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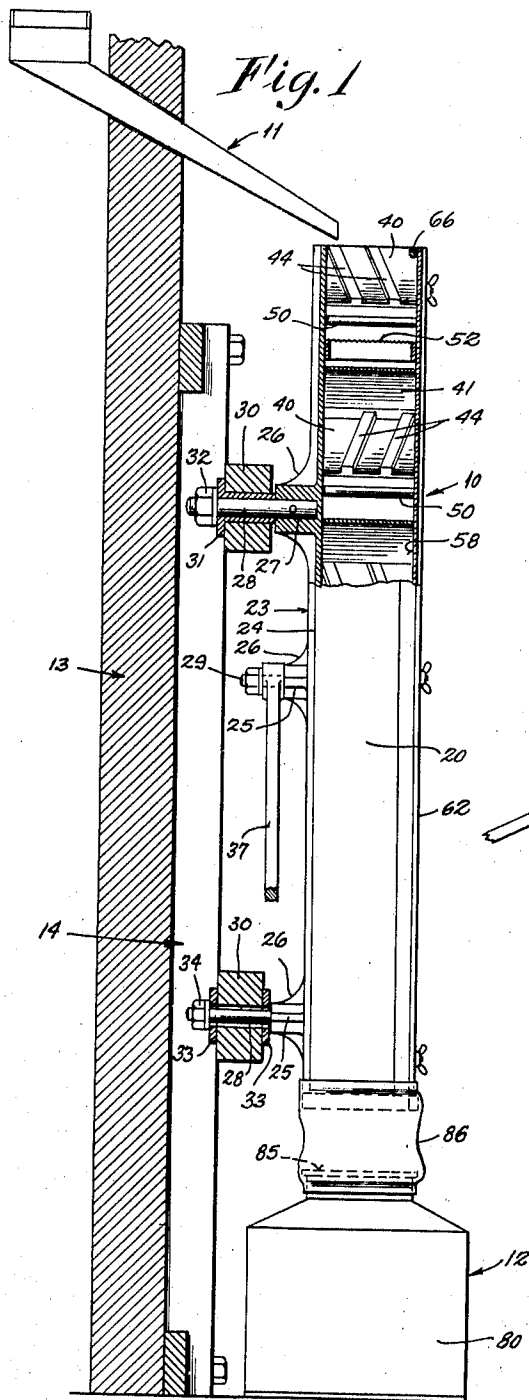
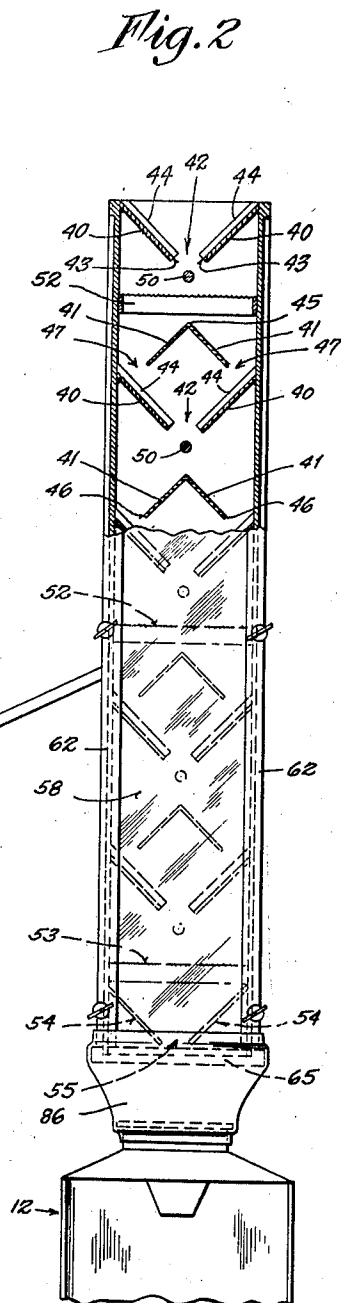
P. H. BURDETT

