

Description

The present invention relates to variable capacity cross-feeding conveyors, comprising a plurality of rotatable parallel shafts with pockets for conveying articles, including input and output shafts with axes fixed in orientation relative to each other and a plurality of intermediate shafts pivotally mounted so as to be movable in position to shorten and lengthen the conveyor path from the input shaft to the output shaft via the intermediate shafts.

Many different systems and equipment designs have previously been employed for providing articles to a particular utilization point in a sequential manner. For example, cigarettes are manufactured by processes involving movement of individual cigarettes, or of an article that is to be eventually cut in half to form two cigarettes. The canning and bottling industries also move cans and bottles along some form of assembly line and, for instance, fill and seal a container at separate stations. In the military, armament has developed to the stage where rapid fire guns are in common use, and thus numerous designs have been proposed for the storage and transportation of shells to the gun.

All of these gun feed systems have a relatively common problem; namely, supplying shells to the guns in precise synchronization with gun demand. This problem is relatively easy when dealing with externally powered guns. In this type of gun, the feed system and gun are usually geared directly together and any convenient external power source may be used. Furthermore, these guns usually accelerate smoothly to full firing rate over a period of about 0.05 seconds, and the rate usually does not vary except during this start-up period.

Self powered guns present more difficult problems, as they actually start and stop once for every shell fired, regardless of the rate of fire. They start up and shut down almost instantly and are generally not capable of supplying enough excess power to drive a feed system. Thus, an auxiliary power source must be employed to drive the feed system, and it must be synchronized with the gun demand. It is also necessary to provide shell accumulation capacity between the gun and the majority of the shells stored by the feed system, as it is not practical to keep the entire complement of shells moving in synchronization with the gun.

Conveyors in accordance with the opening paragraph above are disclosed in U.S. patent 2608133 and French patent 954896. Both patents describe apparatus for conveying rounds of ammunition. Two movable rollers are provided which are pivotally mounted and can variably divert the path of the rounds, in order to vary the length of the path. The distance between adjacent shafts of the conveyor changes so that the conveyors disclosed in those patents can only be used to advance linked articles, such as the rounds of ammuni-

tion described which are linked by an ammunition belt or bandoleer.

It is an object of the present invention to provide a conveyor of the type described above which can be used to convey unlinked articles.

The present invention is characterized in that a first and a last one of the intermediate shafts are pivotally supported for movement about the axes of the input and output shafts respectively, so as to vary the lengths of the arcs through which the articles travel about the axes of the shafts.

In a preferred form of the invention, the intermediate shafts are so linked as to maintain a constant spacing between the axes of adjacent shafts, regardless of the position of the shafts.

The present invention will be described in terms of a variable capacity cross-feeding conveyor for a self-powered automatic gun, such as is used for anti-aircraft defence. However, it is also applicable to positive high speed mechanical feed of other items of uniform size and shape, such as from a supply source feeding at a quasi-steady rate to a demand point operating at a start-stop variable rate. An example of such is the commercial canning and bottling industry, as well as other fabrication and production processes requiring high speed feed and orientation of items of uniform shape and size.

In arrangements of the present invention as described herein, a support structure is attached to the side feed area of a 35 mm gas-operated, rapid fire cannon which has integral with it an indexing feed rotor and shell locating structure generally found in such weapons. The gun feed rotor is powered by the gun and indexes (e.g. 60 degrees for a 6-position rotor) for each shell fired.

In the described embodiment the pockets for conveying the shells are formed by the spaces between the teeth of sprockets on the shafts.

The support structure supports a rotatable first shaft, which is caused to rotate in unison with the gun feed rotor by means of a conveyor belt which circulates around the gun feed rotor and the first shaft. The design of the conveyor elements or buckets depends on the use. They are usually designed to convey specific shells into the gun. Power to the first shaft is transmitted through a pair of sprockets keyed to the shaft and driven by the circulating conveyor elements.

At the shell feed end of the crossfeeder, a fixed position, rotatable outside shaft is provided. It is driven by a booster motor, either directly or indirectly, which provides the external power. At least two further rotatable shafts are interposed between the first and the outside shafts, and a positive gear train is provided between adjacent shafts for synchronous rotation. However, unlike the first shaft and the outside shaft, the intermediate shafts are not fixed in position but are pivotally positioned so that the shaft adjacent the first shaft may pivot

about the first shaft within certain limits and the other intermediate shaft, adjacent the outside shaft, may pivot about the outside shaft.

