C. L. HEISLER.

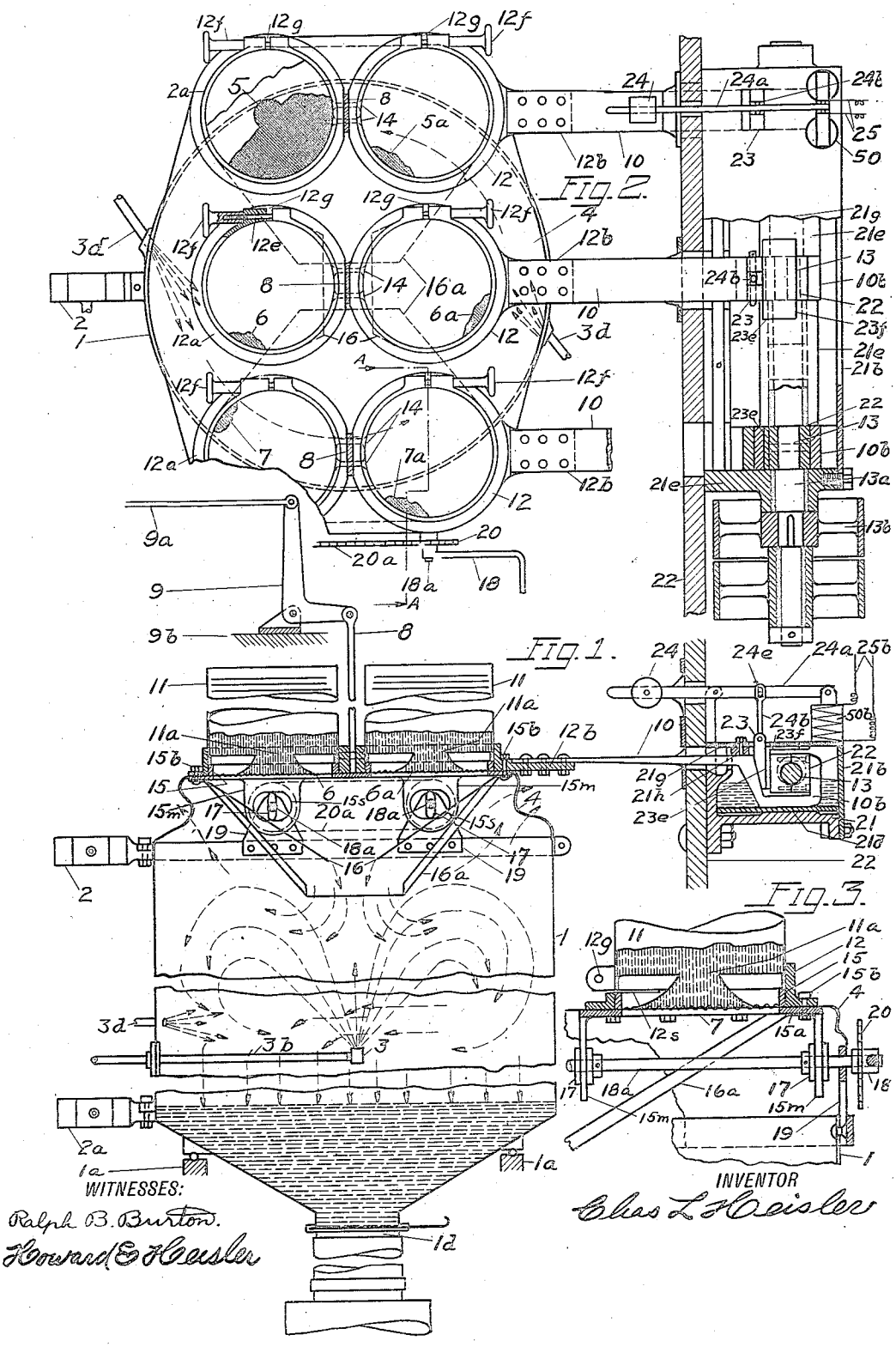
POWDER BLENDING APPARATUS.

APPLICATION FILED JUNE 23, 1916.

1,241,212.

Patented Sept. 25, 1917.

