SUSPENSION AND DRIVE MECHANISM FOR SHAKER TABLE

INVENTOR.
JOSEPH A. AMORI

BY
Hamel and Lane,
HIS ATTORNEYS.
The present invention relates to fruit processing mechanism, and pertains more particularly to a shaker table, and to an improved mounting and drive means for controlling oscillation of such table.

In the processing of various types of fruits and vegetables, it is common practice to pass such products along an oscillating table, which is generally referred to in the industry as a "shaker table." Such shaker tables may be provided with means for grading or otherwise processing the products as they are advanced along the shaker table by the oscillations thereof.

The present invention constitutes an improvement on my Patent No. 2,856,073, issued October 14, 1958, for a generally similar type of mechanism.

The present invention provides suspension and drive control mechanism for a twin unit shaker table of the type used for processing grapefruit, and produces a different type of oscillation at one end of the table from that at the other end thereof. It also balances out the vibratory forces between two similarly suspended, but oppositely oscillating tables mounted on a single support, and driven from a single drive mechanism.

A further object of the invention is to mount a pair of twin shaker table members in side-by-side relation in a supporting frame, one end of each of said tables being supported by a web structure which limits oscillation thereof along a substantially segmental, arcuate path, the other end of each of the tables being supported by springs which permit universal oscillation, an improved, balanced, flexible driven mechanism being provided to balance inertial forces and reduce vibration of the supporting frame.

A further object of the invention is to provide an improved, two unit, fruit processing shaker table and drive mechanism therefor.

These, and other objects and advantages of the invention, will be apparent from the following description and the accompanying drawings, wherein:

FIG. 1 is a perspective view of a twin shaker table embodying the present invention, portions of the supporting frame being broken away.

FIG. 2 is a fragmentary, side, elevational view of the mechanism shown in FIG. 1, portions being broken away.

FIG. 3 is an enlarged, fragmentary, side elevational view of one of the shaker members shown in FIG. 1, portions being broken away, the broken lines showing the position of the table at different limits of oscillatory movement thereof, marks being provided at different points along the side of the shaker member to show the movement of the table relative to a stationary point at each of such marks.

Briefly, in a machine A embodying the invention, a pair of trough shaped shaker units 10 and 11 are mounted on a common supporting frame 12. The discharge ends 13 of both shaker units, which are the left hand ends as shown in each figure of the drawings, are suspended from a common, fixed, transverse frame member 14 by a pair of comparatively stiff, but slightly flexible, supporting webs 17 and 18, while the rear, or right hand end of each of the shaker units is supported by two sets of oppositely extending coil springs 19 and 20.

The two shaker units 10 and 11 are actuated by oppositely counter-weighted shafts 21 and 22, respectively, which shafts are flexibly coupled to opposite ends of an intermediate drive shaft 23. Upon driven rotation of the drive shaft 23, the centrifugal effect of the counter-weighted shafts 21 and 22 imparts oppositely directed oscillative forces to their respective shaker units 10 and 11.

Because of this balanced oscillative effect, and the manner of supporting the shaker units, fruit fed into the shaker units along feed chutes 26, is directed in an extremely lively manner at the inlet ends of the shaker units for rapid processing and feeding thereof, while such fruit is merely shuffled along its downward slope as it approaches the discharge ends thereof.

Referring to the drawings in greater detail, in the illustrative mechanism A embodying the invention, the frame 12 is of structural steel shapes, comprising angle iron legs 24, a rectangular top frame 25 of channel members, and a pair of longitudinal inner channel members 27 and 28. The entire frame 12 is rigidly secured together as by welds 29.

A pair of upright channel members 30 and 31 (FIG. 1) are welded, one to each of the longitudinal inner channel members 27 and 28.

The front, transverse support member 14 is of angle iron, and is welded across the upper ends of the upright channel members 30 and 31. The stiff, but slightly flexible webs 17 and 18 which support the forward, or discharge ends of the two shaker units 10 and 11 are secured by rivets 32 to the outer ends of this support member 14.

Each of the forward support members 17 and 18 may comprise a short length of rubber and canvas belting, or other suitable material having substantially corresponding characteristics. This webbing should be stiff enough to prevent kinking under the stresses imposed thereon, but must withstand the constant flexing back and forth caused by the oscillations of the shaker unit supported thereby.

