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P. GOEBELS

1,971,852

PROCESS FOR STIRRING UP FARINACEOUS MATERIALS IN RECEPTACLES OF
ANY KIND BY COMPRESSED AIR, COMPRESSED GAS, OR THE LIKE

Filed June 1, 1932

2 Sheets-Sheet. 1

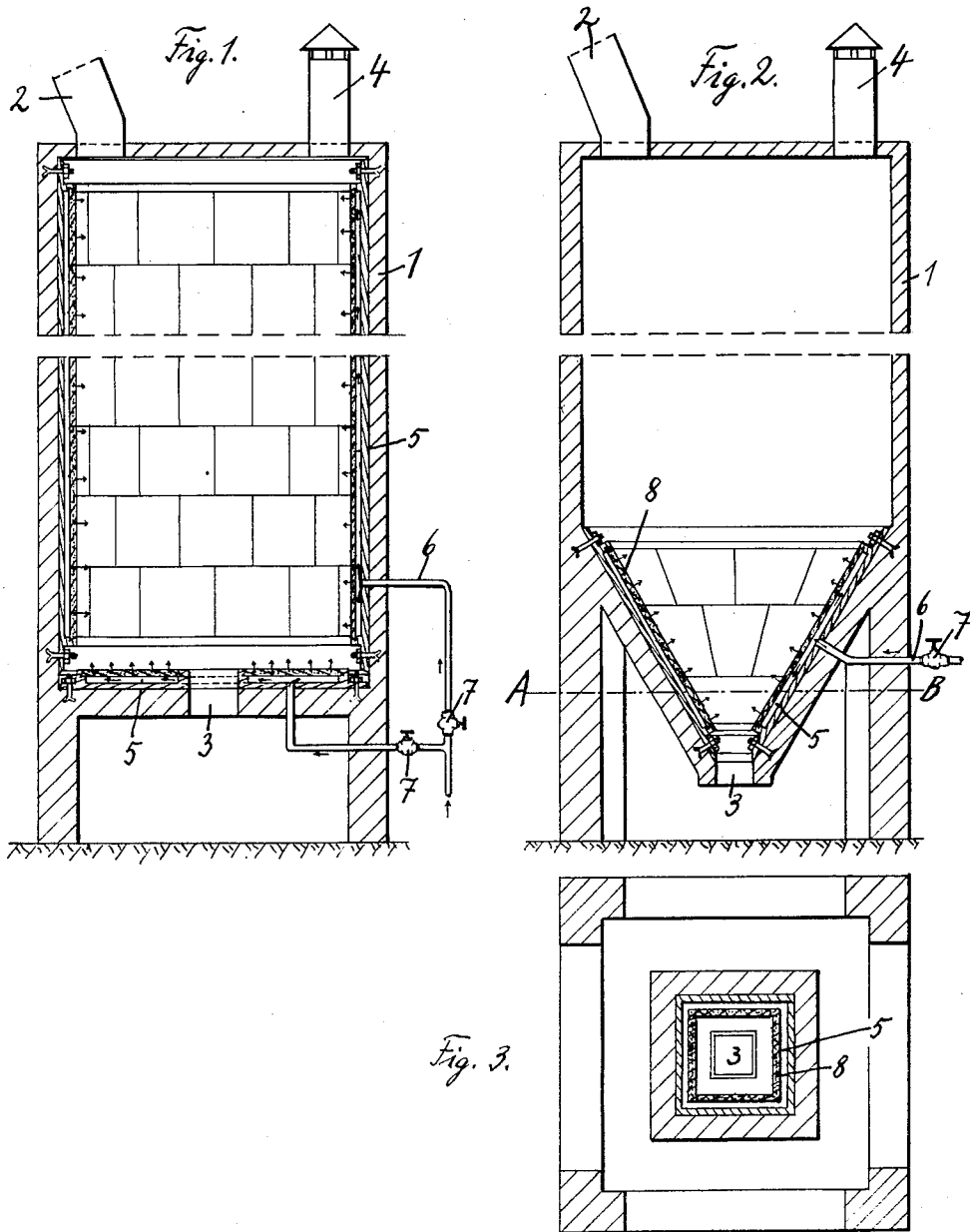


Fig. 3.

