

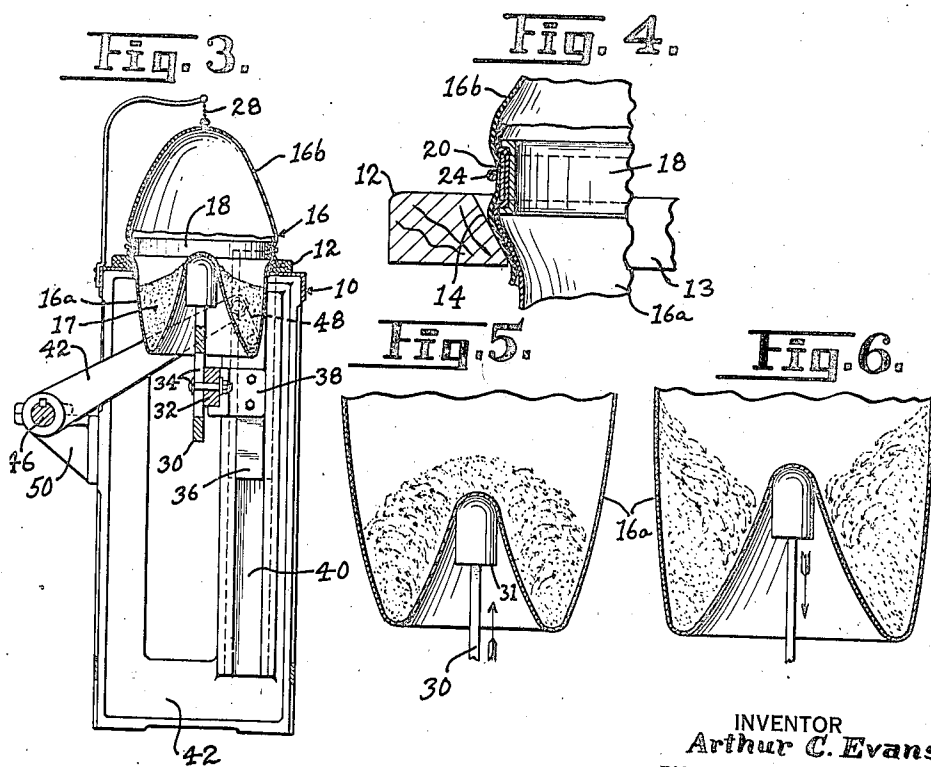
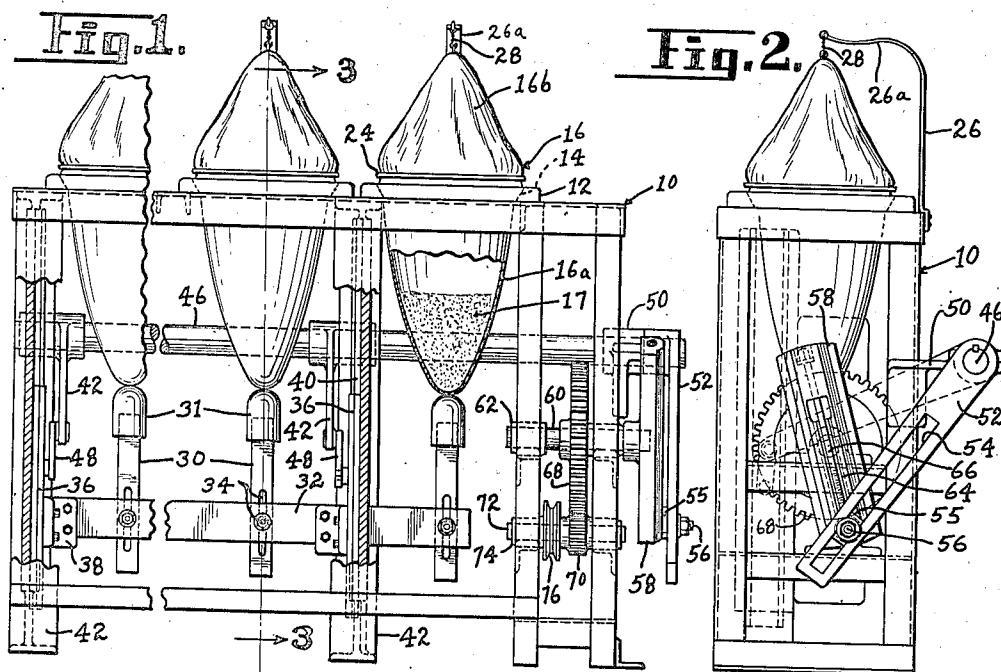
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APPARATUS FOR MIXING POWDERED MATERIALS

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APPARATUS FOR MIXING POWDERED MATERIALS

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This invention relates to a method and the apparatus for mixing materials of a pulverulent character and particularly of an explosive nature.