Each of the trough shaped shaker units 10 and 11 has an inverted, U-shaped metal band 33 fixedly secured thereto. The transverse upper portion 34 of each of these members 33 is preferably twisted as shown in FIG. 1 into substantial alignment with its respective web member 17 or 18, and the lower end of each web is secured to such top portion by rivets 35. Stiffeners 37 and 38, which may be of band metal, are riveted together on opposite sides of the central portion of each web member 17 and 18 to grip such central portion therebetween, thereby to limit the flexing of the web members 17 and 18 to the portions thereof above and below the stiffeners.

A pair of upright channel members 39 are also secured, one to the inner side of each of the inner longitudinal frame members 27 and 28 near their rear ends, and a transverse channel member 40 is welded transversely across the upper ends of these latter uprights. The upper ends of the upper set of springs 19 are connected between a plurality of pins 41 on the transverse channel member 40 to a similar set of pins 42 on the rear of each shaker unit. Each lower set of springs 20 is similarly connected between the pins 42 on each shaker unit to a lower set of pins 43 provided on a transverse lower channel member 44, secured transversely across the top frame 25.

A fruit deflecting apron 45, which may be of material similar to that of the web members 17 and 18, is secured by rivets 47 to the forward side of the upper transverse channel frame member 40 to depend into the trough shaped shaker units 10 and 11, respectively, for guiding fruit, gravitating down a feed chute 26, into its associated shaker unit 10 or 11 as the case may be.

One of the feed chutes 26 is provided near the rear end of each of the shaker units 10 and 11, and is spaced from the bottom and rear end thereof sufficiently to permit fruit, gravitating down the feed chute, to enter the shaker unit and pass beneath the lower end thereof without interference. The machine A is mounted with the
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upper end of each feed chute 26 positioned to receive fruit discharged from a prior processing mechanism as indicated in FIG. 2, for example, a peach splitting and pitting machine. Each feed chute 26 is fixedly supported between the upper ends of a pair of metal plates 48 and 49, the lower ends of which are secured to their respective shaker units.

The counter-weighted shafts 21 and 22 (FIG. 1) are identical to each other, and the right hand one 22 only, as illustrated in FIG. 1, will be described in detail. The shaft 22 is journaled in a pair of axially aligned bearings 50 and 51 which are secured by bolts 52 to the upper ends of a pair of angle plates 53 and 54. The latter, in turn, are secured to the sides of the shaker table 11. The counter-weighted shaft 22 which is journaled in these bearings 50 and 51 is provided with a pair of U-shaped counter-weights 57 and 58, secured thereto in rotatively adjusted position by setscrews 59.

These counter-weights are generally similar to those illustrated in my Patent No. 2,856,073, and operate in a generally similar manner. By rotatively adjusting these two counter-weights, the eccentricity of their combined masses relative to the axis of the shaft 22 may be adjusted from a maximum, when both counterweights are on the same side of the shaft, as shown substantially by the left-hand pair of counter-weights in FIG. 1, to a minimum, when the counter-weights are diametrically opposite each other as shown substantially in the right hand pair of counter-weights in FIG. 1. By rotatively adjusting the two counter-weights relative to each other and to the pair on the other counter-weight shaft 21, the eccentric drive effect on the two shaker units 10 and 11 may be varied as required.

It is desirable to have the eccentric effect of both of the drive-shaft 21 and 22 substantially equal, but diametrically opposite to each other. This balancing of the counter-weights is desirable for several reasons. For example, it causes the two shaker units 10 and 11 to operate with substantially equal oscillative movements, so as to effectively cancel each other out and thus reduce vibration of the entire machine to almost zero. It also causes the central drive shaft 23 to operate in a balanced, wobble condition, wherein there is practically no axial displacement of its medial portion upon which a drive pulley 60 is mounted. Furthermore, it provides for a uniform processing of the fruit in both shaker units 10 and 11.

The central drive shaft portion 23 is connected by flexible shaft connectors 61 and 62 to the inner ends of the counter-weighted shafts 21 and 22, respectively. When the two shaker units 10 and 11 are in a normal, at-rest condition, the central drive shaft portion 23 is in substantial axial alignment with the two counter-weighted shafts 21 and 22 to which it is connected. The drive pulley 60 is a conventional V-grooved pulley, and is secured medially of the central shaft portion 23. This pulley 60 is driven by a conventional V-belt 63 from a pulley 64 of a conventional electric drive motor 65 which is mounted on a suitable support 67 on the frame 12 therebeneath.

