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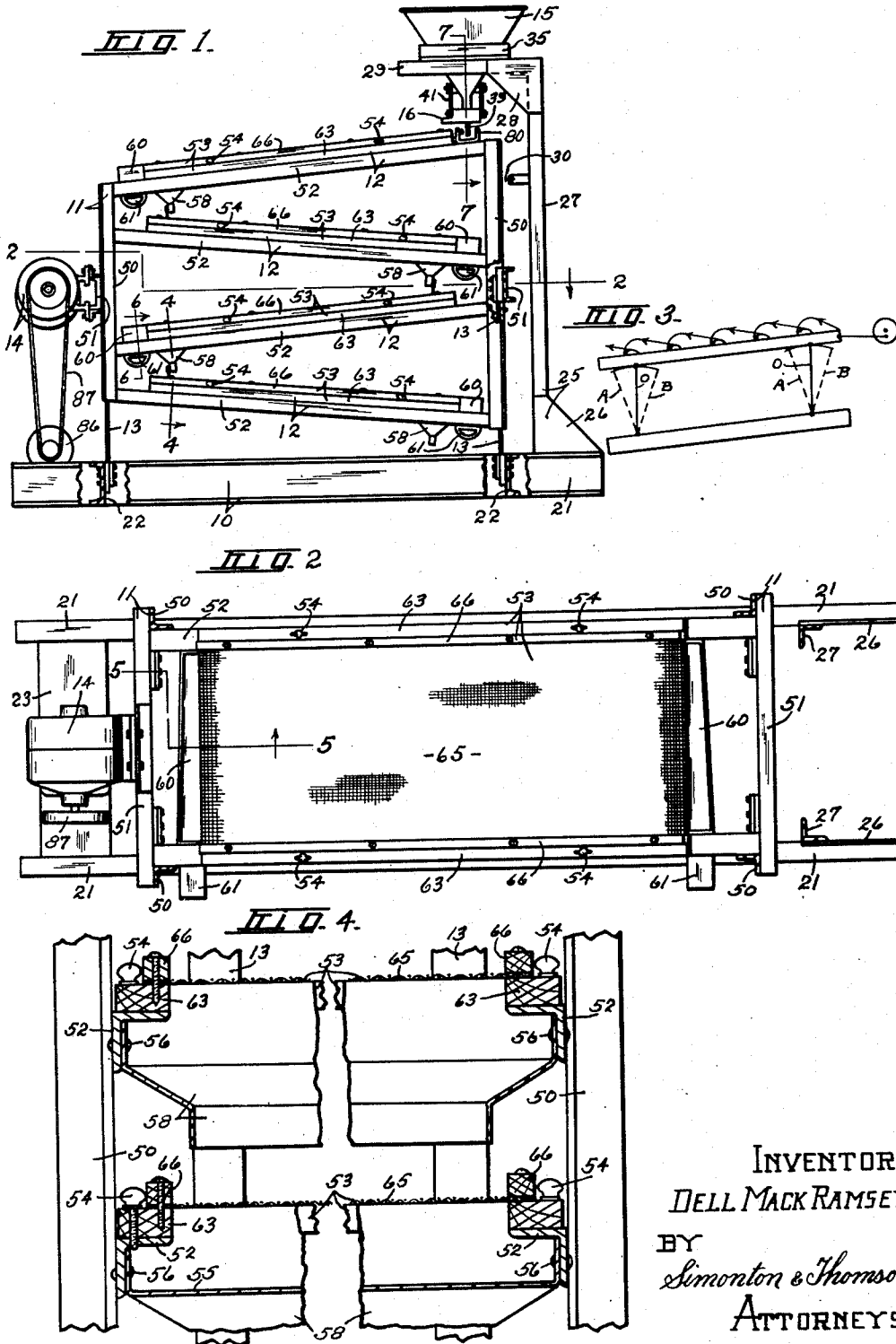
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MULTIDECK SCREEN