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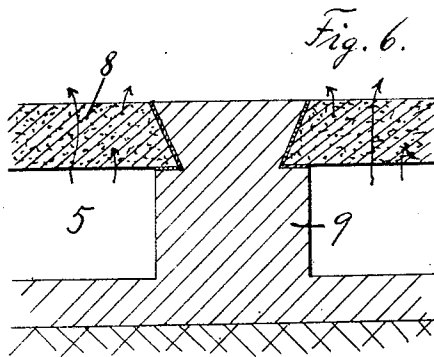
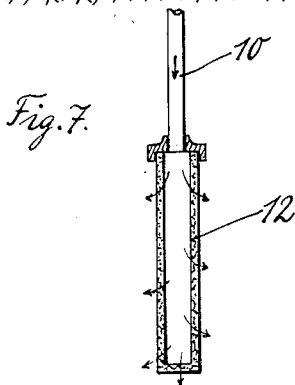
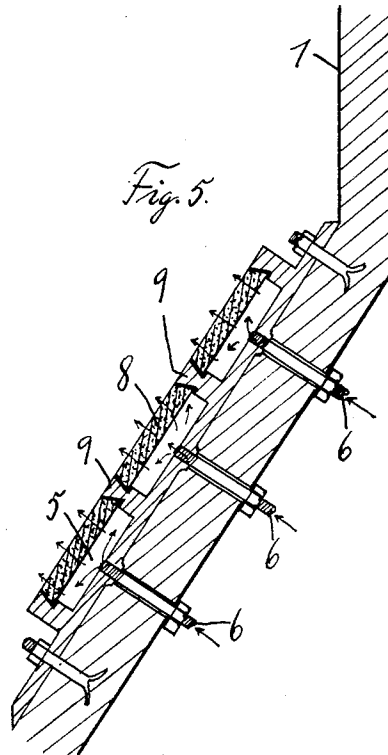
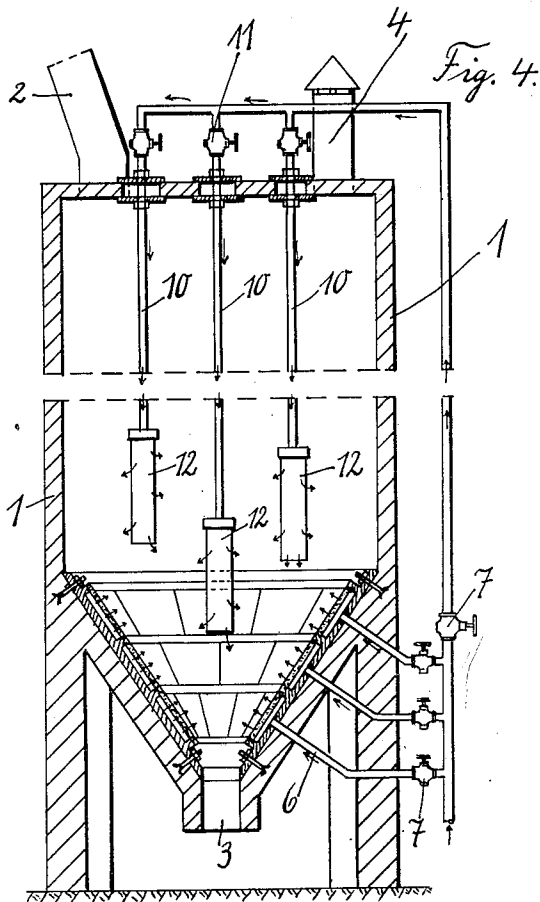
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UNITED STATES PATENT OFFICE

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PROCESS FOR STIRRING UP FARINACEOUS MATERIALS IN RECEPTACLES OF ANY KIND BY COMPRESSED AIR, COMPRESSED GAS, OR THE LIKE

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In Germany June 3, 1931

8 Claims. (Cl. 259-4)

This invention relates to the storage and handling of finely divided materials, for instance cement, coal dust, or farinaceous material, and the principal object of the invention is the provision of means to facilitate the discharge of such materials from storage receptacles.

Considerable difficulty has been encountered heretofore in withdrawing powdered materials from silos and the like in which the discharge is effected primarily by gravity. Thus if an outlet is formed at the bottom of the receptacle it is found that the material tends to form a vault above the outlet which either retards the discharge of material or prevents discharge altogether, and the condition is relieved only by agitation of the material either by a mechanical agitating device or by manual agitation. Under other conditions the angle of repose of the material may cause a considerable proportion to collect adjacent the outlet and partially obstruct the flow.

