 are indicated by the numeral 28. The beams 27 and 28 terminate adjacent the rails 25. Rotatably mounted on the ends of the beams 27 are flanged supporting wheels 29, and similarly mounted on the ends of beams 28 are flanged wheels 30, the latter being narrower than the wheels 29 as shown in Fig. 1.

The rails 25 have depressions 31 in which the wheels 29 are normally positioned and have depressions 32 in which the wheels 30 are normally positioned. As shown in Fig. 1 the depressions 32 are narrower than the wheels 29. Mounted at opposite ends of the casing 18 are horizontal hydraulic rams 33, each having a piston rod 34 extending slidably through the adjacent casing end wall to connect with one of the doors 26. The rams 33 are operable to move the doors 26 between a normal closed position shown in Figs. 1 and 2 and an open retracted position shown in Figs. 3 and 4.

A semi-circular flange 35 depends from the arcuate edge of each door 26 and has a lower knife edge which normally penetrates the sand bed 17. This provides a gas seal around the cupola top opening 12. When the doors 26 are moved to open position by rams 23, the wheels 29 and 30 move out of depressions 31 and 32 and travel along the top surfaces of rails 25. As the wheels move out of the depressions the doors 26 are lifted so that the flanges 35 are disengaged from the sand bed 17 as shown in Fig. 3. When the wheels 29 are moving along the rails 25 they do not enter the depressions 32 because said wheels travel along the top surface portions of said rails which are outwardly of said depressions.

Referring to Figs. 2 and 4, a cylindrical cupola charging bucket **36**, having an open lower end, is provided with a vertically movable bottom bell **37** which bell normally closes the lower end of the bucket. Bucket **36** is also provided with a removable cover **38** normally sealing its open upper end. Suitable mechanism (not shown) is provided for removing the cover **38** and for lowering the bell **37** relative to the bucket, as well as for movably supporting the bucket **36**. These mechanisms form no part of the present invention and may be similar to those shown in the Schwengel application, Serial No. 279,877 hereinbefore referred to.

As shown in Figs. 2 and 4, an annular flange **38** projects radially outwardly from an intermediate portion of the bucket **36** and said flange may be reinforced by suitable members, such as gussets **39**. A downwardly projecting annular flange **40** may be formed on the peripheral edge of the flange **38**. Clampingly engaged between the flange **40** and a clamping ring **41**, is the upper end of a vertical sleeve **42**. A weight in the form of a metal ring **43** is suitably connected to the lower margin of the sleeve **42** as shown, said ring and sleeve having a diameter of a size to readily fit into the trough **23**. The sleeve **42** is made of any suitable flexible sheet material which is substantially gas tight, said sleeve being sealingly connected to the flange **40** throughout its entire periphery.

Operation

In the operation of the improved apparatus, the bucket is filled at a loading station remote from the top of the cupola while the cover **38** is removed and while the bell **37** is closing the bottom of the bucket. During this interval the cupola doors **26** are in their normal closed position. The loaded bucket is then moved to the position shown in Fig. 2 above and in vertical alignment with the cupola opening **12**. In this position the ring **43** and the lower end portion of the sleeve **42** are immersed in the liquid in the trough **23**.

While the bucket is in the position of Fig. 2 the cover **38** is placed over the open upper end of the bucket to seal the latter, and the rams **33** are actuated to move the doors **26** to the open position shown in Fig. 3. During the opening of the doors the sealed condition of the cupola is maintained by the immersion of the sleeve **42** in the water of trough **24**.

The bucket **36** is then lowered to the charging position of Fig. 4, the lower end of the bucket moving through the cupola opening **12**. As the bucket is thus lowered, the sleeve **42** acquires a plurality of folds as shown in Fig. 4, thus maintaining the cupola seal during the lowering movement of the bucket. After the bucket has been thus lowered to charging position, the bell **37** is lowered away from the bottom of the bucket to the dot and dash line position of Fig. 4, permitting the contents of the bucket to be discharged into the cupola. During emptying of the bucket the cover **38** as well as sleeve **42** and trough **23** maintain the sealed condition of the cupola.