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MATERIAL BLENDING

Filed Aug. 26, 1942

2 Sheets-Sheet 1



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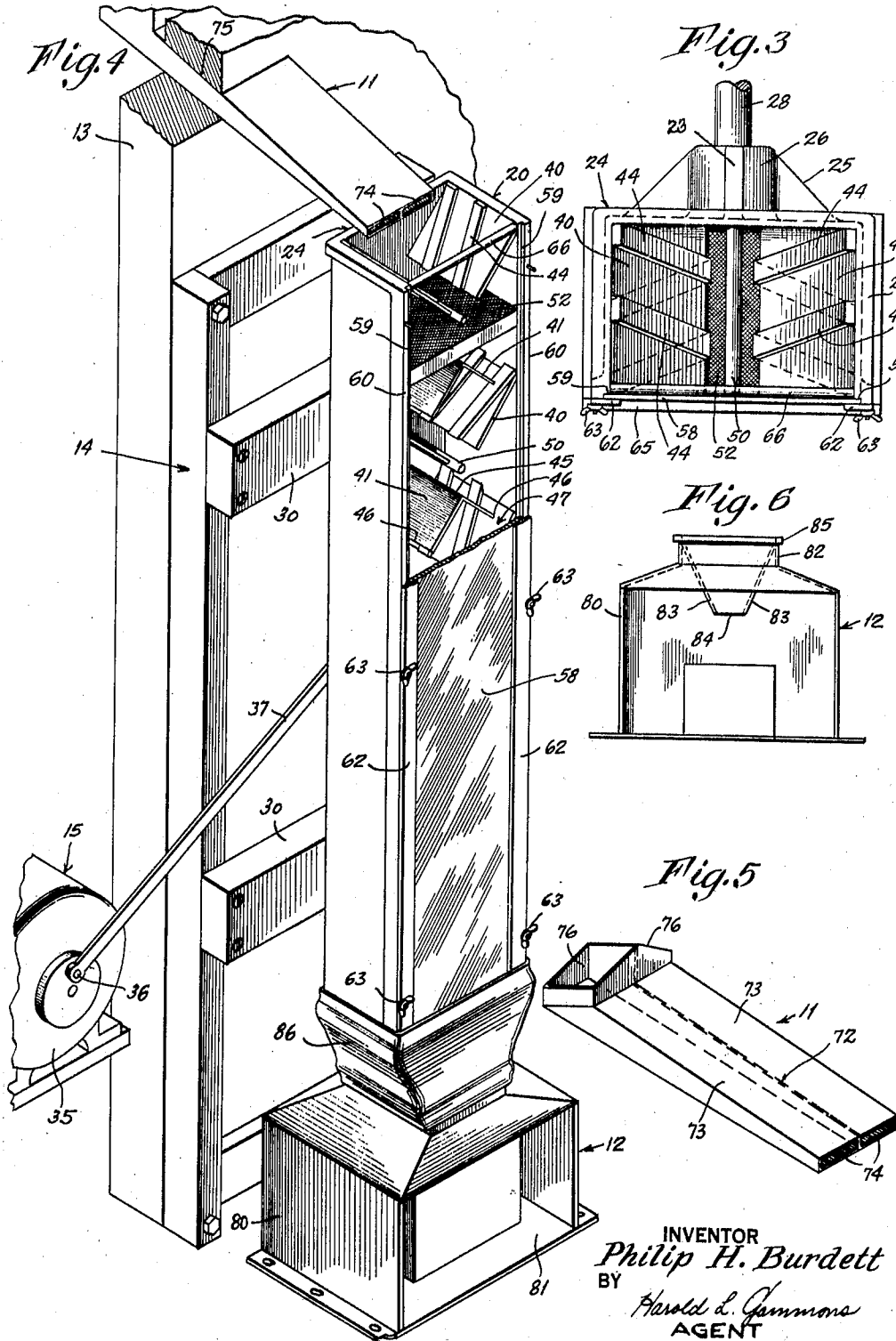
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MATERIAL BLENDING

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9 Claims. (Cl. 259—180)

This invention relates in general to an agitator, and, in particular, to an apparatus for forming a mixture or combination of granular materials such as used in tracer or incendiary projectiles of the small arms variety.