One object of this invention is to provide a new method and a means for mixing a plurality of powdered materials and thoroughly commingling the materials together to arrive at a more perfect blend of materials throughout its entire volume.

A further object is to provide a method and an apparatus of the above nature designed for the purpose of thoroughly blending a plurality of finely powdered materials of different physical characteristics and particularly wherein the difference pertains to the nature of their specific gravities.

The above objects are attained in the method and means for mixing and blending powders of the above nature which comprises the use of a flexible impermeate container of a generally conoidal shape within which the materials properly portioned are deposited and the container operated upon from the exterior to subject the contents of the container to a series of alternately reverse sliding and somewhat rolling actions designed to mix the materials with the same degree of perfection in blending throughout the entire mass.

Heretofore the conventional apparatus known in the art of mixing powders has not been satisfactory in its use for properly mixing powdered materials of different specific gravities in that the mixers of some designs would tend to separate the powders of a different specific gravity, and, in other designs where a certain portion of the powdered contents might be thoroughly mixed, it was found that there was a variation in the degree of blending in the powder taken from different sections of the machine, or in other words there was a variable in the degree of blending of the materials in the same machine. Such a condition becomes a serious problem particularly when it becomes necessary to have a uniformity in the blending of explosive powders or burning powders that are to be used as an accurate timing means in explosive implements.

The heretofore known devices in addition to the above faults have required from two to six hours of operation and attenuated with considerable danger because of moving parts within the mixer. With my machine the time element has been radically reduced and from actual tests it has been discovered that a run of fifteen minutes is sufficient to arrive at the perfection of

the blend of powders desired, and the factors conducive to create a dangerous condition have been eliminated.

A still further object is to provide an apparatus for the blending of powders particularly of a highly inflammable and/or explosive nature, and wherein provision is made to eliminate the dust factor, to provide a hermetically sealed mixing compartment and to allow no exterior movable parts to come in direct contact with the powdered materials being mixed to assure a further maximum degree of safety.

The full nature of this invention along with other objects and various advantages thereof will be more apparent from a consideration of the following description when read in connection with the accompanying drawing in which—

Fig. 1 is a front elevational view of the mixing machine with portions broken away to show detailed construction and showing the machine in its normal starting position.

Fig. 2 is a right end view of the same.

Fig. 3 is a transverse sectional view taken on line 3—3 of Fig. 1 looking in the direction of the arrows and showing the plunger in its uppermost bag inverting position.

Fig. 4 is a fragmentary enlarged sectional view of the mixing bag and supporting structure for the same.

Fig. 5 is a diagrammatical view showing the bag in a partially inverted state by the up-stroke of the plunger and indicating the general direction of flow of the powdered materials in the bag in the act of blending the same, and

Fig. 6 is a similar view with the plunger going in the opposite direction and showing the reverse flow of materials in the bag.

Referring now to the drawing in which like reference numerals designate like parts throughout the several views, numeral 10 refers in general to the frame of the machine, which for the most part may be fabricated from structural iron. Transversely resting upon the upper part of the frame 10 and secured thereto is a compartment support member 12 preferably made of wood and having a circular opening 13 therethrough with an inwardly inclined wall to serve as a supporting seat 14 against which the powder compartment generally indicated by numeral 15 with its contents may be rested. The powder compartment 15 comprises essentially two bags, a lower bag 15a and an upper cap bag 15b both of which are preferably made of soft pliable rubber material and both made in a generally conoidal shape. In order to maintain the open end

of the container bag 16a in an opened position to facilitate handling in charging and emptying the same, a channel ring 18 is provided and slipped into the open end of said container bag 16a. The upper end of this bag is permanently maintained within the U-shaped part of the channel ring 18 by means of a thin metal strap band 20 wrapped thereabout and the ends of which may be releasably held together by any of the conventional forms of strip clips not shown.