3 SHEETS—SHEET 1.



WITNESSES:

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INVENTOR

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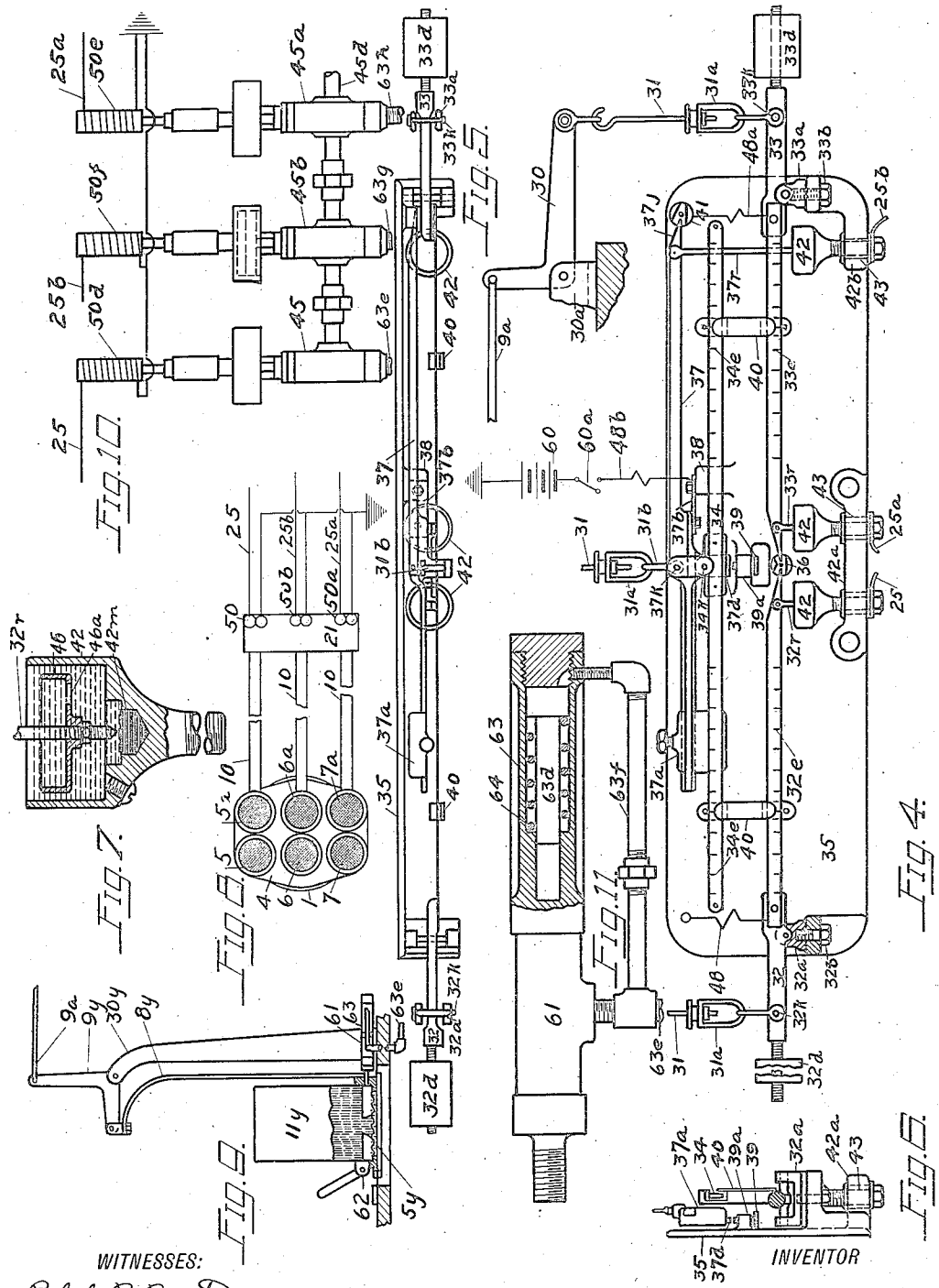
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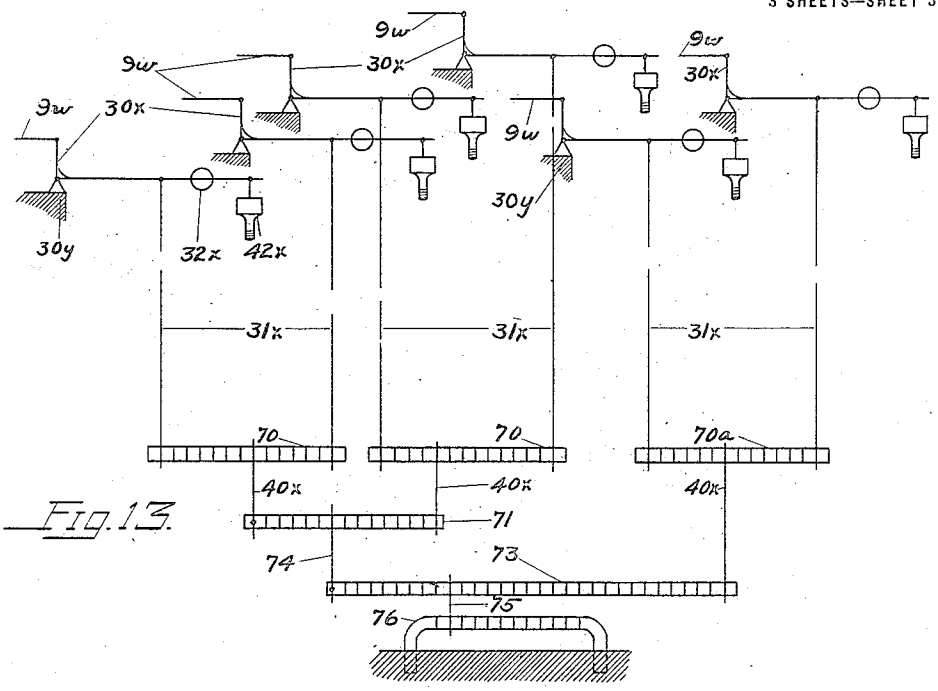