Each of the shafts has plural positioning rotors or sprockets which are synchronized to each other by the meshing of the gear train, and these rotors interface with and control the movement of the 35 mm shells. The angle defined by lines drawn to the first shaft and to the second intermediate shaft, from the first intermediate shaft, is utilized to activate operation of the booster motor on the outside shaft, and provide shells to the crossfeeder unit. In operation, the linkage geometry allows the structure to assume a position which varies between maximum accumulation, where the intermediate shafts are positioned so that the outer intermediate shaft is below the inner intermediate shaft and a minimum accumulation state where the positions of the intermediate shafts are reversed. Utilizing four shafts and five positions on the rotors on each shaft, the differential in accumulation is about four rounds. The crossfeeder is reversible, and thus cartridges can be backed out of the system with a mere reversal of the booster motor which would then drive all of the gears and the rotors in reverse.

Normal operation of the crossfeeder commences with all of the system at rest and the crossfeeder at or near its maximum accumulation state. The boost motor is not active or driving, but the motor and its attached shaft are capable of free wheeling. When a demand begins, the crossfeeder is made operational by the motion of the gun feed rotor, and thus rotation of the first shaft. This rotation tends to move the inner intermediate shaft, as the two are connected by spur gears. Since there is no drive from the booster motor, the inner intermediate shaft tends to revolve about its pivot in order to continue feeding shells. The motion of the inner intermediate shaft is sensed by the control unit, and the booster motor is actuated initiating motion of the outside shaft, and feed of shells to the crossfeeder from the external supply. There is a slight time delay — in the system described herein approximately one-tenth of a second — before supplying at the outside shaft is initiated after gun demand is initiated. This time should be considerably less than the amount of time it takes for the crossfeeder to reach the minimum accumulation state as additional time is required for the external supply feed rate to reach the gun demand rate. Once the drive begins the crossfeeder is then provided with additional rounds, and tends to move back to the full accumulation state when the supply rate of the crossfeeder exceeds the gun demand rate. In the preferred form, the drive begins approximately when the crossfeeder passes the midpoint of accumulation. Thus, as it is driven back towards full accumulation, at its midpoint the booster motor is commanded back to its coast

condition by the operational signal sensed from the angular position noted above. The result is that the crossfeeder "dithers" about the accumulation midpoint; that is, the motor is commanded back and forth between the drive and coast conditions, as required, to meet the demand requirements. When demand ceases, the supply will continue for a short period of time due to inertia, and the system will run back to the full accumulation state, ready for a new round of firing. In order to secure the system, the full accumulation condition is sensed as it is approached, and the motor is commanded into a brack or reverse condition and returns to rest at its maximum accumulation state.

In operation, for example, the unit described in the drawings attached hereto functions by the inner shaft advancing 72 degrees (one fifth of a full rotation) approximately every .085 seconds, rests for .015 seconds, and then advances another 72 degrees, and continues this operation so long as the demand is maintained. In this manner, a shell is fed to the gun every 0.10 seconds, but this rate is variable, depending upon the gun's demand. Due to inertia and the characteristics of the hydraulic motor, however, the outer shaft essentially rotates on an almost continuous basis with power being provided as needed. Thus, a system with an almost continuous input during demand but with a variable rate and time delayed output is provided.

In the accompanying drawings:

Fig. 1 is a perspective view generally showing the crossfeeder of the present invention without its support structure;

Fig. 2 is a detail of the exit area of the crossfeeder of Fig. 1;

Fig. 3 is an exploded view of the crossfeeder;

Fig. 4 is an isometric view of an assembled crossfeeder;

Fig. 5 is a schematic showing minimum accumulation of shells; and

Fig. 6 is a schematic showing maximum accumulation of shells.

In Fig. 1, a 35 mm cannon is indicated generally at 10, and the feed to the crossfeeder is provided, for instance, by a transfer unit indicated generally as 12, in phantom. The shells or cartridges are guided to the top of sprockets 14 on the outside (fourth) shaft 16 which is driven by a hydraulic motor, not shown, and is also provided with gear 18 which meshes with gear 20 to drive third shaft 22 and sprockets 24 mounted thereon. Gear 20 is also meshed with second shaft gear 26 which drives a second shaft (not shown) and related sprockets 30. The second shaft also has a spur gear mounted at the end opposite gear 26, which is mated to first shaft gear 32, attached to first shaft 34. First shaft 34 is provided with sprockets (not shown) for conveyor elements 38. The conveyor elements supply the shells to the gun, and are returned empty to the cross-

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feeder, as shown. The whole crossfeeder is attached to gun housing 40 by brackets 42 which also position first shaft 32 and pivotal guide 44. Pivotal guide 44 is used to locate second shaft 28, and the crossfeeder is provided with further pivotal guides 46 at either end of second shaft 28 which position third shaft 22 in a pivotal relationship to second shaft 28, and guide the cartridges. Fourth shaft 16 also is provided with related pivotal guide 48 which pivotally interconnects fourth shaft 16, and third shaft 22. In operation then the cartridges are picked up in the upper portion of guide 48, and transported by sprockets 14 toward the gun, and in an upward direction. They then contact pivotal guide 46 for transporting from the third shaft to the second shaft and thereafter are transported through pivotal guide 44 to the point where they are picked up by conveyor elements 38 and transported into gun 10.