After the bucket **36** has been emptied, the bell **37** is raised to the solid line position of Fig. 4, and the bucket is raised to the position of Figs. 2 and 3 to permit the doors **26** to be closed. The cover **38** is then removed from the bucket, and after the doors **26** have been closed said bucket is moved to the loading station to begin a new charging cycle.

The improved apparatus maintains the cupola in sealed condition at all times, thus permitting accurate control of the temperatures therein. The improved seal structure is simple in construction and efficient in operation.

Various changes and modifications may be made without departing from the spirit of the invention, and all of such changes are contemplated as may come within the scope of the claims.

What I claim is:

1. In combination: a cupola having a top wall formed with an opening; a pair of cooperating horizontal doors mounted for lateral movement into and out of sealing engagement with said opening; a casing on said cupola top wall enclosing said opening and doors, said casing having a top opening vertically aligned with said cupola top opening; a liquid-containing trough sealed to said casing around the top opening thereof; a charging bucket movable to a predetermined position at the top of said cupola in vertical alignment with said casing and cupola top openings and for movement from said predetermined position downwardly into said openings to cupola charging position; and a sealing sleeve of flexible sheet material depending from said bucket and having its upper end sealed to said bucket, said sleeve having a lower end portion positioned for submersion in the liquid in said trough to form a seal between said bucket and cupola when the bucket is in said predetermined position, said doors being movable to said open position while the bucket is in said predetermined position, and the flexibility of said curtain permitting vertical movement of the bucket between said predetermined and charging positions without breaking the seal provided by said sleeve and trough.

2. In combination: a cupola having a top wall formed with an opening; a pair of cooperating horizontal doors mounted for lateral movement into and out of sealing engagement with said opening; a casing on said cupola top wall enclosing said opening and doors, said casing having a top opening vertically aligned with said cupola top opening; a liquid-containing trough sealed to said casing around the top opening thereof; a charging bucket movable to a predetermined position at the top of said cupola in vertical alignment with said casing and cupola top openings and for movement from said predetermined position downwardly into said openings to cupola charging position; and a sealing sleeve of flexible sheet material depending from said bucket and having its upper end sealed to said bucket, said sleeve having a weighted lower end portion positioned for submersion in the liquid in said trough to form a seal between said bucket and cupola when the bucket is in said predetermined position, said doors being movable to said open position while the bucket is in said predetermined position, and the flexibility of said curtain permitting vertical movement of the bucket between said predetermined and charging positions without breaking the seal provided by said sleeve and trough.

3. In combination, a cupola having a top wall provided with an opening, a movably mounted closure for said opening, a charging bucket adapted for downward movement toward said opening of the cupola to discharge therein, a trough surrounding said opening, means for supporting said trough on the cupola in sealing relationship therewith without interfering with movement of said closure, a flexible curtain sealed to and surrounding said bucket and having its lower edge of a size and contour to fit in said trough when the bucket is in alignment with said opening, means in said trough cooperating with said lower edge of said curtain for effecting a seal before the bucket has completed its movement to discharge position whereby the closure for the opening of the cupola may be moved to open position while said sealing relationship between said curtain and trough is established, the flexibility of the curtain permitting further downward movement of the bucket to final discharge position with respect to said cupola while still maintaining said sealing relationship.

4. In combination, a cupola having a top wall provided with an opening, a movably mounted closure for said opening, a charging bucket adapted for downward movement toward said opening of the cupola to discharge therein, a housing within which said closure is movable, said housing being sealed at its edges to the top of the cupola and having a top opening in registration with the top opening of the cupola, a trough mounted on said housing and surrounding the housing opening, a flexible curtain sealed to and surrounding said bucket and having a lower edge of a size and shape to fit in said trough when the bucket is

in alignment with the cupola opening, means in said trough cooperating with said lower edge of said curtain for effecting a seal before the bucket has completed its movement to discharge position whereby the closure for the opening of the cupola may be moved to open position while said sealing relationship between said curtain and trough is established, the flexibility of the curtain permitting further downward movement of the bucket to final discharge position with respect to said cupola while still maintaining said sealing relationship.

