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FLOW FACILITATING MEANS FOR GRAVITY HOPPERS

Filed April 7, 1925

FIG. I.

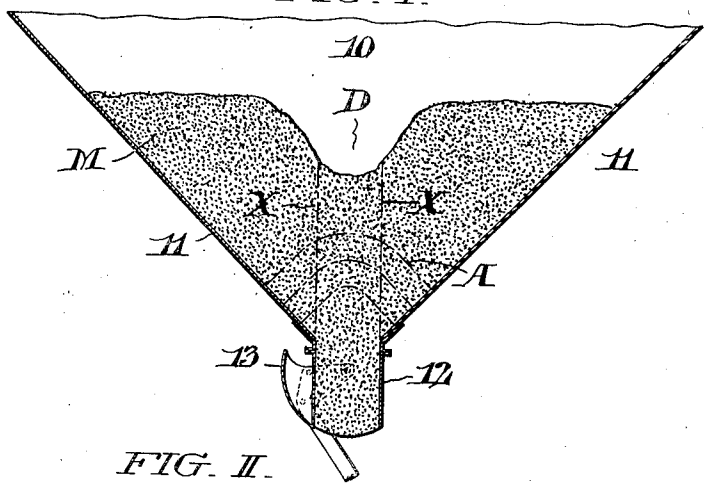


FIG. II.

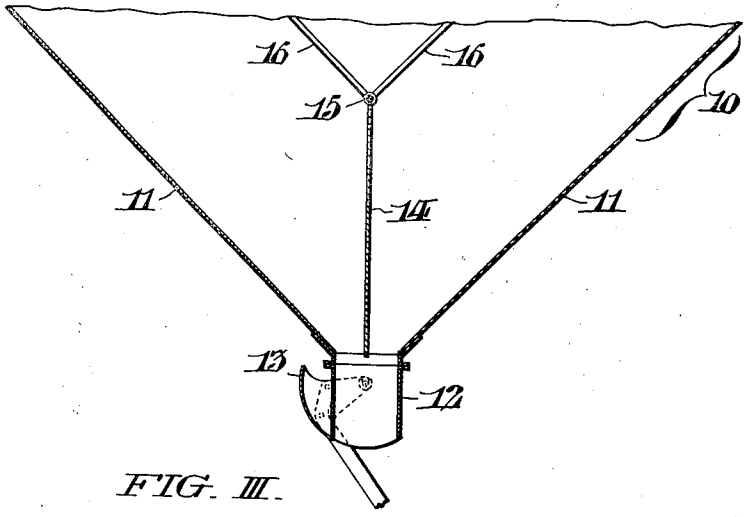
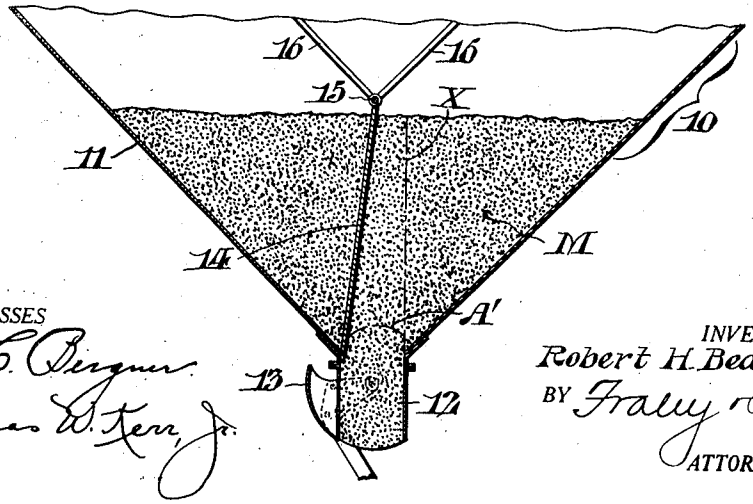


FIG. III.



WITNESSES

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UNITED STATES PATENT OFFICE.

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FLOW-FACILITATING MEANS FOR GRAVITY HOPPERS.

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This invention relates to bunkers or hoppers of the kind commonly used for storage of pulverulent or granular materials like cement, sand, gravel, coal, etc. Such hoppers usually have opposite side walls complementarily sloped to direct the gravitating contents to bottom discharge outlets. When the material is very fine and in a damp or wet condition, difficulty is invariably experienced in effecting proper discharges, owing to a tendency of the material to clog over the hopper outlet.

The objects of my present invention are to obviate the contingency above referred to, and to provide a very simple, reliable and efficient means to that end.