The operation of the illustrated mechanism A is as follows: With the mechanism A mounted with its feed chutes 26 positioned to receive supplies of fruit to be processed, for example, at the discharge end of a peach splitting and pitting machine (not shown), the counter-weights 57 and 58 are adjusted to have a desired eccentric drive effect on their respective shafts 21 and 22 as described previously herein.

The oscillative action of the rear end of the table caused by the rotation of the counter-weighted shafts 21 and 22 can be varied by changing the tensile stresses of the two sets of springs 19 and 20 thereon. This action may be intensified either by adding more springs 19 or 20, or by substituting stiffer springs to intensify the oscillations, while the substitution of fewer or weaker springs has the effect of weakening and increasing the scope of these oscillations.

With the counter-weights 57 and 58 adjusted as required for a fruit processing operation, upon energization of the drive motor 64, the central drive shaft 23 is relatively driven, together with shafts 21 and 22 connected thereto. The counter-weights on the shafts being adjusted so as to be substantially equal and opposite to each other, their gyrations cause the shaker units 10 and 11 to oscillate in similar cycles, but in diametrically opposite relation, so that the oscillations of the counter-weighted shafts and their associated shaker units substantially balance out the oscillative forces of the other.

This balanced oscillation also causes the inner ends of the two counter-weighted shafts 21 and 22, and the two ends of the central drive shaft portion 23 connected thereto, to move in circular orbits, but in diametrically opposite relation, as a result of which the medial portion of the central shaft 23 is substantially stationary except for its rotation, and the slight tilting of the axis caused by such movement. The drive pulley 64, being mounted at this medial portion of the central drive shaft 23, thus simply wobbles slightly which does not adversely affect the drive belt 63 or the motor 65.

The oscillations of the shaker units 10 and 11 by this driving arrangement are best shown in FIG. 3, wherein the small patterns 68, 69, 70, 71 and 72 show the movement of the oscillations of the shaker units 10 and 11. Every other cycle of the oscillation, the counter-weights 57 and 58 are adjusted, from the circular shape of pattern 72, that the right hand, or intake end of each shaker unit operates in substantially circular cycles, which creates a lively agitation of any fruit therein, and causes such fruit to be rapidly processed and forwarded along the shaker unit.

At this stage of its progress, the fruit actually spends more time in the air than it does on the shaker unit bed. At 71, (FIG. 3) the oscillative path of the shaker unit becomes an ellipse, while at 70 the center of mass of the shaker unit, this pattern is small and slightly elliptical. At 69 the oscillative pattern has increased slightly in length, but, due to the action of the webbing 27 or 18, as the case may be, has lost its circular or elliptical shape, and has become arcuate along a line which hastens the movement of the fruit along the shaker table, but reduces the amount of its agitation. As the fruit arrives at the point of pattern 68, the movement has again increased in magnitude but still retains its arcuate shape, thereby hastening the discharge of the fruit from the discharge end of the shaker unit.

The invention provides a simple and effective mounting arrangement for a double unit shaker table, and one which can be easily embodied in machines of type shown in my Patent No. 2,856,073. The present arrangement, however, transforms the shaking pattern of each shaker unit at various stages from the intake toward the outlet end thereof, and permits a wide range of adjustment for differences in processing requirements, which are very important in handling different types of fruit. Additionally, the present invention provides for a simplified and effective single pulley drive arrangement, and a substantially complete balancing of the oscillative forces on the two sides of the machine, so that the frame of the machine is substantially free of vibration, and therefore need not be extremely strong, or firmly anchored to prevent damage or displacement while in use.

While I have illustrated and described a preferred embodiment of the present invention, it will be understood, however, that various changes and modifications may be
made in the details thereof without departing from the scope of the invention as set forth in the appended claims.

Having thus described the invention, what I claim as new and desire to protect by Letters Patent is defined in the following claims.