In attempting to mix powdered materials of the character referred to, i. e. usually of a very fine nature, their tendency to absorb moisture and also to emit dust from agitation are factors that I have also considered in the construction of my powder compartment. To confine the dust entirely within a closed compartment and also effect a hermetical seal, the upper or cap bag 16b previously referred to is disposed upside down with its open end slipped over the top supported open end of the container bag 16a and may be held in place by an elastic band 24 circumventing the bag 16b and causing the latter to be drawn tightly within the U-portion of the channel ring 18. (See Fig. 4.) The channel ring 18 is of a diameter that is approximately equal to the mean diameter as between the upper and lower diameters of the beveled opening 13 in the support member 12. Thus when the ring 18 is assembled with both bags 16a and 16b, as explained to form the powder compartment 16, the entire unit may be readily conveyed to the machine and merely be dropped into place and properly positioned upon the beveled seat 14 without slipping entirely through the opening 13. The materials to be blended are first properly proportioned by suitable measuring implements and then disposed in the container bag 16a. It is recommended that the total quantity to be mixed should approximately fill the bag 16a to one-third of its height, such as is shown in the sectional view of Fig. 1.

As best shown in Fig. 4 it is desirable that the cap bag 16b be slipped over the container bag 16a a distance such that these bags will overlap each other in the general area where the compartment unit 16 is supported against the beveled seat 14 in the support 12 so that the weight of said unit 16 plus the weight of the material 17 within the container bag will cause the overlapping portions of the bags to embrace each other more tightly and further assure the dust proof seal of said unit. The cap bag 16b should be designed preferably to have approximately the same cubical content of air space that is allowed in the container bag 16a after the material is therein. To prevent the cap bag 16b from dropping down within the open end of the container bag 16a, the cap bag 16b is supported by means of a supporting arm 26 secured to the frame 10 and having an offset portion 26a of a resilient character that extends into line with the axis of the compartment unit 16. The distal end of the spring portion 26a may be connected to the apex of said cap bag 16b as by means of any suitable detachable linkage 28. While thus far there is described only one of the set-ups of the powder compartment unit 16, it will be noted that the machine is designed to accommodate a series of such units arranged in a row and may be operated upon at the same time from a single operating mechanism and with the same degree of efficiency.

As explained in the objects of this invention,

in order to arrive at a more perfect blending in powders of various characteristics especially to specific gravity, it is the purpose of this machine to subject the materials to a series of alternately reverse sliding and rolling actions. This is accomplished by having the container bags 16a, as previously pointed out, of a general conoidal shape; and in axial alignment with each of the compartment units is a like number of reciprocating plungers 30 having rounded head ends 31 that when in an inactive state are disposed adjacent the apical end of the container bag 16a. The reciprocal plungers are adjustably attached to a horizontal beam 32 by means of a bolt and slot connection 34. Vertical reciprocal rectilinear motion is imparted to the beam 32 by means of a pair of reciprocating slides 36 connected thereto by angular brackets 38, and which slides 36 are caused to operate in complementary vertical guide ways 40 formed within pedestals 42 that are a component part of the general frame work 10. Vertical reciprocating motion is imparted to the slides 36 by long swinging arms 42 having their proximal embossed ends keyed to a longitudinal shaft 46 and their distal ends connected to the slides 36 through linkage members 48. The longitudinal shaft 46 is supported horizontally to the rear end of the frame work 10 as by bearing brackets 50.

Alternately reversing rotary motion is imparted to shaft 46 by means of a crank arm 52 keyed to the right end thereof and having a longitudinal slot 54 within which operated a slide block 55 rotatable on a wrist or crank pin 56 extending outwardly from the face of a rotating crank plate 58. The crank plate 58 is supported on the outer end of a shaft 60 suitably supported in bearings 62 secured to the frame 10. The wrist pin 56 is preferably adjustably secured to the crank plate 58 so as to be moved inwardly or outwardly from the rotary center of said plate 58 as by means of a slot 64 and adjusting screw connection 66 so that the stroke of the plungers 30 may be varied. Rotary motion is imparted to the above mechanism by means of a gear 68 keyed to shaft 60 and meshing with pinion 70 keyed to shaft 72 suitably supported in bearings 74 attached to the frame 10. A sheave 76 is also fixed to shaft 72 and may be operated by a belt not shown connected to any suitable sort of rotary power.

