June 4, 1957 J. W. PHILIPPOVIC 2,794,539

TRIHEDRAL TUBULAR BEAM SUPPORT

Filed Jan. 20, 1955 4 Sheets-Sheet 1

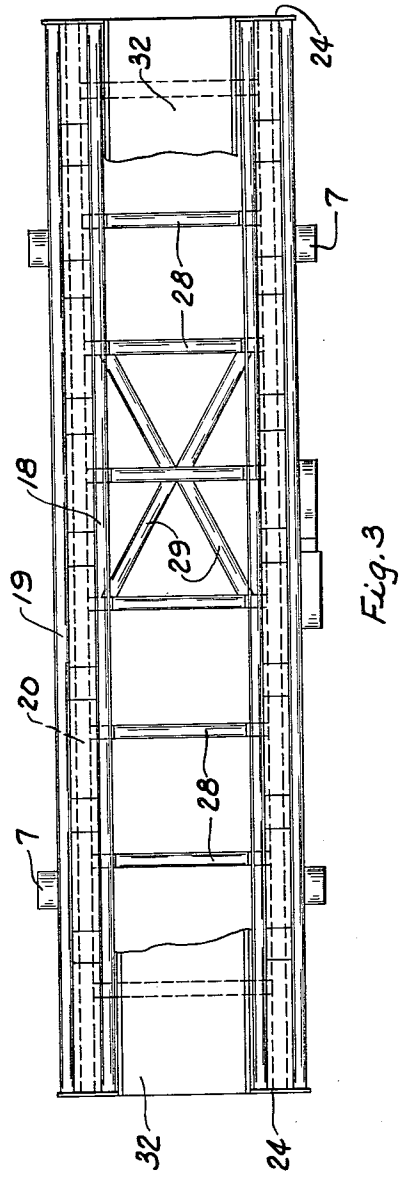


Fig. 3

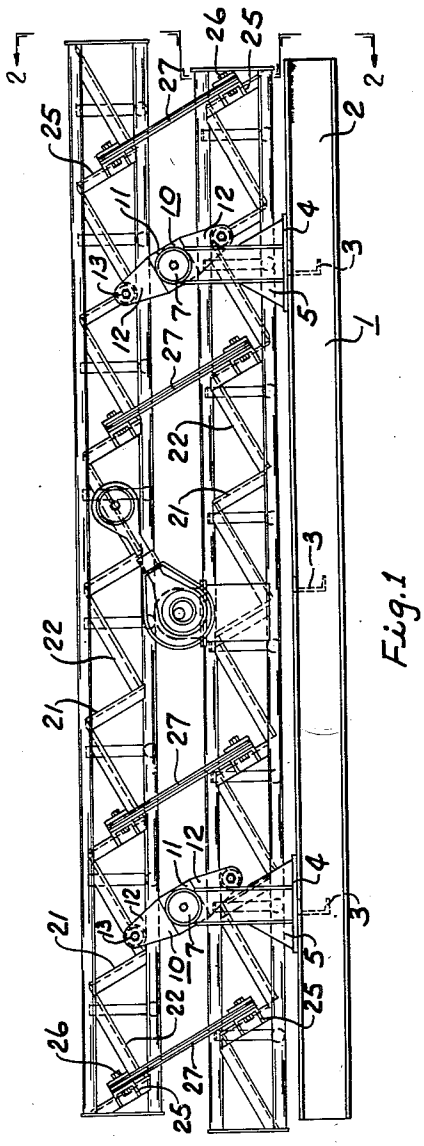


Fig. 1

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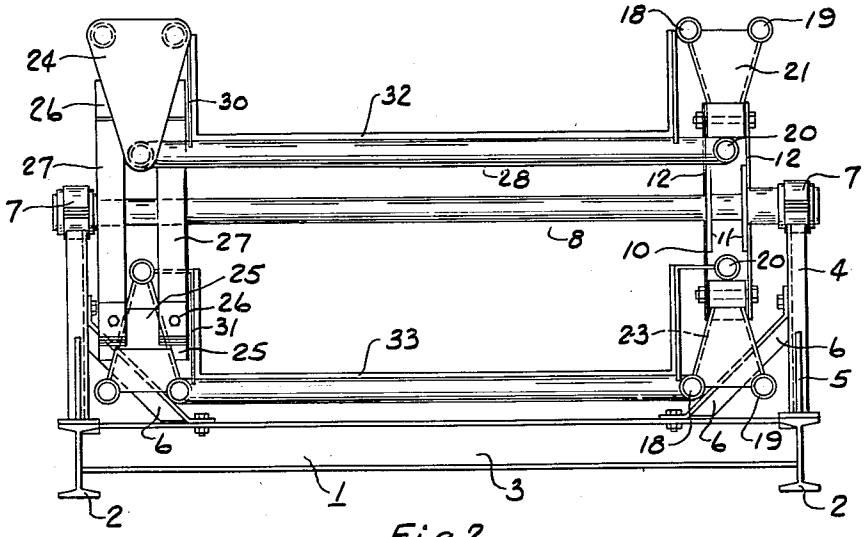