In Fig. 2, the inner structure of the gun is shown in section at 50 with gun housing 40 spaced away from the remaining portions for clarity. In the drawing, cartridges 52 are transported in the direction of the arrows at the tip and base thereof, through the crossfeeder until they contact conveyor elements 38, are positively engaged therewith, and enter the gun through an aperture in housing 40. Conveyor elements 38 are interconnected through related flanges 54 and 56, provided on opposite sides of each conveyor element with the conveyor elements pivotally joined at 58. First shaft 34 has a pair of sprockets 36 mounted thereon which are designed and spaced in such a manner that they contact and guide conveyor elements 36 during operation.

The conveyor elements form an endless loop and, inside housing 40, a loading shaft 60 is provided with gun feed rotor 62. The first shaft and the loading shaft cooperate to transport the conveyor elements from the crossfeeder to gun loading station. Loading is usually effected by a gas operation in which pressure is tapped off the barrel of the gun, and utilized to operate the spent cartridge discharge and fresh cartridge loading functions through a series of pistons. It should be noted that the loading operation is not continuous, but occurs in a pattern, related to the rapidity of firing, and thus loading shaft 60, conveyor elements 38, and first shaft 34, as described above, index each time a cartridge is physically loaded. They do not operate between loading steps. Also, guides and lower positioning structures are often provided below the cartridges. In the alternative, conveyor elements 38 may be of the clam shell type, which open to receive or discharge a cartridge as a result of the curvature produced by passing the endless conveyor element chain over a set of sprockets. Other transfer mechanisms for the endless conveyor element chain can be utilized, the selection and design of the particular conveyor element system depending upon the gun being

utilized.

The exploded view in Fig. 3, showing the particular guide structures, sprocket system and related pieces, details the path of the cartridges through the crossfeeder. Pivotal guide 48 includes fourth shaft mounting rings 64 positioned such that the cartridge passes above the shaft and enters the unit, the base diameter of the cartridge being guided by ridges 66 formed in lower section 68 and the neck diameter of the cartridge being guided by lip 70. Rings 72 are provided for rotational mounting of the third shaft, and upper section 74 is also provided with a ridge 76 to position the base of the cartridge, and lip 78 to position and guide the neck. In manufacture, end plates 80 are essentially mirror images, and are provided with rings 64 and 72 for the mounting of the shafts and, in addition, with channelled extensions 82 designed to receive lower guide section 68 and upper guide section 74. Due to the geometry of the system, that is, since the shells pass above rings 64 and then around rings 72, upper section 74 is constructed in a manner that it curves downward and guides the shell into an engageable position with relationship to the sprockets which are not shown. The central sections of the guides between the second and third shafts, and the first and second shafts are not shown in as much detail, but are constructed such that they mate with, and have essentially the same rigid lip type of structures described above, in order to continue the guiding of the cartridge through the crossfeeder.

Guide 46 is provided with end plates 84 having third shaft mounting rings 86 and second shaft mounting rings 88. As noted above, forward end plate 84 is provided with channelled extensions for upper central section 92 and lower central section 90. The forward end plate has the same neck guides formed therein, shown as 94 and 96 for the lower and upper central sections respectively. Base diameter guidance is supplied by the two integral lips of aft end plate 84. Lower central section 90 is larger than upper central section 92 since the shell is traversing around the third shaft and to the second shaft, and thus travels outside of a line which would intersect each of the four shafts. The cartridge, after passing through the space between the second and third shafts then travels around the outside of the second shaft, and as a result, the upper central section 98 of guide 44 is longer than the lower one, if a lower section is provided. Guide 44 has end plates 100 and related rings 102 for the second shaft and 104 for the first shaft. Rings 104 are positioned around the first shaft which is located on brackets 42. Brackets 42 are attached to the crossfeeder housing (not shown) or directly to gun housing 40. In this manner the second shaft revolves about the first shaft, at a distance defined by the gearing.