Fig. 13.

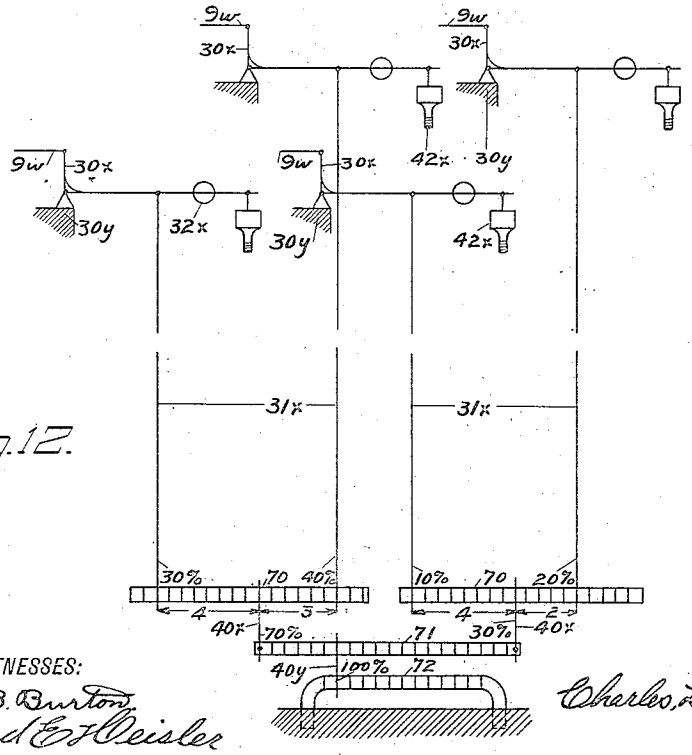


Fig. 12.

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UNITED STATES PATENT OFFICE.

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POWDER-BLENDING APPARATUS.

1,241,212. Specification of Letters Patent. Patented Sept. 25, 1917.

Application filed June 23, 1916. Serial No. 105,505.

To all whom it may concern:

Be it known that I, CHARLES L. HEISLER, of Schenectady and State of New York, have invented a certain new and useful Improvement in a Powder-Blending Apparatus, of which the following is a specification.

My invention relates more particularly to an improved means for automatically proportioning the weights of two or more powders forming a blend as it is sifted into a blending chamber. Its objects are to provide a simple and effective means for automatically governing the rate of sifting two or more powders in accurately weighed proportions and in accordance with determinations made by calculation; to sift the powder directly from commercial shipping cans and thereby avoid danger from dust and the labor of manually handling the powder; to provide a simple means for blending the mixture as it is sifted in accurately weighed proportions into a blending chamber.