Fig. 2

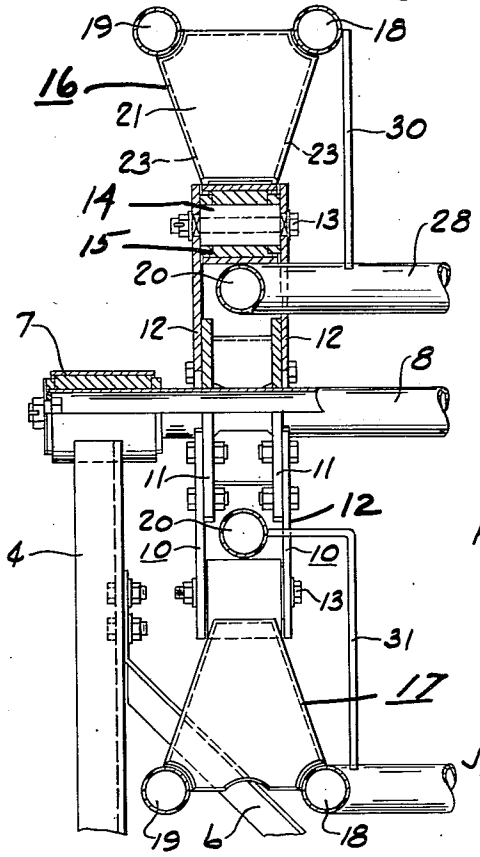


Fig. 4

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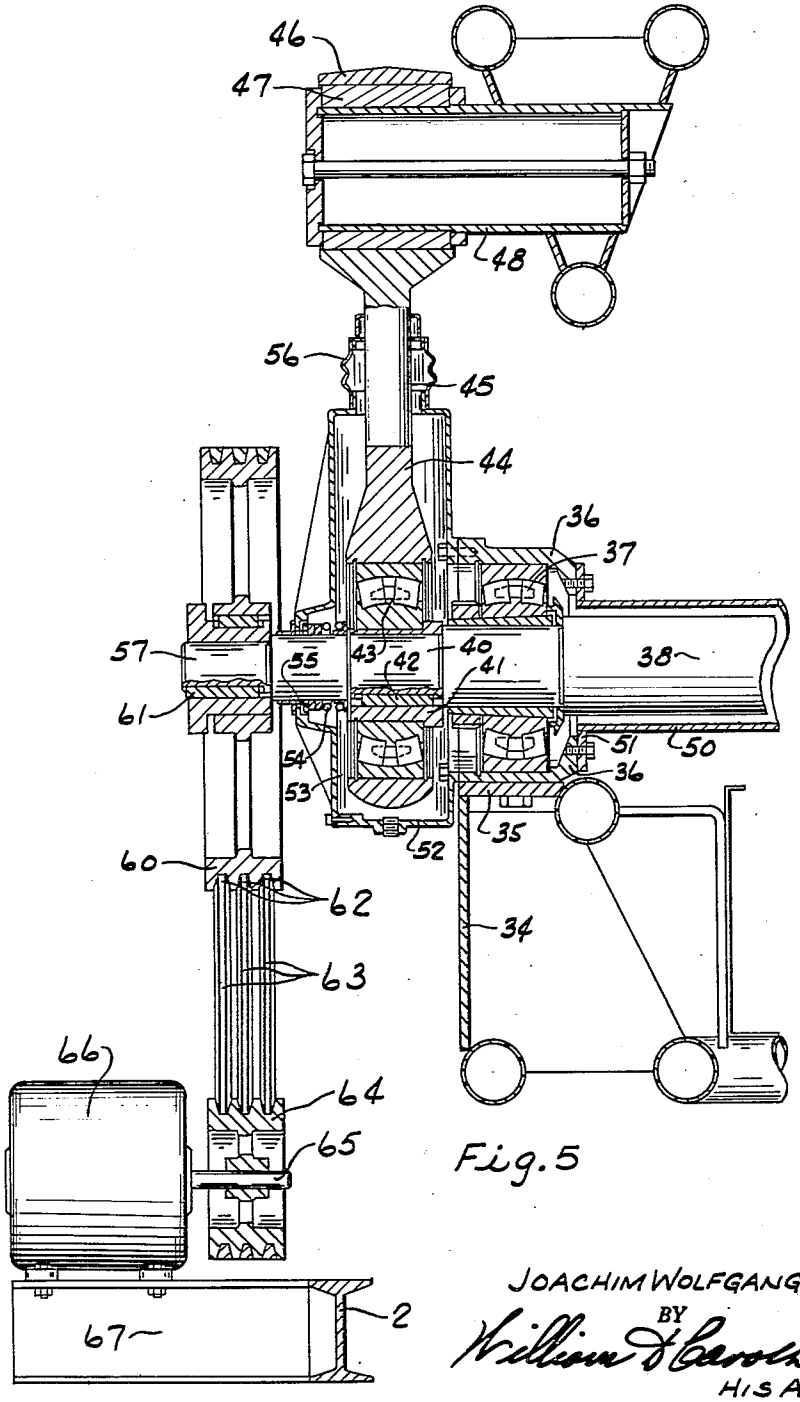