This difficulty, which is particularly objectionable where uniform flow is necessary, for instance where different kinds of flour from several receptacles are to be mixed or in the discharge of coal dust or other combustible material into a burner, cannot be entirely obviated by the provision of mechanical stirring devices since such devices invariably result in a discharge which is less uniform than that which is obtained by gravity when the material is flowing freely through the outlet.

It is a feature of the invention that a gaseous material, for instance air, is introduced under pressure in the receptacle in such manner as to prevent the powdered material from adhering to the receptacle walls or to prevent the development of a static condition in any particular portion of the material within the receptacle. For this purpose the air is introduced into the receptacle at a multiplicity of spaced points, for instance by causing the air to flow through the wall of a passage formed of porous material, this wall either extending into the receptacle or comprising, at least in part, the supporting wall of the receptacle.

It is a more specific object of the invention to provide in a receptacle for the storage of powdered materials a lining spaced from the receptacle wall and preferably adjacent the receptacle outlet whereby a pocket or passage is formed in which a gaseous medium under pressure may be introduced, the lining being pervious to the gaseous medium so that the latter may enter the receptacle over a considerable area of the receptacle

wall as distinguished from an arrangement employing a nozzle for causing simple circulation of the air within the receptacle. By this means a sheet or blanket of air may be established on the inner surface of the porous lining which definitely prevents the powdered particles from adhering to the lining.

Alternatively, the gas-pervious surface may be independent of the receptacle wall and may be so disposed within the receptacle that the material is kept in motion at such points as are deemed necessary to ensure uniform discharge of the material.

Further objects and features of the invention will be apparent from the following description taken in connection with the accompanying drawings, in which

Figure 1 is a vertical sectional view of a receptacle illustrating one embodiment of the present invention;

Figure 2 is a vertical sectional view illustrating the application of the invention to a receptacle of different type;

Figure 3 is a horizontal section on the line A-B of Figure 2;

Figure 4 is a vertical sectional view of a receptacle showing a slightly modified form of the invention;

Figure 5 is an enlarged fragmentary view of a portion of the receptacle shown in Figure 4;

Figure 6 is a further enlargement of a fragmentary portion of the receptacle; and

Figure 7 is a vertical sectional view through one of the elements shown in Fig. 4.

Referring more particularly to the drawings, it will be observed that Figure 1 discloses a silo or other receptacle 1 provided with an inlet 2 through which the finely divided material may be introduced, an outlet 3 through which the material is discharged, and a stack or flue 4 through which the air or other gaseous medium introduced in the receptacle may be discharged. It will be understood that the usual control means such as a valve may be provided at the outlet 3 to regulate the discharge of the material from the receptacle.

It will be observed that the receptacle illustrated is substantially rectangular in vertical cross-section and in this type of receptacle the material tends to collect at the lower corners and eventually the discharge of the material is either impeded or entirely prevented. In order to obviate this difficulty means are provided for introducing the gaseous medium over at least a portion of the interior surface of the receptacle,

for instance adjacent the lower corners, and in the drawings this means is shown as extending over the entire lower wall and side walls of the receptacle. For this purpose a porous inner lining 8 is provided, this lining being conveniently formed of relatively small sections secured together in any suitable manner and supported in spaced relation to the inner wall of the receptacle 1 to provide a passage for the gaseous medium therebetween. In the arrangement shown in the drawings a lining 14 is secured against the inner wall of the receptacle, and the porous lining 8 is supported in spaced relation to this inner lining 14, although it will be appreciated that the latter may be dispensed with if desired. The passage 5 thus provided is in communication with a conduit 6 for conducting air under pressure thereto, there being as many of these conduits provided as are necessary to ensure uniform distribution of the air throughout the passage 5 and to supply each section of the passage 5 in the event separate sections are formed, for instance, at the bottom and at the side walls of the receptacle as shown in Figure 1.

Preferably the passage 5 is subdivided into numerous sections, for instance by the provision of partitions 9 as illustrated more particularly in Figures 5 and 6 of the drawings, a separate conduit 6 being provided for each of these sections so that the pressure of the air supplied to each section may be independently regulated by means of a control valve 7 allocated to each conduit.

It will be observed that by this construction the gaseous medium is introduced under pressure over a very substantial area of the interior of the receptacle and that in effect a wall or blanket of air under pressure is formed over this surface.