The present device will be particularly described in connection with mixing granular materials of the kind identified above, but it will be understood that the apparatus shown and described herein may be used for mixing other materials and is but one embodiment of the invention and that modifications thereof may be made within the scope of the appended claims.

Heretofore the granular materials used in tracer or incendiary bullets have been mixed by hand and in relatively small quantities. Both of these limitations have been deemed expedient in view of the sensitivity of the materials which has necessitated taking extreme precautions in order to prevent accidents.

It is an object of the present invention to provide mechanical means for mixing together extremely sensitive materials without liability of explosion or fire. A further object is to provide an apparatus for automatically mixing relatively large quantities of explosive or incendiary materials in a relatively short time. A still further object is to provide a blending tower having a plurality of mixing means for conducting materials downwardly through the tower in sinuously converging and diverging streams.

Other objects, features and advantages of the invention will be more particularly described hereinafter.

In the drawings:

Fig. 1 is a side elevation partly in section of the mixing apparatus of this invention.

Fig. 2 is a front view partly in section of the blending tower.

Fig. 3 is a top view of the blending tower.

Fig. 4 is a perspective view of the complete blending apparatus shown in Fig. 1.

Fig. 5 is a perspective view of the hopper feed means.

Fig. 6 is a side elevation of the receptacle for receiving the mixed materials from the blending tower.

The apparatus for mixing the granular materials is shown in Figs. 1 and 4 and comprises a blending tower indicated generally at 10 having a hopper 11 for delivering materials into the upper end of the tower and a receptacle 12 for receiving the mixed materials discharged from the lower end of the tower.

The blending tower 10 is supported for oscillation in a vertical plane by supporting means which comprises a wall 13 having frame members 14 secured to one side thereof, the tower 10 being pivotally mounted on the frame members as hereinafter described. Suitable means for oscillating the tower are indicated at 15.

The blending tower is shown in detail in Figs. 2 and 3 and comprises a substantially rectangular trough 20, open at the top and bottom. The trough may be formed of any suitable materials such as wood, brass or aluminum alloy and is provided with a longitudinal rib 23 secured to or formed integral with the back wall 24. The rib 23 is reinforced by transverse webs 25 at three spaced points which constitute bosses projecting from the rear wall of the trough. The bosses are suitably drilled as at 27 to accommodate the shafts 28 and 29. The two shafts 28 are relatively long as compared to the single short shaft 29, each shaft being secured in its drilled boss 26 by a suitable taper pin arranged to pass transversely through the boss and shaft and to be peened thereon.

The upper shaft 28 comprises means for pivotally mounting the trough on the supporting means 13 which embodies the pair of spaced substantially vertical frame members 14 which may comprise any suitable material such as wood and to which are secured a pair of cross members 30, the upper member 30 having a drilled hole substantially midway of its length provided with a flanged bushing 31 of a suitable material such as bronze which constitutes a bearing surface for the shaft 28. A nut 32 is threadedly secured on the end of the shaft 28 to secure the latter in the bushing; in this manner the trough is pivotally mounted to oscillate in a substantially vertical plane.

The lower shaft 28 comprises a guide means for the tower and to this end is arranged to project into a longitudinal slot formed in the lower cross member 30. A pair of slotted plates 33 of brass or other material are secured to the cross member on opposite sides of the slot to form bearing surfaces for the guide shaft 28 which is secured to oscillate within the slot by a nut 34 threaded onto the outer end of the shaft.