5. In combination, a cupola having a top wall provided with an opening, a movably mounted closure for said opening, a charging bucket adapted for downward movement toward said opening of the cupola to discharge therein, a trough surrounding said opening, means for supporting said trough on the cupola in sealing relationship therewith without interfering with movement of said closure, a flexible curtain sealed to the sides of said bucket at a distance above the bottom of the bucket and surrounding the latter and having a lower edge of a size and shape to fit in said trough when the bucket is in alignment with said cupola opening, means in said trough cooperating with said lower edge of said curtain for effecting a seal before the bucket has completed its movement to discharge position whereby the closure for the opening of the cupola may be moved to open position while said sealing relationship between said curtain and trough is established, the flexibility of the curtain permitting further downward movement of the bucket to final discharge position with respect to said cupola while still maintaining said sealing relationship.

6. In combination, a cupola having a top wall provided with an opening, a movably mounted closure for said opening, a charging bucket adapted for downward movement toward said opening of the cupola to discharge therein, a trough surrounding said opening, means for supporting said trough on the cupola in sealing relationship therewith without interfering with movement of said closure, an annular flange secured to the side of the bucket above the lower end thereof and projecting laterally outwardly, a flexible curtain having its upper end connected to a projecting portion of said flange and suspended therefrom around the bucket and having its lower edge of a size and shape to fit in said trough when the bucket is in alignment with said opening, means in said trough cooperating with said lower edge of said curtain for effecting a seal before the bucket has completed its movement to discharge position whereby the closure for the opening of the cupola may be moved to open position while said sealing relationship between said curtain and trough is established, the flexibility of the curtain permitting further downward movement of the bucket to final discharge position with respect to said cupola while still maintaining said sealing relationship.

7. In combination, a cupola having a top wall provided with an opening, a trough surrounding said opening, a

charging bucket adapted for downward movement toward said opening of the cupola to discharge therein, a flexible curtain sealed to said bucket above its lower end and surrounding the bucket and having a lower edge of a size and shape to fit in said trough when the bucket is in alignment with said cupola opening, means in said trough cooperating with said lower edge of said curtain for effecting a seal before the bucket has completed its movement to discharge position, the flexibility of the curtain permitting further downward movement of the bucket to final discharge position with respect to the cupola opening while still maintaining the sealing relationship.

8. In combination, a cupola having a top wall provided with an opening, a trough surrounding said opening, a charging bucket adapted for downward movement toward said opening of the cupola to discharge therein, a flexible curtain sealed to said bucket above its lower end and surrounding the bucket, and having a lower edge of a size and shape to fit in said trough when the bucket is in alignment with said cupola opening, weighted means on said lower edge, means in said trough cooperating with said lower edge of said curtain for effecting a seal before the bucket has completed its movement to discharge position, the flexibility of the curtain permitting further downward movement of the bucket to final discharge position with respect to the cupola opening while still maintaining the sealing relationship.

9. In combination, a cupola having a top wall provided with an opening, a trough surrounding said opening, a charging bucket adapted for downward movement toward said opening of the cupola to discharge therein, an annular flange secured to the side of the bucket above the lower end thereof, and projecting laterally outwardly, a flexible curtain suspended from a projecting portion of said flange and surrounding the bucket and having a lower edge of a size and shape to fit in said trough when the bucket is in alignment with said cupola opening, means in said trough cooperating with the lower edge of said curtain for effecting a seal before the bucket has completed its movement to discharge position, the flexibility of the curtain permitting further downward movement of the bucket to final discharge position with respect to the cupola opening while still maintaining the sealing relationship.

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