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MATERIAL FEEDING HOPPER

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FIG. 1

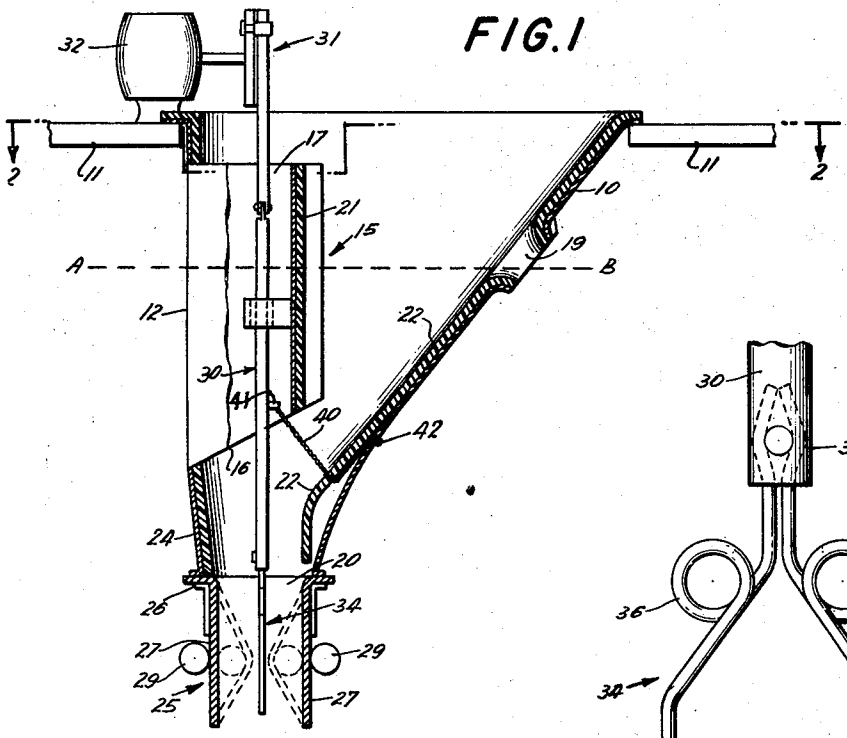
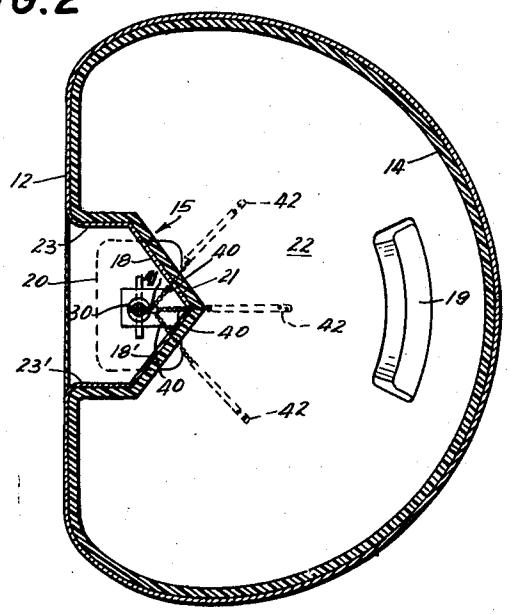


FIG. 3

FIG. 2



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MATERIAL FEEDING HOPPER

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17 Claims. (Cl. 222—227)

This invention relates to an improved hopper for feeding comminuted material, that is, powdery or granular material.

One of the objects of the invention is the provision of an improved hopper for feeding comminuted material at an accurately controlled rate.

A further object is to provide a hopper of the character indicated of such construction that vaults or bridges in the material in the hopper are eliminated, even during humid or sticky weather.

Still another object of the invention is to provide a hopper which has a substantially uniform and regular flow of material therefrom at any flow rate chosen within the range of which the hopper is capable.

Yet another object of the invention is the provision of an improved hopper which may be used advantageously with apparatus wherein the rate of discharge of material from the hopper is governed by an automatically weighing balance.

The above and further objects and novel features of the present invention will more fully appear from the following detailed description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only and are not intended as a definition of the limits of the invention.

In the drawings, wherein like characters refer to like parts throughout the several views,

Fig. 1 is a somewhat diagrammatic view, partially in vertical section and partially in side elevation, of one embodiment of hopper according to the invention;

Fig. 2 is a horizontal section through the hopper of Fig. 1, the section being taken generally on the line 2—2 of Fig. 1; and

Fig. 3 is a fragmentary view in side elevation of the lower end of the stirrer member associated with the hopper.