Fig. 5

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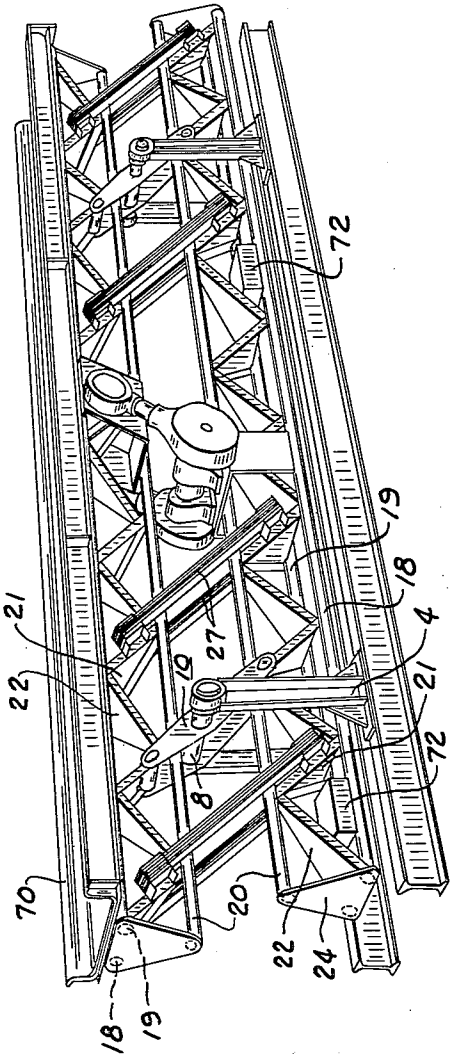