In the several drawings Figure 1 is a mid-sectional elevation of a blending chamber having a plurality of powder sifting screens vibrated by an eccentric shaft and arranged to sift powder from shipping cans or containers into the chamber, portions of which are broken away to show the screens; Fig. 2, a plan view thereof wherein small sections of the cans are broken away to show the screens, a part of the eccentric shaft housing cover is removed, and part of the housing is shown by a section taken on a horizontal plane including the axis of the eccentric shaft; Fig. 3, an enlarged detail sectional elevation taken on the line "A A," of Fig. 2, and illustrating the manner of fastening a vibrating frame to the sifting screen and to a powder can, also the method of mounting the screen above the blending chamber; Fig. 4, an elevation illustrating the construction of an automatic weighing mechanism adapted to be coupled to the screens for governing their rate of sifting the powder into the blending chamber; Fig. 5, a plan view thereof; Fig. 6, an end view; Fig. 7, an enlarged sectional detail of a mercury and oil cup; Fig. 8, a diagrammatic plan view of the sifting apparatus illustrated in Fig. 1; Fig. 9, a modified form of sifting apparatus adapted for air vibrators; Fig. 10, an exterior view of three magnet governed air valves for controlling the air vibrators; Fig. 11, an enlarged detail, part shown in section, of an automatic air vibrator starter; Figs. 12 and 13, diagrammatic illustrations of automatic weighing apparatus for blending more than three powders simultaneously.

A blending chamber 1, is mounted upon any suitable support 1^a, which will give it a limited amount of freedom when vibrated laterally by the vibrators 2 and 2^a, attached thereto in usual manner. The chamber may be of cylindrical or other form and is made of ample height to insure thorough blending of any powder mixtures that may be caused to fall, by means to be described hereinafter, downward upon an outwardly spreading air jet which is projected upward by the air nozzle 3. The air pipe 3^b, delivers superdried air under pressure to the nozzle from any suitable source of supply. An air escape 4, is formed of cloth at the upper extremity of the chamber. The vibrator 2, is attached to the chamber near the cloth air escape and may be operated for a short time for the purpose of causing any accumulation of dust on the cloth and chamber walls to fall to the bottom of the chamber. The vibrator 2^a, is operated when emptying the chamber through the discharge valve 1^d. One or more air jets 3^d, are disposed horizontally and in a manner to impinge against the circular inner side of the chamber for the purpose of giving a swirling motion to any downwardly flowing cloud of powder dust, thereby more completely blending the powder before it is layered upon the bottom of the chamber. The rotary motion imparted to the cloud of dust by the jets avoids the necessity of rotating the chamber.

Three pairs of powder sifting screens 5, 5^a; 6, 6^a; and 7, 7^a; are of like construction. Each pair is supported by a suspension bar 8, from a corresponding elbow lever 9, in a manner to permit a free but limited amount of vibration that may be transmitted thereto from an eccentric 13, hereinafter described, by a connecting rod 10. Each lever is coupled by a rod 9^a, to its corresponding weighing beam which forms part of an automatic weighing apparatus to be described hereinafter. The lever is disposed at a considerable distance above the screens and pivotally supported by a stationary object as 9^b, in a manner to give

ample room for inserting and removing ordinary commercial powder shipping cans 11, which are of well known construction. Each circular sieve frame 12, has a member 12^b, formed thereon for the purpose of rigidly fastening it to its corresponding connecting rod 10, which couples it to the eccentric 13. By means of the rivets 14, each frame is fastened to its mate 12^a, and to the suspension bar 8, but the pair of frames may be cast integral if preferred. Each screen is fastened to its frame by an inner retaining ring 15, in the usual manner. The air escape cloth 4, is fastened to the frames by means of the rings 15^a, and the bolts 15^b. These bolts also fasten the inclined chutes 16 and 16^a disposed under their corresponding screens. These chutes when vibrated with the screens convey all the sifted powder from the several screens to the center of the chamber, directly over and at a considerable distance above the jetting nozzle 3, toward which the powder falls in the form of a cloud of dust and is tossed upward, swirled and thoroughly dried by the air jets before it is precipitated to the bottom of the chamber.

The sieve frame is made in two sections, an upper or can clamping section and a lower or screen section which are separated by a slot 12^s. The powder can clamping section is actuated by means of the threaded stud 12^e and the hand nut 12^f, which close the space 12^g, and cause the clamp section to tightly embrace the open end of an inverted can when inserted in the frame and set upon the ring 15. This ring supports the can with its discharge outlet 11^a, at a determined distance above the screen in a manner to permit the powder to gradually flow downward over the surface of the screen as the powder is simultaneously emptied from the can and sifted, by the vibration, into the chamber below.