In the drawing, the section dealing with the

second shaft is used to depict the arrangement of the sprockets, and the arrangement is essentially the same elsewhere in the unit. Forward sprocket 106 is provided with five circular shell case engaging surfaces 108 and splined surface 110 for contacting and positioning the shaft, not shown. Base sprocket 112 is also provided with circular surfaces 114 to engage the shell case, and splined surface 116 to engage the shaft (not shown). The splined surface, of course, would mate with the shaft, and thus the sprockets would rotate with the shaft. The shell projectile and casing engaging surfaces are circular in order to provide for the proper engagement of the surface with the shell during rotation which produces the motion of the shell through the crossfeeder. Finally, shell guide 118 is positioned between sprockets 106 and 112, and rotatably surrounds the shaft by virtue of the provision of a hole therethrough. At either end of the shell guide, arms 120 are provided and contain contact surfaces 122 which are slideably engaged with channels 124 in projecting arms 126. Projecting arms 126 are attached to the crossfeeder housing 128. Channels 124 protrude from the plane of crossfeeder housing 128 and are curved an appropriate amount so that the motion of the second shaft, about the pivot produced by rings 104 being mounted on the first shaft, is accounted for.

The first shaft has splined sprockets 36 mounted to it, which form the carriers for the conveyor elements, not shown. The conveyor elements are rotated about the two shafts, as previously discussed, by the use of slideable tracks 130 positioned in mount 132. The tracks individually guide the conveyor elements through track lips 134, and attached to mount 132 through smaller lower lips or extensions 136. In the drawing, four separate tracks are shown which are located on mount 132, as indicated by the broken line for each. Outboard mount 132, external to housing 40, is attached to the housing by flange 138, and extends only a short distance so that each conveyor element is engaged by sprockets 36 before being removed from the track. The conveyor element then passes around the sprocket as the shaft is rotated and reengages track 132 on the lower channel portion thereof. In order for entrance and egress of the conveyor elements, the housings are provided with apertures. Indentation 140 is further, provided for proper mounting of track 130. Inside housing 40 of the gun, the track continues and is attached to the mount in the same manner as the outside portion, thereof. The unloading function at the gun loading shaft is described in more detail hereinabove.

In the detail section shown in Fig. 4, projectiles are moved by sprockets 14 on fourth shaft 16 into the guide channel, shown as 74 and 80, and traverse down through the guide channel to contact sprockets 24 on third shaft 22. They are then brought around and through

channels 90 and 96, traverse through the channel and upward to contact second shaft sprockets 30, one of which is shown, while being longitudinally constrained by end plates 84. The cartridges are then rotated over the top of the second shaft, being guided by upper central guide section 98, and contacts conveyor element 38 below first shaft 34. It is then engaged by conveyor element 38 for entry into the chamber of the gun, not shown. First shaft gear 32 is driven by first shaft 34, which is rotated by the motion of the conveyor element arrangement. Gear 32 is meshed with second shaft spur gear 142, and during operation, the second shaft moves up and down about an axis defined by the gear train and the pivoting function of end plates 100 positioned around first shaft 34 by bolt 144. Shaft 34 is positioned, as noted before, by brackets 42 attached to housing 40. Housing 40 is also provided with trunnion mount 146 and through bolts 148 in order to accurately position the crossfeeder structure. The indexing or ratcheting motion of conveyor elements 38 while feeding the gun causes the second shaft to swing about shaft 38 due to the motion of gear 32. This angular motion is sensed by transducer 150 and conveyed to a control unit, not shown by lines 152. As can be seen transducer 150 is mounted off center through arm 154 to central upper guide section 98. The shaft of the transducer, not shown, is connected to gear 156, which is meshed with gear 160 which is concentric with the second shaft. However, gear 160 is mounted to bracket 158 which in turn, mounted to both the second and third shafts. Thus the transducer senses the angle between the first, second and third shafts and provides an input to the control unit to actuate the drive of the unit. Motion of the second shaft is transmitted to the third shaft through gears 20 and 26. Thus, there is positive mechanical and pivotal contact maintained between the first, second and third shafts, in the respective gear trains. In addition, third shaft spur gear 20 is meshed with fourth shaft gear 18, and driven thereby when hydraulic motor 162 is actuated. Hydraulic motor 162 drives the end of the fourth shaft by conventional means, and is mounted to channel shaped mounting structure 164. The mounting structure is provided on both sides of the crossfeeder to provide the appropriate framework for the unit. Hydraulic motor 162 is provided with fluid lines 166 and 168. Hydraulic pressure is provided by control valve 170 which is operated by signals from the controller, not shown, through electric lines 172 the valve being bolted to channel-shaped frame 164, as shown, but may be mounted at any convenient location or position. Pressure supply line 174 and return line 176 provide input hydraulic power. Channel-shaped side portions 164 of the frame are joined at their outer ends by central support assembly 178, which is also provided with mounts 182 for fourth shaft support members

180. The whole of the unit may be covered by a housing, if needed, in order to protect it during use in open situations, etc.