In the embodiment of the hopper shown, the casing 10 of the hopper, which is made, for example, of metal, is supported at its upper end by portions of a fixed frame-work fragmentarily shown at 11. The hopper has one generally flat vertically disposed wall 12, at the left in Figs. 1 and 2, the remainder of the wall being convexly curved in horizontal section as shown in Fig. 2, the curved portion of the wall slanting inwardly and downwardly as shown in Fig. 1. The hopper is ordinarily filled with comminuted material to the level indicated by the line A—B in Fig. 1, there being a centrally located overflow opening 19 in the curved wall portion of the hopper generally located at line A—B.

Secured to the flat wall 12 of the hopper centrally thereof in plan is a vertically disposed displacement body, in the form of a channel member 15, which limits the flow area of the material in the hopper and provides protection for the main vertical extent of a stirrer rod 30, to be described. In the embodiment shown, member 15 has a horizontal section of prismatic form, specifically being in the form of a laterally symmetrical pentagon having a broad base formed by a portion of wall 12 of the hopper. Channel 15 is vertically located in the hopper so that its upper end 17 lies markedly above the line A—B and overflow opening 19.

The flat wall 12 and the curved and tapered wall 14 of the hopper are joined, adjacent the lower end of the hopper, to a generally square discharge chute 20. Channel member 15 terminates somewhat above the upper end of chute 20, the two inner walls 18 and 18' of the channel 15 having their lower edges lying in a horizontal plane, the two side walls 23 and 23' of the channel slanting downwardly and to the left as indicated at 16 in Fig. 1.

In accordance with the invention, the area of the horizontal section of displacement body 15 is at least equal to the area of the horizontal section of chute 20, and the free space or flow area in the hopper throat, that is, immediately above chute 20, is equal at most to three times the area of the horizontal section of the chute.

The inner walls of the hopper and the walls of body 15 which contact material in the hopper are preferably provided with lining layers of smooth plastic material, a layer 21 of such material being shown on channel 15, and lining layers 22 and 24 being provided on walls 14 and 20 of the hopper and chute, respectively.

The chute 20 is provided with a selectively operable adjustable valve 25 which, in the embodiment shown, is formed by opposed flexible linings 27 connected to the upper end of the chute at the joint 26 between the chute and the hopper and to the lower ends of the chute walls. Lining members 27, which may be made for example of rubber, are pressed inwardly to various predetermined extents by opposed adjustable rollers 29, thereby to alter the area of flow of material outwardly through chute 20 in a controlled manner.

The material in the hopper and in the chute 20 is continuously agitated to maintain it free from vaults and bridges by a vertically reciprocable stirrer rod 30 which extends vertically centrally through channel 15 downwardly into chute 20. Rod 30 is reciprocated by a crank means 31 driven by motor 32 mounted on a frame 11. The lower part 34 of rod 30, shown more clearly in Fig. 3, is made up of a wire bent into a laterally symmetrical shape lying in a plane. Such lower part 34, which is joined to the rod 30 at 35, has on each side thereof a reverse bend 36 from which the wire extends in a vertical run 37 and thence into a generally horizontally extended run having sinusoidal bends 39 therein. The rod 30 and its lower end portion 34 continuously reciprocate in the throat and chute portions of the hopper to maintain the material lying therein in freely fluent form regardless of the opening to which valve 25 is adjusted.

In order to maintain the material in the hopper above the throat in freely fluent condition, there are provided means whereby the lining layers in the hopper above the throat are continuously constricted and relaxed during the operation of the hopper. In the hopper such constriction and relaxation of the lining are effected by three chains 40 which extend from a connection 41 adjacent the lower end of stirrer rod 30 downwardly through grommets in the plastic lining layer 22, the chains then extending upwardly between the lining layer and wall 14 of the hopper to connections with said wall, shown generally at 42. It will be understood that when rod 30 moves upwardly chains 40 pull the lower end of flexible lining layer 22 inwardly, and that when rod 30 descends, the lining layer is allowed to relax generally into contact with wall 14 of the hopper. As a result the material in the hopper is continuously subjected to forces which squeeze it inwardly and then releases it as it travels downwardly into the narrowing throat of

the hopper above chute 20. Thus, the material is continuously kept in a "live" state, so that no vaults or bridges can form therein even under extremely humid conditions.

During use of the hopper, comminuted material, that is, material in powdery or granular form, is fed into the hopper at a location laterally removed from displacement body 15, so that the interior of such body remains empty except for such material as wells up into the bottom end thereof. The hopper is usually kept filled to the level A—B, excess material escaping from opening 19 and being returned to the hopper by appropriate means, not shown. The rate of flow of material is controlled by moving members 29 toward or away from each other as required to cause flexible members 27 to define a discharge opening of the requisite area for the desired rate of flow. Just before members 27 are pressed together to stop the discharge of material through chute 20, motor 32 is stopped so that part 34 of the stirrer device is at rest when it is pinched between members 27.

Although only one embodiment of the invention has been illustrated in the accompanying drawings and described in the foregoing specification, it is to be expressly understood that the invention is not limited thereto since various changes may be made therein without departing from the spirit and scope of the invention as the latter will now be undersood by those skilled in the art.