To avoid injury to the weighing mechanism, when inserting or removing powder cans from the frames, the locking cams 17, are thrown into their vertical position as indicated in Fig. 1, by means of the crank 18 and the pair of shafts 18^a, in a manner to touch the top and bottom sides of the slots 15^s, of the slotted member 15^m, formed on the ring 15^a. The shafts 18^a, are supported by bearings 19, which project upward from and are fastened to the chamber 1. The pair of shafts are coupled by the sprocket gears 20 and the chain 20^a, for the purpose of causing the cams to move at the same time and take like positions. To free the frames and place their burdens upon the weighing mechanism, the crank 18, is turned through an angle of 90°, which places the cams horizontally and free from contact with the slotted members.

Vibration is transmitted by the rods 10, to the sieve frames 12, from the oil tight eccentric housing 21, which is preferably for safety located outside the blending room partition 22. It is made quite massive to resist vibration and is arranged to form an oil reservoir to give proper lubrication to the eccentrics 13 and shaft 13^a. This shaft is driven at high speed by the pulley 13^b, from any suitable source of power. Each eccentric is embraced by a journal box 22, which abuts against one side of the jaw 10^b, formed on the rod 10. A movable wedge shaped filler 23, is interposed between the box and the other side of the jaw and when placed in its lower position, as shown, it will transmit a rapid reciprocating motion to the connecting rods and sieve frames when the eccentric shaft is rotated at high speed. A sliding shoe 23^e, is interposed between the wedge shaped filler 23 and the box 22. It is supported by a horizontally disposed plate section 23^f, formed thereon and arranged between the housing cover 21^g and the top of the eccentric journal bearings 21^e. This construction permits the shoe and filler to slide horizontally when actuated by the eccentric box, but not vertically for the purpose of preventing vertical motion from being transmitted to the floating link 24^b and the magnet lever 24^a. Connecting rod guide wear blocks 21^h, are fastened to the under side of the detachable cover 21^g, for the purpose of preventing vertical motion or lifting of the rods 10. The box 22, is given ample freedom in the jaw to stop the vibration of the sieve frames when the filler is lifted by the counterweight 24, which is coupled thereto by the magnet lever 24^a, and the floating link 24^b. The vibration is again started when an electric current is conducted through the wires 25, 25^a or 25^b from the automatic weighing apparatus, and causes the magnet 50, 50^a or 50^b to lower the filler into the position shown. The small slot 24^e, formed in the floating link 24^b, prevents vibration from being transmitted to the magnet lever and permits the lever to rest upon the magnet when the filler 23, is in its lower or contact position. The side wall 21^b, of the eccentric housing 21, is made detachable to give access to the eccentric jaws and to take out the wear plate 21^d, which supports the reciprocating jaw. Journal bearings 21^e, are formed on the housing for supporting the eccentric shaft.

The vibration of the screen frames causes the powder to be discharged from the powder cans as rapidly as it sifts through the screens and slides down the chutes and into the blending chamber.

Excessive dust resulting from manually handling powder and the consequent great danger is avoided by sifting powder directly from the shipping cans as already described.

By the use of an automatic weighing con-

trol, the rate of powder flow, as it is sifted from the several cans, can be governed with the high degree of refinement necessary in obtaining the essential perfection in the blend of a fuse powder used for precisely timing the explosion of a flying projectile.

Each of the elbow levers 9, is coupled by the rod 9ª, to a corresponding elbow lever 30, which is pivotally supported by a suitable stationary member as 30ª, disposed above the automatic weighing apparatus and preferably in a separate room at some distance from the blender to lessen danger from electrical currents used in the apparatus. A vertical rod 31, couples each elbow lever to its corresponding weighing scale beam 32, 33 or 34. This rod is made adjustable in length by the turn buckle 31ª, which is of usual construction.