Filed April 25, 1938

2 Sheets-Sheet 1



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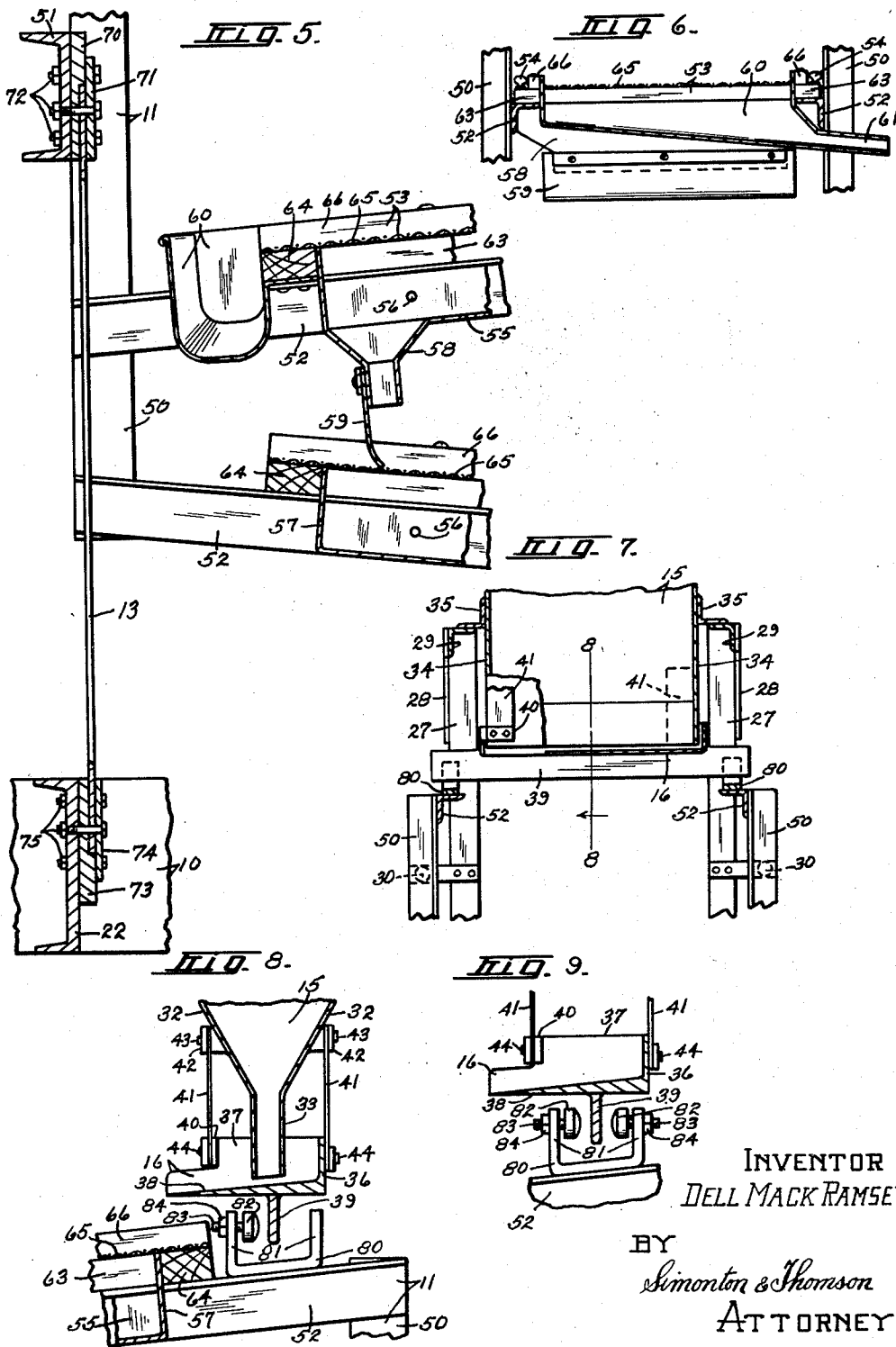
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MULTIDECK SCREEN

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Application April 25, 1938, Serial No. 204,006

2 Claims. (Cl. 209—247)

My invention relates to improvements in the art of classifying particles of material as to size by means of screens and particularly to that branch of the art that accomplishes such classifications by means of multideck screens of the vibratory type.

The primary objects of my invention are, first, to obtain higher screening efficiencies, especially where the classifications must be held within narrow limits of particle size; second, to provide a screening machine of a simple, compact and economical design.

Another object of my invention is to provide a novel means for supporting the screens above the base in such manner that when the machine is at rest the supports are substantially vertical and when the machine is vibrated the motion paths of the screens are symmetrical about the point of rest.

Still another object of my invention is to provide a synchronized feed mechanism for evenly distributing the feed on the screen at the head end of the apparatus.