The third or intermediate shaft 29 comprises means for connecting the tower to the oscillating means 15 which may comprise an explosion proof motor 35 provided with a rotating eccentric pin 36 suitably connected by a rod 37 to the intermediate shaft 29 of the tower. It is preferable that the starting switch for the motor 35 be lo-

cated at a distance from the blending tower as, for example, on the opposite side of the wall 13.

The means for blending or mixing the materials, which are introduced by the hopper 11 into the top of the tower, comprises in part a series of symmetrically converging and symmetrically diverging surfaces 40 and 41 respectively, spaced vertically alternately throughout the length of the tower.

The converging surfaces 40 are imperforate substantially rectangular plates of cast bronze or other suitable material, provided with smooth upper surfaces and arranged symmetrically in pairs which converge at an angle of substantially 90 degrees with respect to each other, each surface being at an angle of substantially 45 degrees with respect to the longitudinal axis of the tower. As shown in Fig. 3, the surfaces are substantially equal in length to the depth of the trough and are fixedly secured to the back and side walls thereof by solder joints or other securing means. A suitable aperture 42 is formed by the spaced lower edges 43 of each pair of converging surfaces 40 adjacent the apex point thereof.

Suitable means for deflecting the flow of material over the converging surfaces 40 are shown in Fig. 2 and comprises riffle bars 44 secured to or cast integrally with the surface 40. In the present embodiment, each surface is provided with a pair of riffle bars disposed diagonally on the surface and in spaced parallel relation. It will be understood, however, that the number and disposition of the riffle bars on each surface may be varied as desired.

Referring to Fig. 4, the riffle bars of each pair of symmetrically converging surfaces 40 are shown oriented in substantially the same direction, which direction is reversed in the next succeeding pair of converging surfaces, that is to say, the riffle bars 44 of the first pair of converging surfaces extend diagonally downwardly and forwardly towards the front of the tower, whereas the riffle bars of the next succeeding pair of converging surfaces extend diagonally downwardly towards the back of the tower. It will be evident, therefore, that the streams of material flowing down over the successive converging surfaces will be directed back and forth in sinuous paths which lie in the planes of the converging surfaces.

All corners and joints of the riffle bars 44 and converging surfaces 40 are suitably rounded in order to reduce the friction between the materials being mixed and the mixing elements.

Each pair of diverging surfaces 41 comprises an inverted V-shaped plate of cast bronze or other suitable material which is soldered at one end to the back wall 24 of the tower and projects forwardly to the front of the tower, the apex 45 of each plate being spaced below the apex point of the converging surfaces 40 and in vertical alignment therewith. The upper faces of the plates 41 are made smooth and diverge at an angle of substantially 90 degrees with respect to each other. As shown in Fig. 4, the longitudinal edges 46 of the plates are not secured to the adjacent walls of the tower but are spaced therefrom so as to form apertures 47 through which materials may flow from the diverging surfaces 41 onto the surfaces of the converging plates 40 located immediately below.

Suitable means for diffusing materials as they flow downwardly from the converging surfaces onto the diverging surfaces comprises suitable

rods or pins 50 which are screw threaded into the holes at the back wall 24 of the tower. Each rod 50 is long enough to project forwardly adjacent the front face of the tower, as shown in Fig. 3, and is located substantially at the apex point of a pair of symmetrically converging surfaces 40.

Interposed between the topmost diffusing rod 50 and the apex of the adjacent diverging surfaces 41 is a substantially rectangular perforated surface, in this instance a screen 52, say of 20 mesh, which extends across the trough and is fixedly secured by solder joints to the side and back walls thereof, in the manner shown.

A second screen 52, similar to the first screen, is similarly secured in the tower at a point lower down, which as shown, is intermediate the third diffusing rod 50 and the adjacent diverging surface 41. In this connection, it will be noted that the upper and lower screens 52 are disposed substantially equally distant on each side of the pivot means 31 of the tower so that each screen receives substantially the same degree of agitation.