Fig. 6

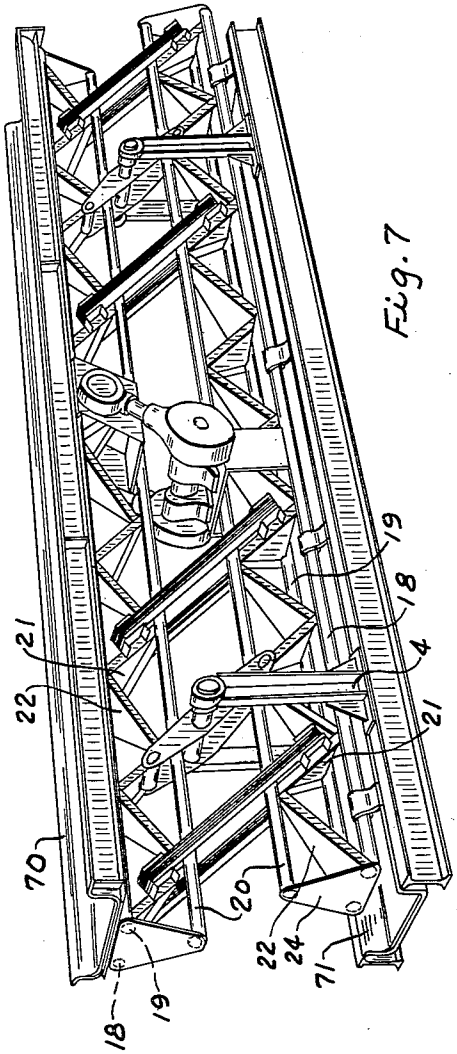


Fig. 7

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United States Patent Office

2,794,539

Patented June 4, 1957

2,794,539

TRIHEDRAL TUBULAR BEAM SUPPORT

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Application January 20, 1955, Serial No. 483,112

8 Claims. (Cl. 198—220)

This invention relates generally to conveyors and more particularly to the spring suspension trough supporting structure of the conveyor.

Conveyors and particularly balanced vibratory conveyors are usually provided with two subjacent and independent trough sections connected to each other through many tuned springs and guide arm units. The whole of this system is suspended from mid position of the connecting guide links or springs. One independent conveyor trough section balances the other through this tuned spring system and substantially no reaction is transmitted through the connecting guide links to the support as shown in United States Patent No. 2,725,984, issued December 6, 1955, for Vibratory Conveyors. However, a considerable twisting action arises between the spring supports and is effective on the conveyor trough sections. The springs were originally secured to the sides of the trough sections. This twisting action literally tore the trough sections apart. Intermediate spring suspension members or drive beams were then inserted between the two sets of springs and placed on each side of a trough. This alone was found inadequate to prevent the destruction of the trough.

The principal object of this invention is the provision of a drive beam structure for mounting dual spring trough supporting means under or on each side of balanced conveyor troughs to prevent their destruction. These drive beams offset the twisting and trough tearing action of the tuning springs.

Another object is the provision of an open drive beam for a balanced conveyor trough system. This open drive beam permits construction and adjustment of the dual spring means when the trough is in place.

Another object is the provision of an open drive beam having trihedrally mounted tubes interconnected with triangular plates to which the ends of pairs of connecting springs are secured. A pair of drive beams connected by parallel rows of springs permit the springs to be tightened or adjusted and provide a secure and balanced structure to withstand the forces induced by the oscillating conveyor sections.

Another object is the provision of an improved rotary driver crank means for a balanced swing mass wherein the driver is mounted on one mass and connected to the other mass for simultaneously moving said masses in opposite directions. This improved crank means is completely enclosed preventing dust from entering and wearing the parts of this vibratory drive.

Another object is the provision of a novel cradle structure suspended between a pair of driving beams to complete a supporting frame for conveyor.

Other objects and advantages appear hereinafter in the following description and claims.

The accompanying drawings show for the purpose of exemplification without limiting the invention or claims thereto certain practical embodiments illustrating the principles of the invention wherein:

Fig. 1 is a view in side elevation of the balanced conveyor structure comprising this invention.

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1.

Fig. 3 is a plane view of one of the cradles for supporting the conveyor section.

Fig. 4 is a detailed sectional view of the supporting connecting links between the balanced conveyor members.

Fig. 5 is a detailed sectional view of the connecting rod drive between the balanced conveyor units.

Fig. 6 is a view of a single beam structure for a double swing singular conveyor.

Fig. 7 is a view of a single beam structure for a double swing double conveyor.

Referring to the drawings, the conveyor comprises the base 1 formed of I beams 2 connected by the cross channels 3. At each cross channel the I beams have a series of opposed standards 4 in the form of vertical channels braced by the angle plates 5 and the straps 6 which actually extend through the open driving beam of the lower conveyor and are connected to the cross channels. The top of each standard 4 is provided with a bearing 7 to support the transverse shafts 8 which are connected between each pair of standards. The conveyors may be fifty or one hundred feet in length and this base structure must be made sufficiently long to support such a conveyor. The long conveyors may have as many as eight or ten transverse shafts 8. Each shaft 8 carries a pair of arms 10 having spaced hub sections 11 with two pairs of plates 12 secured thereto. The outer end of each pair of plates 12 carries a pin 13 with a bushing 14 mounted thereon and journaled in a second bushing 15 secured to the upper and lower pairs of drive beams 16 and 17 on one side of the conveyor.