Generally, in the use of sloping screens or sieves for the classification of material particles as to size, the particle stream is caused to flow down the screen surface by various means well known in the art. In the course of such flow, the smaller particles fall through the interstices between the larger particles and eventually through the interstices of the screen or sieve mesh, thus effecting the separation into sizes. The usual method of obtaining a flow of particles down the screen surface is by vibrating or reciprocating the sloping screen, thus causing a continuous or intermittent movement of the particles in one direction.

Instead of maintaining this unidirectional flow, I utilize a sloping screen in combination with a motion that causes the stream of particles at least in considerable part to advance down the screen surface, come to a complete stop, reverse the direction of flow, stop and repeat the cycle. The net result of this cycle of movements is an intermittent progress down the screen surface.

In my invention, the preferred form is a multideck screen wherein the alternate decks are oppositely inclined to the horizontal in the direction of their lengths. The accompanying drawings illustrate the principles involved and a machine adapted to employ these principles.

Figure 1 is a side elevation of my multideck screen, parts being broken away.

Figure 2 is a horizontal section taken substantially on the line 2—2, Figure 1.

Figure 3 is a schematic representation of the particle movement obtained on the screens of the apparatus of Figures 1 and 2, the arrows indicating the directions of particle travel.

Figure 4 is a vertical section taken substantially on line 4—4, Figure 1, showing details of the collection troughs and delivery spouts for undersized material.

Figure 5 is a vertical section on the line 5—5, Figure 2, showing details of the collection troughs for oversized material and for undersized material.

Figure 6 is a vertical section taken on line 6—6, Figure 1, showing details of the collection troughs and delivery spouts for oversized material.

Figure 7 is a vertical section through the feed hopper on line 7—7, Figure 1.

Figure 8 is an enlarged detail section through the feed hopper on line 8—8, Figure 7.

Figure 9 is a section through the feed tray showing a modification comprising double bumper buttons.

Referring more particularly to Figures 1 and 2, the multideck screen of my invention comprises generally a base 10, a movable deck frame 11, in which are mounted a plurality of screen decks 12, a plurality of vertical withes 13 supporting the deck frame 11 on base 10, means 14 for vibrating deck frame 11, a feed hopper 15, and a feed distributing tray 16.

The base 10 comprises a plurality of longitudinally disposed members 21, here shown as standard steel channels. Cross members 22, also standard steel channels are fastened transversely to members 21 by suitable means, for example welds or angles and rivets. Motor plate 23 is fastened transversely to members 21 by similar suitable means. Frame 25 comprises steel plates 26 fastened to members 21, vertical members 27, here shown as standard steel angle sections, fastened to plate 26, plates 28 fastened to members 27, horizontal members 29, here shown as standard steel angle sections, fastened to plates 28 and supporting hopper 15.

A plurality of adjustable bumper buttons 30 is supported on members 27 and so positioned and adjusted as to limit the amplitude of motion of deck frame 11 when said frame is started vibrating.

Feed hopper 15 and distributing tray 16 are shown more clearly in Figures 7 and 8.

Feed hopper 15 is transversely disposed in relation to the base 10. The hopper may be formed of two sloping sides 32 brought downwardly and formed into spout 33, said spout 33 being open at

the bottom. Ends 34 are vertically disposed and fastened to sides 32 or formed therefrom. Supporting angles 35 are horizontally disposed and fastened to ends 34.

5 Distributing tray 16 comprises a rear wall 36, two side walls 37 and a bottom plate 38. A tongue 39 projecting downwardly from plate 38, is fastened thereto or formed as part thereof. Ears 40 are formed from side walls 37 by cutting and-bending, or may be made of angles fastened to 37.

10 A means for suspending tray 16 from hopper 15 comprises flexible withes 41, here shown as flat steel strips disposed on opposite sides at each end of tray 16 and so positioned as to permit movement of tray 16 in a longitudinal direction with respect to base 10. Substantially U shaped members 42 are fastened to hopper 15. The upper ends of withes 41 are fastened to pieces 42 by means here indicated as rivets 43. The lower ends of withes 41 are fastened to back 36 and ears 40 of tray 16, by means here shown as rivets 44.

25 Referring again more particularly to Figures 2 and 4; movable deck frame 11 is comprised of a plurality of vertical members 50, here shown as standard steel angle sections, positioned at the four corners of the frame 11. A plurality of transverse members 51, here shown as standard steel channel sections, is positioned horizontally substantially at the plane of the center of gravity of frame 11. Means are provided for fastening said transverse members 51 to vertical members 50, for example by welds or rivets. A plurality of decks 12 is positioned within the deck frame 11. The decks 12 are disposed one above the other, oppositely inclined to the horizontal, and fastened to the deck frame by suitable means, for example welds or rivets. In practice the decks 12 are arranged in even multiples above and below the horizontal plane through the center of gravity of the frame 11, although the number of decks can be odd or even if desired.