Figs. 5 and 6 are provided in order to show the crossfeeder in the stages of maximum and minimum accumulation, in schematic form. In Fig. 5, the minimum accumulation state, gun 10 positions first shaft 34 through brackets 42. First shaft 34 has sprockets, not shown, which position conveyor elements 38 to hold projectiles 52. Second shaft 28 has sprockets 30 which guide projectiles 52 to first shaft 34. Third shaft 22, through sprockets 24 and guides, not shown, guides projectiles 52 to second shaft 28. Finally, fourth shaft 16, mounted to the frame assembly by bracket 182, has sprockets 14 for guiding shells 52 out of transfer unit 12 and to third shaft 22. The same functions occur in Fig. 6.

The difference, as can be seen by comparing both figures, is that in the minimum accumulation state shaft 28 is rotated relatively downward, and third shaft 22 is rotated relatively upward by the function of the drive train as previously discussed. In the maximum accumulation state, on the other hand, second shaft 28 is rotated upward to its maximum point, as controlled by the guides, previously discussed, and third shaft 22 is rotated downwardly to provide more projectiles 52 in the maximum accumulation state.

Claims

1. A variable capacity cross-feeding conveyor, comprising a plurality of rotatable parallel shafts (16, 22, 28 and 34) with pockets for conveying articles (52), including input and output shafts (16 and 34) with axes fixed in orientation relative to each other and a plurality of intermediate shafts (22 and 28) pivotally mounted so as to be movable in position to shorten and lengthen the conveyor path from the input shaft (16) to the output shaft (34) via the intermediate shafts (22 and 28), characterised in that a first and a last one of the intermediate shafts (22 and 28) are pivotally supported for movement about the axes of the input and output shafts (16 and 34) respectively, so as to vary the lengths of the arcs through which the articles travel about the axes of the shafts.

2. a conveyor according to claim 1, characterised in that the intermediate shafts (22 and 28) are so linked as to maintain a constant spacing between the axes of adjacent shafts regardless of the shaft positions.

3. A conveyor according to claim 1, further including pivoted support guides (44 and 48) extending respectively from the input and output shafts (16 and 34) to define the paths of the intermediate shafts (22 and 28) in pivoting about the adjacent shafts.

4. A conveyor according to claim 3, characterised in that the guides (44 and 48) are operative to guide the items along the conveyor and

define the shape of the transfer path.

5. A conveyor according to any of claims 1 to 4, characterised by a plurality of gears (18, 20, 26, 32 and 142) coupling all of the shafts (16, 22, 28 and 34) together.

6. A conveyor according to claim 5, characterised in that the gear drive and the conveyor drive to the intermediate shafts (22 and 28) co-act to determine the angular position of the intermediate shafts (22 and 28) about their respective pivot axes.

7. A conveyor according to claim 6, characterised by a position sensor (15) for sensing the position of one of the intermediate shafts (28) relative to an adjacent shaft.

8. A conveyor according to claim 7, characterised by a drive motor (162) coupled to drive the input shaft (16) under the control of signals from the position sensor (150).

9. A conveyor according to claim 8, characterised in that the drive motor (162) is variable in average speed to correlate the rate of feeding items at the input shaft (16) to the average rate of demand by the utilization device.

10. A conveyor according to claim 8 or 9, characterised by a control unit responsive to signals from the position sensor (150) and operative to control the activation of the motor (162) accordingly.

11. A conveyor according to claim 10, characterised in that the control unit is operative to activate the drive motor (162) when the transfer path is within a preselected minimum deviation from a straight line between the input and the output shafts (16 and 34).

12. A conveyor according to claim 10, characterised in that the control unit is operative to deactivate the drive motor (162) when the transfer path is outside a preselected maximum deviation from a straight line between the input and the output shafts (16 and 34).

13. A conveyor according to any of claims 8 to 12, characterised in that the drive motor (162) is reversible to back the items out of the crossfeeding apparatus conveyor for return to the supply source.

14. A conveyor according to any of claims 10 to 12, characterised by a brake mechanism for stopping the motor when the motor is deactivated by the control unit.

15. A conveyor according to any of claims 1 to 14, characterised in that the items are cartridges (52) and the utilization device is a gun for firing the cartridges (52) and drawing succeeding cartridges (52) one at a time from the output end of the conveyor as the gun fires.