The upper and lower pairs of drive beams 16 and 17 are trihedral and are mounted to oppose each other. These beams have two spaced tubes 18 and 19 in one plane and a third tube 20 triangularly spaced therefrom. The trihedrally arranged tubes are connected by triangular plates 21 and 22 which are flanged along their side edges as indicated at 23. The top of each plate 21 connects with the tubes and with the top of the next consecutive plate 22 in one direction, and the bottom of each plate 21 connects with the bottom of the next consecutive plate 22 in the other direction as indicated in Fig. 1. The ends of these open drive beams are covered with vertical triangular plates 24 which may be weighted if it is necessary to balance the device. The top drive beam is disposed opposite to the bottom drive beam.

Selected of the plates 21 have a transverse channel plate 25 fixed thereto and which extend beyond both sides of the plates 22 to form spring seats and receive the bolts 26 that clamp the ends of two sets of springs 27 at opposite ends of the channel 25. The springs connect the upper and lower open drive means on each side of each drive beam. In one short conveyor section there may be as many as four sets of springs on each side of the conveyor trough or there may be as many as sixteen sets. Each set of springs 27 may have as many as two to eight flat leaf springs depending upon the load and tuning required. The plates 21 and 25 are mounted at the same angle as the arms 10. The plate 22 is made sufficiently long to connect between the top of one plate 21 and the bottom of the next plate 21 of the trihedral frame. The connecting springs straddle the single tube 20 and are not much wider than the two tubes 18 and 19.

The upper and lower drive beams of the conveyor units are connected by the guide arms 10 and the springs 27 and the whole of this vibrating unit is supported from the center bearings of these guide arms. The arms are approximately two-thirds to three-fourths the length of the

springs. The drive beam bushing **15**, which is made of resilient material, such as rubber or the like, supports the pins in the ends of the guide arms, and is mounted by compressing it axially in housings formed into the plates **21** at their corresponding locations. With the exception of the braces **6**, each of these parts is welded together to form an integral upper and lower trihedral driving beam structure. These upper and lower driving beams are connected by the spaced cross tubes **28** which connect the lower tubes of each drive beam at positions forward of the connection of angularly disposed plates **21** and **22**. Adjacent to the drive connection these frames are reinforced by the diagonal braces **29** of which there are four making an X brace. The straps **30** and **31** are secured to each cross tube **28** and to the upper tube of the drive beam of the upper and lower conveyor frames as shown in Figs. 2 and 3. Thus the straps **30** and **31** complete the frames or cradles for receiving the upper and lower conveyor troughs **32** and **33**.

At the drive position on each side of the conveyor, the lower drive frame is provided with a vertical box plate **34** that has welded thereto the outer edge of the sloping plate **22**. The top of the plate **34** has the heavy floor plate **35** connecting it to the tube **20** of the lower drive beam **10**. The floor plate **35** on each side of the conveyor has secured thereto the housing **36** which has mounted therein the bearing **37** to support the shaft **38**. The shaft **38** projects beyond the bearing **37** and has a reduced section **40** formed thereon. The reduced section **40** has the eccentric sleeve **41** locked thereon by the key **42**. A bearing **43** is mounted on the eccentric sleeve and it in turn is carried in the bearing housing **44** which has a connecting rod **45** extending to another bearing housing **46**. This housing carries the resilient bearing **47** that engages on the stub tube shaft **48** attached to the upper drive frame. When the shaft **38** mounted on the lower conveyor drive beam is rotated, the eccentric sleeve **41** moves the connecting rod **42** to alternately push and pull the upper and lower conveyor drive beams relative to each other. When the eccentric pushes, the upper drive beams move forward on to the right and the lower drive beams move back or to the left. When the eccentric pulls, the upper conveyor moves back and the lower moves forward. Thus the arms **10** oscillate first clockwise, then counterclockwise and this movement flexes the springs **27**. If these springs **27** are tuned just a few cycles above or below the natural period of this mechanical system then the continuous operation will follow a predetermined vibration at a selected speed of rotation of the shaft **38**.

To keep these driving parts free of dirt and dust the shaft **38** is enclosed by the tube **50** which has end flanges **51** connected to their respective housings **36**. The outer end of the housing **36** has the casing **52** attached thereto which is shaped to enclose the bearing housing **44** and has a shaped and fitted lid **53** closed by the seal **54**. A flexible boot or sleeve **56** around the connecting rod **45** shields out the dirt and flexes as the eccentric travels each revolution.