30 Deck 12 comprises a plurality of members 52, here shown as standard steel angles, positioned on opposite sides of frame 11 and disposed longitudinally thereto, said members 52 being fastened at either extremity to members 50. Removable screen 53 is fastened to members 52, by means here shown as thumb screws 54. A trough 55 substantially of U cross section is disposed longitudinally below and fastened to members 52 by rivets 56. Referring to Figure 5, a lip 57 is formed transversely at the upper end of trough 55 to prevent material from backing out of said trough. A distributing hopper 58 is located at the lower end of trough 55 and serves to feed collected material to the next lower deck. A back plate 59 positioned transversely and projecting downwardly is fastened to hopper 58 and serves to prevent material from backing off the next lower deck. Discharge trough 60 is positioned at the discharge end of screen 53 and disposed transversely thereto, in such manner as to collect and discharge material passing over screen 53. Trough 60 is fastened to members 52 preferably by welds or rivets. The trough 60 may be closed at one end, the opposite end being formed into a discharge spout 61. The trough 60 is of substantially U-shaped cross section and is of increasing depth from the closed end to the discharge end. The effect of the increasing depth is to give a bottom slanting toward the discharge end, which slant causes material collected in the trough 60 to travel down and be

discharged when the deck frame 11 is vibrated.

Removable screen 53 is comprised of a plurality of longitudinal members 63, a plurality of transverse member 64 fastened to the ends of members 63 to form a rectangular frame. Screen cloth 65 is fastened to the frame thus formed by means of rails 66 screwed to member 63.

Withes 13 are here shown as single leaf flat steel springs disposed vertically with the flat sides of the springs normal to the longitudinal axis of deck frame 11 to permit flexure in a vertical plane parallel to the longitudinal axis of the deck frame. Withes 13 are positioned substantially at the four corners of the deck frame 11. The upper ends of the withes are fastened to members 51 of deck frame 11 by means of clamps comprising recessed plate 70, cover plate 71 and bolts 72. The lower ends of withes 13 are fastened to members 22 of the base 10 by means of clamps comprising recessed plate 73, 20 cover plate 74, and bolts 75.

The object of attaching the free ends of the withes 13 to the movable deck frame 11 at substantially the horizontal plane of the center of gravity of the movable deck frame system is to avoid rocking forces that would be set up in the movable deck frame if any other position of attachment were used.

It will be noted that this means of supporting the movable screen deck frame permits the movement of the screen deck frame and confines the motion to a curvilinear motion path symmetrical about the point of maximum vertical displacement of the motion path.

A vibrator mechanism 14, here shown as a Shaler vibrator is fastened to member 51 of frame 11 by suitable means, preferably bolts. Motor 86 is fastened to plate 23 by similar means and drives vibrator 14 through belt 87.

Referring more particularly to Figures 8 and 9, a plurality of substantially U-shaped pieces 80 is fixed to the upper members of deck frame 11 subjacent to tongue 39 of shaking tray 16 in such manner that arms 81 of pieces 80 project upwardly on either side of tongue 39. An adjustable bumper button 82 is mounted on threaded shaft 83 which is screwed into a threaded hole in arm 81. 84 is a lock nut for locking button 82 in adjustment.

An alternate scheme showing two bumper buttons oppositely placed is shown in Figure 9.

The angle of the decks to the horizontal is fixed in this construction. Small changes in the fixed angle of the screens are obtainable by inserting blocks between the screen frame 52 and members 64. If an increased angle is desired the blocks will be inserted at the head end of the screen. If a decrease in angle is desired the blocks will be inserted at the discharge end. It is understood, however, that the deck angles may be made continuously variable if desired by methods well known to those skilled in the art.

Operation

Figure 3 is a schematic representation of the particle movement obtained on the screens of the apparatus of my invention. It will be noted that the displacement, both vertically and horizontally from the position of rest 0 which is the point of maximum vertical displacement, to points A and B is equal. This symmetrical motion of the screen frame permits the arrangement of oppositely sloping screen decks and assures substantially equal velocity of travel of the material particles on the oppositely inclined screens. It

will be noted that the combination of a sloping screen with the symmetrical curvilinear motion path illustrated, will give the material particles a forward and reverse direction of travel with each cycle of screen movement, but the movement of the particle will be greater in the direction of the downward slope of the screen, with a resultant intermittent motion down the screen surface. In defining the motion of the particle stream, it is understood that the motion is considered relative to the motion of the screen surface.