With reference to the drawings herewith, Fig. I is a sectional elevation of a standard type of gravity discharge hopper showing, diagrammatically, the conditions obtaining during delivery of pulverulent or finely divided granular material through the bottom discharge outlet.

Fig. II shows the same hopper equipped with my improved flow facilitating means; and

Fig. III shows said means in one of its operative positions.

In order to expedite proper understanding of this invention, I will first briefly describe, by way of introduction, the conditions that I have observed to prevail ordinarily in the operation of gravity discharge bunkers or hoppers. For this purpose attention is directed to Fig. I of the drawings wherein the hopper, comprehensively designated 10, has its opposite side walls 11, 11 complementarily inclined or sloped to direct the pulverulent or granular material M toward the central bottom outlet 12, the latter being controllable by a swinging closure gate 13 of standard or conventional form. In discharging, only that material vertically above the outlet and between the dotted lines X flows at first, with incidental formation of a medial depression D at the surface. As the discharge proceeds and the depression D deepens, the bulk of the material at the sides will roll over at the top and at the same time shift downward along the sloping walls 11 of the hopper. Lateral pressure is thus exerted from opposite sides against the vertically-moving column X seeking to escape through the outlet, thereby tending to arrest the progress of said column. When this lateral pressure becomes sufficiently potent to overcome the effect of gravity upon the column, flow will cease entirely through arching of the material across the outlet 12 as indicated graphically by the curved dotted lines A in the illustration, the convergingly-sloped side walls 11 affording the buttresses tending to sustain the heels or footings of the arch.

In accordance with my invention, I insure free flow through the hopper outlet 12 by preventing the material from arching in the manner above described, or, to be more specific, by depriving the arch of the footing necessary to sustain it. The means whereby I accomplish this end is shown in Fig. II as having the form of a vertical diaphragm 14 that is hung within the hopper 10 centrally between its sloping side walls 11, from a horizontally-disposed pivot axis 15. Any approved expedients such as suspension rods 16 may be employed to support the axis 15 securely in position. As the material M is dumped into the hopper 10, the diaphragm 14 swings on its axis 15, toward one or the other side 11 of said hopper, coming to rest after the manner shown in Fig. III. Here again, and as before, the material in the column X vertically above the outlet 12 is the first to move during the discharge of the hopper, said lateral limits of the column being defined on the one hand by the diaphragm 14, and on the other, by the dotted prolongation of the opposite side of the outlet 12. By such interposition of the diaphragm 14, it will however be observed that one of the sloping walls 11 of the hopper is eliminated as a source of lateral pressure and also as a footing for arch formation. Assuming that an arch as indicated at A^1 in Fig. III could form, the footing afforded by the side wall 11 of the hopper now opposing the diaphragm, could not resist the pressure of the mass of material shifting downward along the slope so that said arch would collapse at the foot before the crown could really form. By thus eliminating the source of congestion at the region of the hopper outlet 12, it will be apparent that I am able to insure a continuous and free discharge flow notwithstanding the fineness of the material or its

condition as to moisture content. It will of course be understood that when the material in the hopper 10 at one side of the diaphragm 14 is exhausted, the latter will yield under pressure of the material at the other side thereof and be swung in the direction opposite to that shown in Fig. III, and function thereafter in precisely the same manner as before. As shown in Figs. II and III, the diaphragm 14 is only in the lower region of the hopper, where packing and arching of the contents tend to occur. It does not, however, extend by any means to the top of the hopper, and hence does not interfere with complete filling of the hopper from either side.

While a rigid control partition 14 within the hopper 10 would serve to prevent arch formation, I prefer the use of a pendulant diaphragm of the character described so as to avoid restricting the gate opening. In either case, however, (whether free to swing under the impulsion of the material, or fixed) the partition serves passively, by its mere presence, to prevent arching of the material in the hopper, without any external actuation whatever.

Having thus described my invention, I claim:

1. In combination with a sloping sided hopper having a bottom outlet, an anti-bridging plate pivoted below the top of the hopper to swing freely therein and of such length that its lower terminus can swing from the lower end of one inclined side of the hopper adjacent the bottom outlet to the lower end of the inclined portion of the hopper adjacent the other side of the outlet, and a chute section attached to the hopper at the outlet thereof.

2. The combination with a sloping sided hopper having an outlet between them of an anti-bridging diaphragm suspended between the oppositely sloping hopper walls said diaphragm being free to swing toward either of them under the impulsion of material in the hopper so as to prevent arching of said material across the hopper outlet.

In testimony whereof, I have hereunto signed my name at Philadelphia, Pennsylvania, this second day of April, 1925.

ROBERT H. BEAUMONT.