Revendications

1. Transporteur transversal à capacité variable, comprenant plusieurs arbres rotatifs parallèles (16, 22, 28 et 34) ayant des logements destinés au transport d'articles (52), comprenant des arbres d'entrée et de sortie (16



180. The whole of the unit may be covered by a housing, if needed, in order to protect it during use in open situations, etc.

Figs. 5 and 6 are provided in order to show the crossfeeder in the stages of maximum and minimum accumulation, in schematic form. In Fig. 5, the minimum accumulation state, gun 10 positions first shaft 34 through brackets 42. First shaft 34 has sprockets, not shown, which position conveyor elements 38 to hold projectiles 52. Second shaft 28 has sprockets 30 which guide projectiles 52 to first shaft 34. Third shaft 22, through sprockets 24 and guides, not shown, guides projectiles 52 to second shaft 28. Finally, fourth shaft 16, mounted to the frame assembly by bracket 182, has sprockets 14 for guiding shells 52 out of transfer unit 12 and to third shaft 22. The same functions occur in Fig. 6.

The difference, as can be seen by comparing both figures, is that in the minimum accumulation state shaft 28 is rotated relatively downward, and third shaft 22 is rotated relatively upward by the function of the drive train as previously discussed. In the maximum accumulation state, on the other hand, second shaft 28 is rotated upward to its maximum point, as controlled by the guides, previously discussed, and third shaft 22 is rotated downwardly to provide more projectiles 52 in the maximum accumulation state.

Claims

1. A variable capacity cross-feeding conveyor, comprising a plurality of rotatable parallel shafts (16, 22, 28 and 34) with pockets for conveying articles (52), including input and output shafts (16 and 34) with axes fixed in orientation relative to each other and a plurality of intermediate shafts (22 and 28) pivotally mounted so as to be movable in position to shorten and lengthen the conveyor path from the input shaft (16) to the output shaft (34) via the intermediate shafts (22 and 28), characterised in that a first and a last one of the intermediate shafts (22 and 28) are pivotally supported for movement about the axes of the input and output shafts (16 and 34) respectively, so as to vary the lengths of the arcs through which the articles travel about the axes of the shafts.

2. a conveyor according to claim 1, characterised in that the intermediate shafts (22 and 28) are so linked as to maintain a constant spacing between the axes of adjacent shafts regardless of the shaft positions.

3. A conveyor according to claim 1, further including pivoted support guides (44 and 48) extending respectively from the input and output shafts (16 and 34) to define the paths of the intermediate shafts (22 and 28) in pivoting about the adjacent shafts.

4. A conveyor according to claim 3, characterised in that the guides (44 and 48) are operative to guide the items along the conveyor and

define the shape of the transfer path.

5. A conveyor according to any of claims 1 to 4, characterised by a plurality of gears (18, 20, 26, 32 and 142) coupling all of the shafts (16, 22, 28 and 34) together.

6. A conveyor according to claim 5, characterised in that the gear drive and the conveyor drive to the intermediate shafts (22 and 28) co-act to determine the angular position of the intermediate shafts (22 and 28) about their respective pivot axes.

7. A conveyor according to claim 6, characterised by a position sensor (15) for sensing the position of one of the intermediate shafts (28) relative to an adjacent shaft.

8. A conveyor according to claim 7, characterised by a drive motor (162) coupled to drive the input shaft (16) under the control of signals from the position sensor (150).

9. A conveyor according to claim 8, characterised in that the drive motor (162) is variable in average speed to correlate the rate of feeding items at the input shaft (16) to the average rate of demand by the utilization device.

10. A conveyor according to claim 8 or 9, characterised by a control unit responsive to signals from the position sensor (150) and operative to control the activation of the motor (162) accordingly.

11. A conveyor according to claim 10, characterised in that the control unit is operative to activate the drive motor (162) when the transfer path is within a preselected minimum deviation from a straight line between the input and the output shafts (16 and 34).

12. A conveyor according to claim 10, characterised in that the control unit is operative to deactivate the drive motor (162) when the transfer path is outside a preselected maximum deviation from a straight line between the input and the output shafts (16 and 34).