1. A fruit processing shaker table comprising:
   (a) a frame,
   (b) a pair of shaker units mounted in side-by-side relation,
   (c) a comparatively stiff but flexible web member connected at one end thereof to the frame and supporting one end of each shaker unit to guide the latter for longitudinal, arcuate, oscillative movement thereof,
   (d) a first plurality of coil springs depending from the frame and resiliently supporting the other end of each shaker unit higher than its said one end,
   (e) a second plurality of coil springs connected to the frame and resiliently biasing said other end of each shaker unit downwardly in opposition to the supporting springs,
   (f) a length of stiff sheet material depending from the frame and fitted freely into said other end of each shaker unit to permit free universal oscillative movement thereof in a vertical plane and to restrict transverse movement thereof,
   (g) a pair of counterweight shafts one thereof being journaled on each shaker unit,
   (h) a counterweight mounted on each shaft with its center of mass at an adjusted distance from the axis of such shaft,
   (i) and diametrically opposite the center of mass of the other counterweight,
   (j) and means for rotatively driving said counterweight shafts in unison, whereby, the centrifugal force produced by rotation of the counterweights about the axes of their respective shafts imparts an oscillative driving force to each of the shaker units, the pattern of oscillation of which is different at different ends thereof.

2. A fruit processing shaker table comprising:
   (a) a pair of similar shaker units,
   (b) mounted in laterally opposite relation,
   (c) means guiding one end of each shaker unit for longitudinal, oscillative movement,
   (d) means resiliently supporting the other end of each shaker unit for universal, oscillative movement,
   (e) a pair of counterweight shafts, one thereof being journaled on, and substantially medially of the length of each shaker unit,
   (f) with its axis disposed transversely of the length of the shaker unit,
   (g) the two counterweight shafts being spaced endwise of and substantially co-axial with each other when the shaker units are at rest,
   (h) a counterweight secured eccentrically to each counterweight shaft,
   (i) on a side of the shaft axis diametrically opposite to the other counterweight,
   (j) a drive shaft mounted to extend endwise between, and co-axial with, the two counterweight shafts,
   (k) a pair of flexible couplings connecting opposite ends of the drive shaft in driving, supported relation to the counterweight shafts,
   (l) a drive pulley mounted co-axially of the drive shaft approximately medially of its length, and
   (m) a rotatively driven belt passing around said pulley in driving relation therewith for rotatively driving said drive shaft and the counterweight shafts coupled thereto to cause said counterweights to revolve about their respective shaft axes, whereby, the centrifugal force produced by rotation of the counterweights about their axes imparts opposite, balancing oscillative, driving forces to the two shaker units, and the opposite ends of the drive shaft move in similar circular orbits, but 180° out of phase with each other, and the center point of the drive shaft rotates without substantial orbital movement while the pulley wobbles slightly thereby by retaining the belt under substantially uniform tension.

3. A fruit processing shaker table comprising:
   (a) a pair of similar shaker units,
   (b) mounted in laterally opposite relation,
   (c) means supporting each shaker unit for longitudinal, oscillative movement,
   (d) a pair of counterweight shafts, one thereof being journaled on, and substantially medially of the length of each shaker unit,
   (e) with its axis disposed transversely of the length of the shaker unit,
   (f) the two counterweight shafts being spaced endwise of and substantially co-axial with each other when the shaker units are at rest,
   (g) a counterweight secured eccentrically to each counterweight shaft,
   (h) on a side of the shaft axis diametrically opposite to the other counterweight,
   (i) a drive shaft mounted to extend endwise between, and co-axial with, the two counterweight shafts,
   (j) a pair of flexible couplings connecting opposite ends of the drive shaft in driving, supported relation to the counterweight shafts,
   (k) a drive pulley mounted co-axially of the drive shaft approximately medially of its length, and
   (l) a rotatively driven belt passing around said pulley in driving relation therewith for rotatively driving said drive shaft and the counterweight shafts coupled thereto to cause said counterweights to revolve about their respective shaft axes, whereby, the centrifugal force produced by rotation of the counterweights about their axes imparts opposite, balancing oscillative, driving forces to the two shaker units, and the opposite ends of the drive shaft move in similar circular orbits, but 180° out of phase with each other, and the center point of the drive shaft rotates without substantial orbital movement while the pulley wobbles slightly thereby by retaining the belt under substantially uniform tension.

References Cited by the Examiner

UNITED STATES PATENTS

1,943,076 1/34 Jackson .................. 209—367
2,192,279 3/40 Symon .................. 209—415
2,204,379 6/40 Overstrom ................. 209—415
2,445,175 7/48 Hittson .................. 209—367
2,856,073 10/58 Amori .................. 209—415

FOREIGN PATENTS

765,692 3/34 France.

HARRY B. THORNTON, Primary Examiner.
HERBERT L. MARTIN, Examiner.