One end of the reduced section **40** of the shaft **38** extends to a second reduced section **57** which has the driver pulley **60** secured thereon by the key **61**. The face of the pulley **60** has multiple grooves **62** to receive V belts **63** connecting with the drive pulley **64** on the shaft **65** of the motor **66**. This motor may be varied in speed to operate the conveyor at different periods of reciprocation per minute to accommodate different loads and within the range of the operation of the conveyor, or the most suitable speed range can be selected and fixed by choosing the appropriate driver-to-driver pulley ratio. The motor **66** may be mounted on the base **67** attached to one of the I beams **2** which is preferably located so that the V belts merely move laterally with the movement of the eccentric providing very little change in the length of these belts as they drive the conveyor. The conveyor troughs may be solid or they may have screen sections to operate with

each other or with another conveyor or storage unit therebelow. They may have partitions or other means of segregating and stiffening the trough because of its great length which may be greater than several hundred feet.

In the structure shown in Fig. 6, the single trough **70** is supported on one upper drive beam which in turn is pivotally supported by the guide arms **10** that are swung from the shafts 8 supported from the standard **4**. The lower drive beam is merely a counter-balance to the upper drive beam and trough providing an equal and opposite counter-balance weight. In the structure of Fig. 6 weights such as illustrated at **72** may be employed as a substitute of the lower conveyor to equalize the balance of the conveyor.

The structure shown in Fig. 7 is similar to that shown in Fig. 6 but employs an upper trough **70** as well as a lower trough **71**, which is attached to the lower beam and which balance each other.

The attachment of the connecting rod to the other beam by means of an elastic bushing permits the translation of the natural rocking motion of the connecting rod into straight line push-pull, and also allows for fractional deviations between the tuned spring-mass system and the compulsory drive stroke and frequency.

The whole conveyor may be suspended by cables on suitable superstructures at the bearing supports **7**, thus saving height and dispensing with the base **1** and the standards **4**.

I claim:

1. A driving beam vibratory conveyor trough support comprising a set of three parallel tubes on each side of the conveyor trough, a series of spaced triangular plates for each set of tubes to secure them in trihedral relation with the plates sloping in parallel planes, a second series of triangular plates for each set of tubes sloped in the opposite direction and secured to and connecting the tubes adjacent the connections of the first series of plates to provide staggered bracing, and transverse bars connecting the driving beams on each side of the conveyor trough.

2. The structure of claim 1 which also includes a series of anchored vibratory tunable spring means each having one end secured to selected of said plates to provide reactive movement to said drive means.

3. The structure of claim 2 which also includes guide arms pivotally connected at one end to said drive beams, and a base having bearing supports to carry said guide arms.

4. The structure of claim 3 which also includes a second vibratory conveyor trough having a driving beam on each side thereof and positioned below the first and pivotally connected to the other end of said guide arms, and characterized in that the opposite ends of said spring means are anchored to corresponding triangular plates of driving beams on said second vibratory conveyor.

5. The structure of claim 4 characterized in that said spring means comprises two sets of springs at each location on each driving beam.

6. A driving beam conveyor supporting structure for balanced conveyor comprising a base, spaced parallel shafts suspended from said base, spaced guide arms mounted on each shaft, an upper and a lower conveyor cradle each having spaced drive beams each having three parallel tubes connected in trihedral relation and connected by transverse members, pivot means connecting the ends of said guide arms with said upper and lower drive beams to support the cradles for vibratory motion, and quadrangularly disposed leaf spring means having their ends connected to the upper and lower drive beams, each spring means being disposed on opposite sides of each drive beam.

7. A conveyor drive beam for balanced swing conveyor structure comprising a base, parallel shaft means supported on said base, guide arms rotatably mounted on said shafts, drive beam means having three parallel tubes con-

nected in trihedral relation and pivotally connected to the upper ends of said guide arms, second drive beam means having three parallel tubes connected in trihedral relation and pivotally connected to the lower ends of said guide arms, and trough means carried by at least one of said drive beams.

8. A balanced conveyor comprising a pair of conveyor drive beams each having three parallel tubes connected in trihedral relation by alternately disposed plates forming a zigzag brace, a base, spaced guide arms pivotally

mounted on said base, pivot means on the ends of said guide arms to support said drive beams one above the other, spring means connecting the drive beams, and drive means connected between said drive beams to simultaneously push them in opposite directions.

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