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Revendications

1. Transporteur transversal à capacité variable, comprenant plusieurs arbres rotatifs parallèles (16, 22, 28 et 34) ayant des logements destinés au transport d'articles (52), comprenant des arbres d'entrée et de sortie (16



et 34) ayant des axes d'orientation fixe mutuellement et plusieurs arbres intermédiaires (22 et 28) montés sous forme articulée afin qu'ils aient une position mobile permettant le raccourcissement et l'allongement du trajet du transporteur de l'arbre d'entrée (16) à l'arbre de sortie (34) par l'intermédiaire des arbres intermédiaires (22 et 28), caractérisé en ce qu'un premier et un dernier des arbres intermédiaires (22 et 28) sont supportés de manière articulée afin qu'ils se déplacent autour des axes des arbres d'entrée et de sortie (16 et 34) de manière que les longueurs d'arcs parcourues par les articles autour des axes des arbres varient.

2. Transporteur selon la revendication 1, caractérisé en ce que les arbres intermédiaires (22 et 28) sont raccordés de manière qu'ils assurent un espacement constant entre les axes des arbres adjacents quelles que soient les positions des arbres.

3. Transporteur selon la revendication 1, comprenant en outre des guides articulés de support (44 et 48) dépassant respectivement des arbres d'entrée et de sortie (16 et 34) afin qu'ils déterminent les trajets des arbres intermédiaires (22 et 28) lors du pivotement autour des arbres adjacents.

4. Transporteur selon la revendication 3, caractérisé en ce que les guides (44 et 48) assurent le guidage des objets le long du transporteur et déterminent la configuration du trajet de transfert.

5. Transporteur selon l'une quelconque des revendications 1 à 4, caractérisé par plusieurs pignons d'engrenage (18, 20, 26, 32 et 142) assurant le couplage mutuel de tous les arbres (16, 22, 28 et 34).

6. Transporteur selon la revendication 5, caractérisé en ce que l'entraînement transmis par les pignons d'engrenage et l'entraînement transmis par le transporteur aux arbres intermédiaires (22 et 28) coopèrent à la détermination de la position angulaire des arbres intermédiaires (22 et 28) autour de leur axe respectif de pivotement.

7. Transporteur selon la revendication 6, caractérisé par un capteur de position (150) destiné à détecter la position de l'un des arbres intermédiaires (28) par rapport à un arbre adjacent.

8. Transporteur selon la revendication 7, caractérisé par un moteur (162) d'entraînement couplé de manière qu'il entraîne l'arbre d'entrée (16) sous la commande de signaux provenant du capteur de position (150).

9. Transporteur selon la revendication 8, caractérisé en ce que le moteur d'entraînement (162) a une vitesse moyenne variable afin que la vitesse d'alimentation des objets à l'arbre d'entrée (16) soit corrélée à la vitesse moyenne de demande par le dispositif utilisateur.

10. Transporteur selon l'une des revendications 8 et 9, caractérisé par un ensemble de commande sensible à des signaux provenant du

capteur de position (150) et destiné à commander la manoeuvre du moteur (162) en conséquence.

11. Transporteur selon la revendication 10, caractérisé en ce que l'ensemble de commande est destiné à commander le moteur d'entraînement (162) lorsque le trajet de transfert s'écarte moins d'une quantité minimale prédéterminée d'une droite passant entre les arbres d'entrée et de sortie (16 et 34).

12. Transporteur selon la revendication 10, caractérisé en ce que l'ensemble de commande est destiné à désexciter le moteur d'entraînement (162) lorsque le trajet de transfert se trouve en dehors d'un écart maximal prédéterminé par rapport à une droite passant entre les arbres d'entrée et de sortie (16 et 34).

13. Transporteur selon l'une quelconque des revendications 8 à 12, caractérisé en ce que le moteur d'entraînement (162) est réversible afin qu'il extrait les éléments du transporteur de l'appareil d'alimentation transversal et les renvoie à la réserve.

14. Transporteur selon l'une quelconque des revendications 10 à 12, caractérisé par un mécanisme de freinage destiné à arrêter le moteur lorsque celui-ci est désexcité par l'ensemble de commande.

15. Transporteur selon l'une quelconque des revendications 1 à 14, caractérisé en ce que les éléments sont des cartouches (52) et le dispositif utilisateur est un canon destiné à tirer les cartouches (52) et à prélever des cartouches successives (52) une à une à l'extrémité de sortie du transporteur lors du tir du canon.