A third and preferably more finely perforated plate 53 is secured within the tower and comprises typically a 35 mesh screen located below the lowermost diffusing rod 50 and immediately above the material discharging means of the tower. Due to its relatively great distance from the pivot point 31, the screen 53 is subjected to greater agitation than the screens 52.

The means for discharging the mixed materials from the tower comprises a pair of substantially rectangular symmetrically converging plates 54 soldered to the side and rear walls of the tower and arranged at their lower edges to form a discharge aperture 55 as shown in Fig. 2.

Although five sets of successively arranged converging, diffusing and diverging means have been shown, it should be understood that the shape, disposition and number of mixing elements may be varied depending on such considerations as the homogeneity required of the mixture and the speed at which any given quantity of material is to be mixed.

The front wall or face plate 58 of the tower may be formed of plate glass, lucite, bronze or similar materials, and is supported by its edges on longitudinally extending shoulders 59 formed on the edges 60 of the sides of the tower as shown in Figs. 3 and 4.

Means for securing the face plate in position comprises a pair of holding plates 62 which consist of relatively thin metal strips secured to the edges 60 by a plurality of wing nuts 63 and arranged to overlie the longitudinal edges of the face plate 58. The bottom edge of the face plate is adapted to be supported on an inwardly projecting ledge of an end plate 65, the latter being secured at its opposite ends by screws, to the lower ends of the tower. The upper end of the face plate is shown supported by a transverse rod 66 which is disposed adjacent the front of the tower, the opposite ends of the rod being secured in engagement with the inside surfaces of the sides of the tower by suitable screws.

In its assembled position, the rear surface of the face plate is adapted to closely engage the unsupported ends of the mixing elements and screens above described so that no material may drop down between the ends of the mixing elements and the face plate.

Referring to Figs. 4 and 5, 11 is the hopper means for delivering the materials to be mixed to the upper end of the tower and comprises a rectilinearly tapering conduit provided with a lon-

itudinal partition 72 adapted to divide the conduit into two isolated conduits 73 of substantially equal size. The lower ends of the conduits constitute discharge apertures 74 located adjacent the upper end of the blending tower.

The hopper is shown supported by the wall portion 13 of the tower supporting means and to this end a hole 75 is cut through the wall 13 conforming to the shape of the hopper; the latter projects through the hole 75 and is provided at its opposite end with two isolated charging apertures 76. By providing a wall between the charging and discharging apertures, these two points are effectively separated and hence the occurrence of an accident at the blending tower will not endanger the supply of materials at the charging apertures.

The mixed material being discharged from the bottom of the tower is directed into a suitable receiver 12 which, as shown in Fig. 6, comprises a substantially rectangular box 80 adapted to be fixed to the floor or other suitable supporting means. The box has an open side 81 and a restricted neck or throat 82, the latter being substantially rectangular and provided with four downwardly converging walls 83 which form a funnel shaped aperture 84 within the receptacle 80. A suitable flange 85 extends around the upper edge of the throat 82 of the receptacle for the purpose hereinafter described.

Suitable means for connecting the fixed receptacle to the oscillating tower is indicated at 86 and comprises a resilient or flexible tube or bellows adapted to fit tightly at one end over the lower end of the blending tower and at its opposite end over the rectangular flange 85 of the receiver.

The materials to be mixed, which in this instance comprise two different components such as used in tracer or incendiary bullets, are introduced into the tower from the two isolated hopper discharge apertures 74. The tower is then oscillated by energizing the motor 35, whereupon the materials which descend in two streams onto the converging surfaces 40 are deflected towards the front of the tower by the riffle bars 44. The two streams of material thus converge into a single stream which flows downwardly through the aperture 42 and impinges on the diffusing rod 50 which spreads the material over the surface of the screen 52. The material is then sifted through the screen, due to the agitation thereof, onto the diverging surfaces 41 which divides the material into two separate streams, each of which flows through an aperture 47 onto the next pair of converging surfaces. Here the materials again converge downwardly in the manner above described except that the riffle bars 44 of the second pair of converging surfaces deflect the streams toward the back of the tower. Thus, it will be evident that as the materials fall down through the tower they are continuously being united into a single stream, divided into separate streams, diffused over the surface of the screens and sifted through the screens; and throughout these treatments the streams of materials are being deflected back and forth in a sinuous path. As a result, a substantially homogeneous mixture is obtained in a relatively short time; and further, since all mixing elements are fixed with respect to the tower the material under treatment encounters no relatively moving parts, and hence the probability of accidents or explosions due to friction is substantially eliminated.