Vibrator mechanism 14 is set in motion through belt 87 by means of motor 86, thus causing the movable deck frame 11 to sway back and forth on vertical withes 13. The amplitude of vibration is damped at the start by bumper buttons 30. When the machine has reached substantially its predetermined frequency and amplitude of vibration, the material to be classified is placed in hopper 15 and fed through shaking tray 16 on to screen 53. Shaking tray 16 is actuated by bumper button 82 as follows: Bumper button 82 is adjusted so that when the deck frame 11 is vibrated the bumper button 82 is thrown into contact with tongue 39 causing the shaking tray 16 to move back. Withes 51 being of flexible material, cause shaking tray 16 to follow the bumper button 82 when it retreats on reverse motion of frame 11. The shaking motion of tray 16 being synchronized with the motion of deck frame 11, then feeds the material evenly on to screen 53. The particle stream, in traversing the length of screen 53 is separated into material that passes over, called oversized material, and material that passes through the screen mesh, called undersized material. The oversized material is collected in trough 60 and discharged laterally through spout 61. The undersized material is collected in trough 55. The vibrating movement of the deck causes the undersized material to flow down trough 55 and drop through distributing hopper 58 which deposits said undersized material on the succeeding screen at the head end. This method of collection and discharge of undersized material makes the full length of each succeeding screen available for the further classification of material and permits classification of the oversized material from the second deck onward within very narrow limits. Oppositely sloping the subjacent decks permits continuous travel over all screen surface without intermittent conveying and permits taking full advantage of the symmetrical motion path of the movable deck frame.

Tests of commercial size multi-deck screens utilizing this combination of oppositely inclined screens with a symmetrical curvilinear motion path, as hereinbefore described, have given much higher screening efficiencies than methods and apparatus employed heretofore. With a multi-deck screen so described, commercial grades of screened products are regularly obtained from each deck without the necessity of re-screening. The specific embodiment of my invention, as

shown in the accompanying drawings and described in the specification, employs withes fastened at the bottom to the frame of the machine. It is possible, and within the concept of the invention, to obtain similar advantages and results by swinging the withes from an overhead frame, giving hanging support to the movable deck frame.

Although I have described specific embodiments of my invention with considerable detail, it will be understood that many changes and modifications could be made by those skilled in the art without departing from the spirit of my invention and I desire to be limited, therefore, only by the prior art and the scope of the appended claims.

I claim:

1. In a vibratory type of screen having a base, a movable screen deck frame, means for supporting said screen deck frame on said base, means for vibrating said screen deck frame and a feed hopper supported on said base and located over the high end of the top screen, in combination, a feed tray, flexible straps for suspending said feed tray below said feed hopper, means for fastening said flexible straps at their upper ends to the said feed hopper, means for fastening the lower ends of said flexible straps to the feed tray, a bumper button supported on said screen deck frame, said button being so disposed as to strike said feed tray to drive it backward with respect to the direction of flow of material over said tray when the screen deck frame is vibrated, thus imparting to said feed tray a shaking motion, said motion of said feed tray being synchronized with the motion of said deck frame.

2. In a multi-deck vibratory type of screen having a base and a movable screen deck frame, the combination of a plurality of screen decks superposed within said screen deck frame and disposed in even multiples above and below the center of gravity of said screen deck frame, subjacent pairs of said screen decks being longitudinally oppositely inclined to the horizontal, a plurality of vertical withes for supporting said screen deck frame, said withes being flat steel strips disposed substantially at the four corners of said screen deck frame, means for clamping the upper ends of said withes to said screen deck frame at substantially the plane of the center of gravity of said screen deck frame, means for clamping the lower ends of said vertical withes to the base, said clamping means comprising a cross member fastened to said screen deck frame in the first instance and to the base in the second instance, a plurality of recesses in said cross member adapted to receive the ends of the vertical withes, a cover plate for clamping said withes within said recesses, means for fastening said cover plate to said cross member, said withes being so disposed as to allow longitudinal curvilinear movement of the screen deck frame in relation to the base when said frame is vibrated, and means for vibrating said screen deck frame.

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