What is claimed is:

1. A hopper for feeding comminuted material comprising an upper portion of downwardly tapering section, said hopper having a lower discharge opening below said upper portion, a flow-limiting displacement body located in the hopper vertically above the discharge opening, the displacement body having vertical walls and an effective horizontal section at least equal to the horizontal section of the discharge opening, the displacement body being of such length and being so located in the hopper that the area of the most constricted zone between the walls of the hopper and the displacement body is no greater than three times the area of the outlet opening.

2. A hopper as defined in claim 1, said hopper having an overflow opening in the upper portion of the hopper, said overflow opening being located below the upper end of the displacement body.

3. A hopper as defined in claim 1, wherein the displacement body has vertical prismatic walls.

4. A hopper as defined in claim 3, wherein the displacement body is laterally symmetrical, and has a centrally disposed vertical edge.

5. A hopper as defined in claim 4, wherein the displacement body is hollow, and has opposite lower edges thereof inclined downwardly away from the lower end of said vertical edge.

6. A hopper for feeding comminuted material comprising an upper portion of downwardly tapering section, said hopper having a lower discharge opening below said upper portion, a flow-limiting displacement body located in the hopper above the discharge opening, the displacement body having vertical walls, a lining of smooth material on the inner wall of the hopper and the wall of the displacement body exposed to the material in the hopper, zones of the lining being displaceable inwardly of the hopper wall, and means for periodically thus displacing the lining at said zones.

7. A hopper as defined in claim 6, comprising a stirrer member vertically reciprocable in the discharge opening.

8. A hopper as defined in claim 7, comprising means connecting said displaceable zones of the lining to the stirrer member, whereby reciprocation of the member causes alternate inward and outward displacement of the said zones of the lining.

9. A hopper as defined in claim 8 wherein the stirrer member is a generally flat open-framed laterally symmetrical bent wire member having loops on opposite sides thereof and generally disposed in the discharge opening.

10. A hopper for feeding comminuted material comprising an upper portion of downwardly tapering section, said hopper having a lower discharge opening below said upper portion, a flow-limiting displacement body located in the hopper vertically above the discharge opening, the displacement body having vertical walls, a stirring device having a vertically reciprocable member passing through the displacement body and into the discharge opening and driving means located above the displacement body connected to the reciprocable member adjacent the upper end thereof.

11. A hopper for feeding comminuted material comprising an upper portion of downwardly tapering section, said hopper having a lower discharge opening below said upper portion, a flow-limiting displacement body located in the hopper above the discharge opening, the displacement body having vertical walls, a stirring device having a vertically reciprocable member passing through the displacement body and into the discharge opening, a flexible lining in the hopper, zones of the lining being inwardly displaceable, and means connecting said zones of the lining to the stirring device whereby alternately to constrict and expand the lining as the member of the stirring device reciprocates.

12. A hopper for feeding comminuted material comprising an upper portion of downwardly tapering section, said hopper having a lower discharge opening below said upper portion, a flow-limiting displacement body located in the hopper vertically above the discharge opening so as substantially completely to mask the discharge opening in a vertical direction, whereby material flowing to the discharge opening must flow laterally thereto in the hopper, the displacement body having vertical walls and an effective horizontal section at least equal to the horizontal section of the outlet opening, the displacement body being of such length and being so located in the hopper that the area of flow of material of the most constricted zone between the walls of the hopper and the displacement body is no greater than three times the area of the outlet opening.

13. A hopper as defined in claim 12, said hopper having an overflow opening in the upper portion of the hopper, said overflow opening being located below the upper end of the displacement body.

14. A hopper as defined in claim 12, wherein the displacement body has vertical prismatic walls.

15. A hopper as defined in claim 14, wherein the displacement body is laterally symmetrical, and has a centrally disposed vertical edge.

16. A hopper as defined in claim 15, wherein the displacement body is hollow, and has opposite lower edges thereof inclined downwardly away from the lower end of said vertical edge.

17. A hopper for feeding comminuted material comprising an upper portion of downwardly tapering section, said hopper having a lower discharge opening below said upper portion, a flow-limiting displacement body located in the hopper vertically above the discharge opening, in such a manner that the area of flow of material between the walls of the hopper and the displacement body is no greater than three times the area of the outlet opening, the said body having vertical walls, and a stirring device having a vertically reciprocable member passing through the displacement body and into the discharge opening.

References Cited in the file of this patent

UNITED STATES PATENTS

880,374	Fanning	Feb. 25, 1908
1,117,058	Kohner	Nov. 10, 1914
1,504,543	Draver	Aug. 12, 1924
2,260,926	Wright	Oct. 28, 1941
2,715,980	Frick	Aug. 23, 1955