What is claimed is:

1. A tower for mixing materials comprising alternately arranged pairs of vertically spaced symmetrically converging and diverging surfaces; means on said converging surfaces for deflecting the flow of materials thereover; and means at the apices of said converging surfaces extending transversely to and in the path of said materials to diffuse and distribute the materials being discharged from said converging surfaces onto said diverging surfaces.

2. A tower for mixing materials comprising alternately arranged pairs of vertically spaced symmetrically converging and diverging planar surfaces; and pairs of spaced parallel riffle bars on said converging surfaces for deflecting the flow of materials rectilinearly thereover, said bars being arranged diagonally thereon, each set of bars on successive converging surfaces being disposed in a direction reverse to that of the preceding set.

3. A tower for mixing materials comprising alternately arranged pairs of vertically spaced symmetrically converging and diverging imperforate surfaces; a fixed rod arranged at the apices of said converging surfaces extending transversely to and in the path of said materials to diffuse and distribute the material being discharged from said converging surfaces onto said diverging surfaces; and perforated surfaces interposed between said diffusing means and said diverging surfaces.

4. A tower for mixing materials comprising alternately arranged pairs of vertically spaced symmetrically converging and diverging imperforate surfaces; means at the apices of said converging surfaces to diffuse and distribute the material being discharged thereon from said converging surfaces onto said diverging surfaces; perforated surfaces interposed between said diffusing means and said diverging surfaces; and riffle means on said converging surfaces for deflecting the flow of material thereover.

5. In an apparatus for mixing materials, the combination with a vertical tower and means for oscillating said tower; of means for delivering materials to said tower; means for mixing said materials by the oscillation of said tower comprising alternately arranged pairs of vertically spaced symmetrically converging and diverging surfaces; and riffle means on said converging surfaces for deflecting the flow of materials thereover.

6. In an apparatus for mixing materials, the combination with a vertical tower and means for oscillating said tower; of means for delivering materials to said tower; means for mixing said materials due to the oscillation of said tower comprising alternately arranged pairs of vertically spaced symmetrically converging and diverging surfaces; riffle means on said converging surfaces for deflecting the flow of materials thereover; means at the apices of said converging surfaces to diffuse and distribute the materials being discharged thereon from said converging surfaces onto said diverging surfaces; and means for discharging the mixed materials from said tower.

7. In an apparatus for mixing materials, the combination with a tower and means for oscillating said tower; of means for supporting said tower to oscillate in a vertical plane, said supporting means having a slot; and means mounted in said slot for delivering materials into said tower, said delivery means comprising isolated

conduits having discharging apertures at the ends thereof, said apertures being disposed adjacent the upper end of said tower.

8. In an apparatus for mixing materials, the combination with a tower and means for oscillating said tower; of means for supporting said tower to oscillate in a vertical plane, said supporting means having a slot; and means mounted in said slot for delivering materials into said tower, said delivery means comprising isolated conduits having discharging apertures at one end and charging apertures at the opposite end thereof, said discharging apertures being disposed adjacent the upper end of said tower.

9. In an apparatus for mixing materials, the combination with a tower and means for oscillating said tower; of means for supporting said tower to oscillate in a vertical plane, said supporting means having a slot; and hopper means mounted in said slot for delivering the materials into said tower, said hopper means comprising a pair of rectilinear tapering isolated conduits having discharge apertures adjacent the top of said tower and on one side of said supporting means, and charging apertures on the opposite side of said supporting means.

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