The beam 32, is preferably coupled to the outer pair of screens 5, 5ª; 33, to 7, 7ª, and the intermediate beam 34, to the intermediate pair of screens 6, 6ª, for simplicity and convenience in operating. The outer weighing scale beams 32 and 33, are disposed horizontally and are of like construction. They are pivotally supported on the base 35, by their pivotal bearings 32ª and 33ª, which are secured to the base by the bolts 32ᵇ and 33ᵇ. These beams are provided with adjusting weights 32ᵈ and 33ᵈ and have graduations 32ᵉ and 33ᵉ, marked thereon preferably in decimal fractions for convenience in making calculations when proportioning the blending mixtures. The long inner, or scale end of the beams are pointed and disposed in horizontal alinement with each other, in a manner to place their pointed ends directly opposite each other and within the guard 36, which limits their oscillating movement, the intermediate, or equalizing weighing scale beam 34, is disposed parallel to and a short distance above the beams 32 and 33 and is coupled thereto by a pair of adjusting links 40. This beam is pivotally supported at its middle by the horizontal adjusting lever 37, which is provided with an adjusting weight 37ª. It is positioned by the flexible blade 37ᵇ, which is fastened thereto and to a supporting member 38, that is formed on and projects horizontally from the base 35. The blade 37ᵇ, forms a flexible hinge which prevents longitudinal and lateral movement of the scale beam 34, and provides a free but limited vertical motion which may be transmitted thereto by the corresponding rod 31, from the corresponding pair of intermediate blender sifting screens 6, 6ª. The vertically disposed thumb screw 39, is positioned by a projection 39ª, formed on the base in a manner to locate the screw directly under the downwardly projecting lug 37ᵈ, formed on the lever 37, for the purpose of preventing vertical movement of the lever 37, when the screw is made to abut against the lug; thereby cutting out the intermediate pair of screens 6, 6ª, from the weighing apparatus, without affecting the weighing accuracy and control of the outer screens 5, 5ª and 7, 7ª, by the outer scale beams 32 and 33. The knife edge bearings 34ᵏ and 37ᵏ and the stirrup 31ᵇ, provide a ready means for coupling the rod 31, to the beam 34, in a manner to transmit vertical motion thereto and cause a slight oscillation of the right hand end 37ʲ, of the lever 37. This oscillation, is limited by the stationary guard 41, which projects from the base. The floating scale beam adjusting links 40, are disposed vertically and parallel with each other, and are set to suit the calculated proportions desired in the powder blend. When each is set at a distance from the corresponding bearing 32ª, or 33ª, equal to twice the distance of the same bearing from the corresponding knife edge bearing 32ᵏ or 33ᵏ, the scale beams will all balance with an equal burden on each of the pairs of sifting screens, or rods 31. By a carefully calculated adjustment of the links 40, toward the right or left, many desired proportions may be obtained and maintained as will be described hereinafter. Metallic contact interrupting cups 42, of like construction, are adjustably supported by the members 42ª, and 42ᵇ, which project from the base 35. Electrical insulation 43, is interposed between the supporting member and the cups. Electrical conductors 25, 25ª and 25ᵇ, are connected with the cups and to corresponding magnets or solenoids 50, 50ª and 50ᵇ, to be described hereinafter. Each cup is placed directly beneath the oscillating end of its corresponding scale beam. A dash pot 46, is pivotally suspended within the oil contained in each cup by a dash pot rod 32ʳ, 33ʳ and 37ʳ, from the beams 32, 33 and the lever 37, respectively, in a manner to permit a free but steady movement of the beams and levers within the limits determined by the guards 36 and 41. A small hole 46ª, in the dash pot measures the rate of oil flow to and from the pot and the cup, thereby determining the time of the beam oscillations. Mercury 42ᵐ is placed at the bottom of each cup directly beneath and close to the lower extremity of the dash pot rod for the purpose of interrupting an electrical current transmitted by the wires 25, 25ª, 25ᵇ, 48, 48ª and 48ᵇ, which lead to and from the cups, beams and levers. Electrical current is provided in any suitable manner as from a battery 60 and governed by a switch 60ª.

When operating the apparatus, the links 40, are adjusted upon the beams to give the calculated proportions desired for a given powder blend. The proper powder, contained in shipping cans, is selected for the blend. The cans are opened in usual manner, inverted and clamped to the proper pair

of screen frames. Six cans, two of each kind, may be clamped over a pair of screens or frames; or three cans, that is, one can of a kind on each pair of screens or frame when it is desired to blend a smaller quantity. The frames are then freed by the crank 18, as already described. The weighing beams are balanced by adjusting the weights 32^d, 33^d and 37^a, until the scale beam and lever ends point to a positioning dot marked in the guards 36 and 41, the thumb screw 39, having been previously adjusted to clear the lug 37^d. When all the beams are balanced, the lower extremity of all the dash pot rods will touch the mercury within the cups and after closing a battery switch, 60^a, current will be transmitted to all the magnets 50, 50^a and 50^b, through the wires 25, 25^a and 25^b, thereby cause the three fillers 23, to be lowered and transmit vibration from the rotating eccentrics to the three screen frames.