By the above mechanism described it will be apparent that the apical end of the series of bags 16a may be rhythmically inverted and restored imparting to the materials therewithin a reversing rolling action. This is diagrammatically shown by Figs. 5 and 6. By making the bags 16a of a relatively light rubber material, as the plunger ascends into the apical end of each bag 16 the reversed portion of said bag will assume the same general shape as its normal outside shape except for the bending portion as it progressively ascends up the outside part of the bag. Coincident with the ascending stroke of the plunger the reversing inner wall of the bag will initially carry the powdered material with it and ahead of it in more or less of a pyramiding formation and then break through causing the powder to slide and more or less roll over, outwardly and downwardly upon itself into the vacant space adjacent the outer wall of the bag, which space becomes a progressively increasing annular generally V-shaped compartment as the plunger ascends. Then as the plunger descends, the powder will more or less adhere to the outer

stationary part of the bag and the middle portion will naturally flow into the center and follow the restoring portion of the bag downwardly in a more or less opposite sliding and rolling manner to the one previously described in the upstroke of the plunger.

This particular motion of rhythmically inverting and restoring the apical end of a conoidal bag with powders of different characteristics contained therein has proven very satisfactory in properly blending the powders uniformly throughout the entire mass and retain the blended state without any tendency for the powders to separate due to a difference in specific gravity or powder size.

While a relatively large machine is here shown for purposes of producing a large quantity of blended powders, it is within the purview of the invention to adopt the method and the general character of the mechanism to smaller units such that might find a desirable use in drug stores and laboratories where there is need of mixing powders and other substances into a homogeneous mass.

I claim:

1. In a machine for mixing powdered materials of different specific gravities, a frame, a bag-like receptacle of a generally conoidal shape for receiving said materials and having its open end supported by said frame and suspended in a normal vertical axial position, a plunger member mounted on said frame exterior of said bag and in axial alignment therewith, and means for slowly and rhythmically reciprocating said plunger into the apical end of said bag for alternately inverting and restoring said bag and subjecting the materials within the bag to a series of alternately reversing sliding and partially rolling action of a character to preclude the materials of different physical characteristics tending to separate from each other.

2. A mixing machine based on claim 1, wherein a flexible cover member is closed over the open end of said bag to seal the contents thereof and of a size to compensate for the air displaced in said bag during the inverting stroke of said plunger.

3. A mixing machine based on claim 1 wherein a flexible bag-like cover member is fitted over the open end of said cover member to seal the contents thereof, and means for retaining said cover member in an inverted position over said bag.

4. In a machine for mixing powdered materials of an explosive nature, a frame, a support disposed across the top of said frame and having an opening therethrough, a bag-like receptacle of a generally conoidal shape for receiving said materials, means for maintaining said receptacle in an open position, a bag-like cover inverted and secured over the open end of said receptacle for sealing the contents thereof, said receptacle

and cover forming a compartment adapted to be manipulated as a unit separate from the machine and held upon said support with the receptacle extending downwardly through said opening, and a plunger member adapted to be reciprocated into the apical end of said receptacle to alternately invert and restore that end of said receptacle by a series of relatively slow rhythmical strokes.

5. A mixing machine based on claim 4 wherein a support is provided for maintaining the cover in an inverted position over said receptacle.

6. In a machine for mixing powdered materials of an explosive nature, a frame, a support disposed across the top of said frame and having a circular opening therethrough with inclined walls forming a beveled seat, a bag-like receptacle of a generally conoidal shape for receiving said materials, a ring member fitted into the open end of said receptacle and of a diameter approximating the mean diameter of said seat, a bag-like cover inverted and secured over the open end of said receptacle for sealing the contents thereof, said receptacle and cover forming a compartment adapted to be manipulated as a unit separate from the machine and be held upon said support with the unit seeking its normal position in the beveled seat with the receptacle extending downwardly through said opening, and a plunger member adapted to be reciprocated into the apical end of said receptacle to alternately invert and restore that end of said receptacle by a series of relatively slow rhythmical strokes.

7. A claim based on claim 6 wherein said cover bag is assembled over said receptacle bag to provide a sufficient overlapping portion that is adapted to be annularly pressed against said beveled seat to serve as a supplemental seal.

8. In a machine for mixing powdered materials of different specific gravities, a frame, a bag-like receptacle of a generally conoidal shape for receiving said materials and having its open end supported by said frame and suspended in a normal vertical axial position, a plunger member mounted on said frame exterior of said bag and in axial alignment therewith, and a means for slowly and rhythmically reciprocating said plunger into the apical end of said bag for alternately inverting and restoring that end of said bag whereby coincident with the upstroke of said plunger the powdered materials will initially be pyramided within the bag and caused to slide outwardly and downwardly by a more or less rolling action into the outer space in said bag and on the downstroke of said plunger to cause a similar reverse action of the powder into the center space of said bag, which action is of a character to preclude the powders of different specific gravity tending to separate from each other.

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