Patentansprüche

1. Querrörderer veränderlicher Kapazität, die eine Anzahl mit Ablagen für die zu fördernden Gegenstände versehener drehbarer, paralleler Wellen (16, 22, 28 und 34), einschließlich einer Ausgangs- und einer Eingangswelle (16 und 34), deren Achsen zueinander orientiert fixiert sind, und mehrerer zwischen diesen angeordneter Wellen (22 und 28), die als Drehachsen so montiert und in ihrer Lage veränderlich sind, daß der Zubringweg von der Aufnahmewelle (16) zur Abgabewelle (34) über die Zwischenwellen (22 und 28) verkürzt oder verlängert werden kann, aufweist, dadurch gekennzeichnet, daß eine erste und eine letzte der Zwischenwellen (22 und 28) derart schwenkbar abgestützt sind, daß sie um die Achsen der Eingangs- bzw. der Ausgangswellen geführt werden können, wodurch die Länge der Bögen, über die die Gegenstände um die Achsen der Wellen geführt werden, variiert wird.

2. Querrörderer nach Anspruch 1, dadurch gekennzeichnet, daß die Zwischenwellen (22 und 28) so angelenkt sind, daß der Abstand zwischen den Achsen benachbarter Wellen in jeder Stellung der Wellen zueinander konstant bleibt.

3. Querrörderer nach Anspruch 1, gekenn-



zeichnet durch schwenkbare, stützende Führungen (44 und 48), die von der Eingangs- bzw. der Ausgangswelle (16 und 34) ausgehend den Weg der Zwischenwellen (22 und 28) beim Schwenken um die benachbarten Wellen vorgeben.

4. Querrörderer nach Anspruch 3, dadurch gekennzeichnet, daß die Führungen (44 und 48) so eingesetzt werden können, daß sie die Gegenstände durch die Vorrichtung führen und die Form des Zubringweges bestimmen.

5. Querrörderer nach einem der Ansprüche 1 bis 4, gekennzeichnet durch Getriebe (18, 20, 26, 32 und 142), durch die alle Wellen (16, 22, 28 und 34) miteinander gekuppelt sind.

6. Querrörderer nach Anspruch 5, dadurch gekennzeichnet, daß der Getriebeantrieb und der Zubringerantrieb für die Zwischenwellen (22 und 28) so zusammenwirken, daß sie die Winkelstellung dieser Zwischenwellen (22 und 28) um ihre Schwenkachsen bestimmen.

7. Querrörderer nach Anspruch 6, gekennzeichnet durch einen Stellungssensor (150) zur Überwachung der Stellung einer der Zwischenwellen (28) zu einer benachbarten Welle.

8. Querrörderer nach Anspruch 7, gekennzeichnet durch einen Antriebsmotor (162), der so gekuppelt ist, daß er die Eingangswelle (16) unter der Kontrolle von dem Stellungssensor (150) ausgehenden Signalen antreibt.

9. Querrörderer nach Anspruch 8, dadurch gekennzeichnet, daß die mittlere Geschwindigkeit des Antriebsmotors (162) so variiert ist, daß die Geschwindigkeit der Zufuhr von Gegenständen an der Eingangswelle (16) dem mittleren Bedarf an der Verwendungsstelle angepaßt werden kann.

10. Querrörderer nach Anspruch 8 oder 9,

gekennzeichnet durch eine auf Signale des Stellungssensors (150) ansprechende Steuervorrichtung, durch die die Aktivierung des Motors (162) entsprechend gesteuert wird.

11. Querrörderer nach Anspruch 10, dadurch gekennzeichnet, daß die Steuereinrichtung den Antriebsmotor (162) aktiviert, wenn der Überführungsweg innerhalb einer vorgegebenen Mindestabweichung von einer Geraden zwischen Eingangs- und Ausgangswelle (16 und 34) verläuft.

12. Querrörderer nach Anspruch 10, dadurch gekennzeichnet, daß die Steuereinrichtung den Antriebsmotor (162) entaktiviert, wenn der Überführungsweg außerhalb einer vorgegebenen Höchstatabweichung von einer Geraden zwischen Eingangs- und Ausgangswelle (16 und 34) verläuft.

13. Querrörderer nach einem der Ansprüche 8 bis 12, dadurch gekennzeichnet, daß der Antriebsmotor (162) reversibel ist, so daß er die Gegenstände aus der Zubringervorrichtung hinausführen kann, um sie an die Lieferstelle zurückzubringen.

14. Querrörderer nach einem der Ansprüche 10 bis 12, gekennzeichnet durch einen Bremsmechanismus zum Anhalten des Motors, wenn der Motor durch die Steuereinrichtung entaktiviert ist.

15. Querrörderer nach einem der Ansprüche 1 bis 14, dadurch gekennzeichnet, daß die Gegenstände Geschosse (52) sind und die Verwendungsvorrichtung ein Geschütz zum Abfeuern der Geschosse (52) und zur Entnahme von jeweils einem von nacheinander herangeführten Geschossen (52) vom Ausgangsende des Querrörderers beim Feuern des Geschützes ist.

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