If powder is sifted by any one of the three screen frames faster than the calculated proportion, the corresponding dash pot rod is lifted by the unbalanced beam and breaks the electric current which stops the vibration of that frame. If a second frame sifts too fast, it will be stopped in like manner until the third frame sifts sufficient powder to again balance the system; after which all three will continue sifting. These cycles of sifting operations will repeat themselves until the powder is all sifted from any one of the pair of screens or cans, and the corresponding scale beam lifts and breaks its electric circuit. The other two pairs will continue to sift until they have reduced the weight of powder in their cans to give the calculated proportion as accurately measured by the delicate scale beams; after which, these beams will lift and also stop their screens, thereby automatically stop the entire apparatus.

When it is desired to check the operation of the machine, the powder is accurately weighed to give the calculated proportions for which the links 40, are set. At the close of the sifting operation, all the cans should be emptied.

When only two powders are to be blended, the thumb screw 39, is raised to prevent a vertical movement of the lever 37, and the powder is placed only on the screen frames coupled to the scale beams 32 and 33. When so arranged the beam 34, acts merely as an equalizer between the beams 32 and 33.

When simultaneously blending more than three powders, a correspondingly greater number of scale beams are coupled in the manner illustrated diagrammatically by Figs. 12 and 13. These figures respectively show weighing apparatus for blending four and six powders simultaneously, and wherein the elbow levers 30^x; the extension rods 9^w; the stationary pivotal supports 30^y; the mercury cups 42^x; the adjusting links 40^x; and the adjusting weights 32^x; are of like construction and adapted for the same purpose as the corresponding parts, 30, 9^a, 30^a, 42, 40 and 32, respectively; with the exception that the horizontal arm of the elbow lever 30^x, is provided with an extension to support the adjusting weight 32^x and a pivotal connection for the mercury cup 42^x. The several parts are also related and connected in like manner with corresponding vibrating screens and magnets for governing the rate of sifting, as already described.

The vertically disposed rods 31^x, can be adjusted laterally at their lower ends to pivot at any selected reading marked on the opposite sections of the horizontal scale beams 70. The adjustable floating link 40^x, couples each scale beam 70, near its middle to another parallelly disposed equalizing scale beam 71. In Fig. 12, the beam 71, is coupled by a laterally adjustable link 40^y, to a horizontally disposed stationary scale bar 72. In Fig. 13, one of the scale beams 70^a, is coupled to the longer end of an intermediate scale beam 73, in a manner to balance the force transmitted to its shorter end from the beam 71 by the link 74. The link 75, transmits the force from the beam 73, to the stationary scale bar 76.

For convenience in illustrating the operation in Fig. 12, the vertical rods and links are marked to show the percentage of the total force that is transmitted thereby to the stationary scale bar 72 and indicate the relative proportions of the powders selected for an assumed blend. By simple calculation the distance of each pair of rods 31^x, from its corresponding link 40^x, is determined and set on the scale beam 70, as shown in Fig. 12, by the numerals 4, 3, and 4, 2. By further calculation, the link 40^y, is properly adjusted on the scale bar 72 and the scale beam 71, as indicated by the numerals 3 and 7. The link 40^y, is adjusted on the bar 72, to a position which places the several rods 31^x, as near vertical as possible. These rods are preferably made of sufficient length to reduce the weighing error, due to a slight angularity between them, to a negligible quantity. After making the adjustments, the operation is practically the same as when blending three powders. At times it is desirable to blank off or cover sections of screen area by means of a sheet of paper, card board, or otherwise, to avoid too frequent stopping of the corresponding vibrator while any screen is sifting a relatively small percentage or quantity of powder. By reducing certain screen areas, or by changing their screen meshes, to proportion their relative sifting capacity so as to approximate the corresponding percentage of powder required for a blend, it is possible to have all

the vibrators operate almost continuously and thereby obtain a greater degree of refinement in blending.

When it is desired to actuate the sifting screens by air vibrators instead of eccentrics, the modified construction shown in Figs. 9, 10 and 11, is coupled to and governed by the weighing apparatus shown in Figs. 4, 5 and 6. When desired a single screen frame 62, may be substituted for the double frames shown in Figs. 1 and 2. Likewise, the vertical suspension bar 8^{y}; the elbow lever 9^{y}; the stationary pivotal support 30^{y} and the powder container 11^{y}, may be substituted for 8, 9, 9^{b} and 11, respectively and coupled to the weighing apparatus in like manner. Evidently, any number of the single screen frames 62, or double frames, when desired, can each be vibrated by an air vibrator 61, which is attached thereto in usual manner. An air conduit 63^{e}, 63^{g}, or 63^{h}, connects a vibrator with any usual type of air supply governing valve 45, 45^{a} or 45^{b}, the details of which are not shown. The conduit 45^{d}, connects the valves to any suitable source of air supply. Three valves adapted to govern the vibration of the screen frames 62 are shown for convenience of illustration. Magnets 50^{d}, 50^{e} and 50^{f}, control the air valves in usual manner, and are electrically connected by means of the wires 25, 25^{a} and 25^{b}, to the corresponding wires on the weighing apparatus, which when so arranged stops and starts the air vibrators 63, instead of the vibrating eccentrics 13, and in like manner thereby governs the rate of sifting.