In the event the receptacle is of the type shown in Figure 2 employing a downwardly tapering discharge spout, it may be found necessary to employ the inner lining of porous material 8 over the wall of the spout only. The porous material may be formed of various substances or may be so constructed as to render it pervious to gas under pressure. Thus it may be formed of filter stone, porous brick, porous caoutchouc, or the like or of any material having a multiplicity of perforations or openings therein.

Referring now to Figure 4 of the drawings, it will be observed that the gas-pervious lining hereinbefore referred to for the receptacle walls may be replaced by or the effect of such a lining may be augmented by the introduction into the receptacle of a plurality of conduits 10 for supplying the gaseous medium under pressure to the associated drums 12, the latter having a very considerable area and being formed so as to be pervious to air as hereinbefore described. These drums 12 may be located at any convenient point in the receptacle, and preferably where they will contact with the material stored within the receptacle and in such manner as to maintain portions of the material in a state of movement.

The flow of air under pressure to each of the drums 12 is preferably controlled by a separate valve 11 so that the movement of the material within the receptacle may be regulated as appears necessary in order to ensure uniform discharge through the outlet opening. In addition to the features hereinbefore indicated, the apparatus may be utilized to effect desired physical or chemical changes in the material in the receptacle. For instance, cement stored in a receptacle of this character may be ripened by forcing a gaseous medium including

carbonic acid gas through the porous lining, the finely divided condition of the gas as it emerges from the porous substance facilitating reaction with the cement.

It will be observed that this invention does not depend primarily on the maintenance of a complete circulation of air within the receptacle such as would be caused by the introduction of the air through a jet, for instance by movement of the air in a circuitous path. On the contrary, the arrangement described herein applies pressure to the material stored over a very considerable area to prevent any development of a static condition of any considerable quantity of the material.

Various modifications of the construction illustrated in the drawings and described specifically herein may be made without departing from the spirit and scope of the invention as defined in the appended claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In apparatus for storing and discharging finely divided material, the combination with a receptacle for the material provided with a discharge outlet, of means associated with the receptacle for introducing therein a gaseous medium under pressure at a multiplicity of spaced points, said means including a passage for the gaseous medium having a wall of porous material disposed within the receptacle.

2. In apparatus for storing and discharging finely divided material, the combination with a receptacle for the material provided with a discharge outlet, of means associated with the receptacle for introducing therein a gaseous medium under pressure at a multiplicity of spaced points, said means including a lining of porous material for the receptacle disposed adjacent the receptacle outlet, and means for passing the gaseous medium through the said lining.

3. In apparatus for storing and discharging finely divided material, the combination with a receptacle for the material provided with a discharge outlet, said receptacle having a wall of gas pervious material on which the finely divided material normally rests, of means for forcing a gaseous medium through said wall to prevent adhesion of the finely divided material to the said wall.

4. In apparatus for storing and discharging finely divided material, the combination with a receptacle for the material, said receptacle having a discharge outlet in the lower portion thereof, of means forming a lining of porous material in the lower portion of said receptacle, and means for directing a gaseous medium through said lining.

5. In apparatus for storing and discharging finely divided material, the combination with a receptacle for the material, said receptacle having a discharge outlet, of a lining for a portion of the interior of the receptacle spaced from the receptacle walls to form a passage therebetween, said lining being formed of material pervious to gas, and means for introducing a gaseous medium under pressure in said passage.

6. In apparatus for storing and discharging finely divided material, the combination with a receptacle for the material, said receptacle having a discharge outlet, of a lining for a portion of the interior of the receptacle spaced from the receptacle walls to form a passage therebetween, said lining being formed of material pervious

to gas, partitions between said lining and the receptacle walls for separating the passage thus formed into separate sections, separate conduits for conducting a gaseous medium into each of said sections, and a control valve associated with each conduit.

7. In apparatus for agitating and conveying finely divided material, the combination with a passage having a material inlet and a material discharge outlet, said passage having a wall on which the material may rest formed largely of porous material, and means for introducing a gaseous medium into said passage through said porous wall to ensure movement of the material

in said passage toward the said discharge outlet.

8. In apparatus for agitating and conveying finely divided material, the combination with a conduit comprising an outer shell and an inner lining formed of porous material on which the material may rest, said shell and inner lining being spaced to define therebetween a passage isolated from said material except for the porosity of said lining, and means for introducing a gaseous medium under pressure in said passage, whereby said medium may flow through said lining and maintain said material in motion.

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25	100
30	105
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60	135
65	140
70	145
75	150