Air vibrators frequently fail to start when air is admitted and require to be given a hammer blow before starting. To do this automatically, a small cylinder 63, is attached directly to the vibrator cylinder 61, and is provided with a piston hammer 63^{d}. A coil spring 64, is interposed between the piston and the vibrator cylinder so as to normally hold the hammer away therefrom. When air is admitted from an air valve, as 45, through a conduit, as 63^{e}, to the vibrator cylinder 61, it also enters the cylinder 63, through the duct 63^{f}, and causes the hammer 63^{d}, to strike and start the vibrator.

The apparatus may be applied for blending dye stuffs, grain flour and evidently by using different meshed screens, it is equally well adapted to blend coarser materials, or grain, when desired, without departing from the spirit of my invention.

What I claim is:

1. In a blending apparatus, the combination of a plurality of means for sifting comminuted substances, means for supporting said substances after being sifted, a plurality of weighing beams, means for coupling said weighing beams to the sifting means, means for controlling the sifting means by a movement of the weighing beams, and adjustable means adapted to couple the weighing beams and proportion their leverages so as to correspond with the predetermined proportions of the comminuted ingredients desired in a blend.

2. In a powder blending apparatus, the combination with a blending chamber, of a plurality of independent sifting screens above said chamber, supports for inverted powder cans above said screens, independent mechanisms for vibrating said screens, a plurality of weighing devices for supporting said screens, and connections between said weighing devices and said vibrating mechanisms whereby the operation of the latter is controlled by the amount of powder on said screens.

3. In a powder blending apparatus, the combination with a blending chamber, of a plurality of independent sifting screens above said chamber, supports for inverted powder cans above said screens, independent mechanisms for vibrating said screens, a plurality of weighing beams, connections therefrom to support said screens, means to render each of said vibrating mechanisms inoperative, and electrical connections between said beams and said means, whereby the latter are actuated whenever the amount of powder on any screen exceeds the amount required for the blend.

4. In a powder blending apparatus, the combination with a blending chamber, of a plurality of pairs of sifting screens, a frame for each pair provided with means to hold inverted powder cans, rods connected to said frames, eccentrics for reciprocating said rods, wedges interposed between said eccentrics and said rods, means to raise and lower said wedges, independent means to suspend each of said frames, scale beams connected to each of said independent means, and connections between said beams and said wedge raising and lowering means, whereby the reciprocation of each of said rods is controlled by the amount of powder on the frame connected to said rod.

5. In a powder blending apparatus, the combination with a blending chamber, of a plurality of sifting screens, independent means to suspend said screens above said chamber, means to support inverted powder cans above said screens, independent means to vibrate the latter, means to control the operation of said vibrating means, weighing beams connected to said suspending means, and electrical circuits governed by said beams and including means to actuate said controlling means.

6. In a powder blending apparatus, the combination with a blending chamber, of a plurality of sifting screens, independent means to suspend said screens above said chamber, means to support inverted powder

cans above said screens, independent means to vibrate the latter, adjustable means interposed between each of said vibrating means and its connected screens, solenoids to actuate said adjustable means, a weighing mechanism for each of said suspending means, and electrical circuits including said solenoids and controlled by said weighing mechanisms, whereby the vibration of each screen is governed by the weight of the powder thereon.

7. In a powder blending apparatus, the combination with a blending chamber, of a plurality of sifting screens, independent means to suspend said screens above said chamber, means to support inverted powder cans above said screens, independent means to vibrate the latter, adjustable means interposed between each of said vibrating means and its connected screens, solenoids to actuate said adjustable means, a scale beam connected to each of said suspending means, electrical circuits including said solenoids and closed or broken by said scale beams, and adjustable means connecting the latter and proportioning their leverages, whereby the relative proportions of powder sifted through each screen is kept constant for any particular blend required.

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