ABSTRACT

A conveyor structure which comprises a base and a plurality of booms mounted thereon. The booms are interconnected to move in and out together. A belt travels on upper plates of the base and booms. A belt take-up carriage is connected to boom advancing means so that the length of the portion of the belt on the upper plates is increased as the booms are extended and reduced as the booms are retracted.

6 Claims, 20 Drawing Figures
CONVEYOR WITH EXTENDIBLE BOOMS

This invention relates to a conveyor structure. More particularly, this invention relates to an extendible conveyor.

An object of this invention is to provide a conveyor structure having a stationary base and plurality of boom members which extend outwardly therefrom.

A further object of this invention is to provide such a conveyor structure in which booms extend in alignment and in which the base and booms support each other.

Briefly, this invention provides a conveyor including a base which supports a first boom for inward and outward movement and in which a second boom is supported on the first boom for similar movement. Additional booms are similarly supported in order from the first boom. A conveyor belt runs on the base and on the booms. The booms are driven in and out in unison, and conveyor belt take-up mechanism moves in synchronism with the booms to maintain the conveyor belt taut.

The above and other objects and features of the invention will be apparent to those skilled in the art to which this invention pertains from the following detailed description and the drawings, in which:

FIG. 1 is a somewhat schematic plan view of a conveyor constructed in accordance with an embodiment of this invention in extended position;

FIG. 2 is a plan view of the conveyor illustrated in FIG. 1 in partly retracted position;

FIG. 3 is a view in side elevation of the conveyor shown in FIG. 1 in extended position, a vehicle body being shown in dot-dash lines;

FIG. 4 is a view in side elevation of the conveyor in partly retracted position;

FIG. 5 is a somewhat schematic plan view of the conveyor retracted position;

FIG. 6 is a view in section taken generally on the line 6—6 in FIG. 5;

FIG. 7 is a schematic plan view of the base of the machine showing chain drives thereof, a fragmentary portion of one boom of the machine being shown in dashed lines;

FIG. 8 is a schematic side elevational view of the machine showing chain drives thereof, a fragmentary portion of the boom shown in FIG. 7 being shown in dashed lines;

FIG. 9 is a schematic view in side elevation of the booms of the machine showing chain drives of the booms;

FIG. 10 is a schematic view in side elevation of the machine showing details of support for a conveyor belt thereof;

FIG. 11 is an enlarged view in section taken on the line 11—11 in FIG. 7 showing details of construction of the machine;

FIG. 12 is an enlarged view in section taken on the line 12—12 in FIG. 7;

FIG. 13 is a view in section taken generally on the line 13—13 in FIG. 10;

FIG. 14 is a view in section taken on the line 14—14 in FIG. 13;

FIG. 15 is a perspective view of an end portion of one of the booms of the machine in extended position;

FIG. 16 is a view in lengthwise section of the first boom of the machine;

FIG. 17 is a view in lengthwise section of a second boom of the machine;

FIG. 18 is a view in lengthwise section of the third boom of the machine;

FIG. 19 is a fragmentary view in side elevation of an end portion of the third boom of the machine; and

FIG. 20 is a schematic view of electrical connections of the machine.

In the following detailed description and the drawings, like reference characters indicate like parts.

In FIGS. 1–6, inclusive, is shown a conveyor assembly 21 constructed in accordance with an embodiment of this invention. The conveyor 21 includes a main assembly or base 22, a first boom 23, a second boom 24, and a third boom 25. The first boom 22 is mounted on the base 22 for movement to the right or left as shown in FIGS. 1–4 inclusive. The second boom 24 is mounted on the first boom 23 for movement to the right and left thereon, and the third boom 25 is mounted on the second boom 24 for movement to the right and left on the second boom. A conveyor belt 28 runs on the base 22 and on the booms 23, 24, and 25.

As shown in FIG. 15, the third boom 25 has a top plate 29 on which the belt 28 runs. Similarly, the booms 23 and 24 have top plates 31 and 32, respectively, on which the belt 28 runs, and the base 22 has a top plate 33 (FIGS. 11 and 12) on which the belt 28 runs.

As shown in FIGS. 11, 12 and 13, the base 22 includes upper lengthwise main frames 34 and 36 and lower lengthwise main frames 37 and 38. Upright frames 41 run between the upper and lower lengthwise main frames. Upper lengthwise roller mounting frames 42 and 43 are rigidly attached to the upper lengthwise frames 34 and 36, respectively. Upper cross frames 46 connect the roller mounting frames. Lower cross frames 47 connect the lower lengthwise frames 37 and 38. The base is thus formed into a hollow box-like structure. Side panel frames 48 and 49 cover sides thereof.

A series of upper roll mounts 51 (FIGS. 11 and 12) is mounted on the lengthwise roller mount frames 42 and 43. A roller 52 is rotatably supported on each of the upper roll mounts 51. In FIG. 6, the arrangement of rollers 52 on one side of the machine is shown. The arrangement of rollers on the other side of the machine can be similar. A plurality of side guide roll mounts 53 (FIGS. 11 and 12) is attached to each of the lengthwise main frames 34 and 36 with a roller 54 being rotatably mounted in each of the side guide roll mounts 53. The arrangement of the side guide rolls 54 is shown in FIG. 6. Lower lengthwise roller support frames 57 and 58 (FIGS. 11 and 12) are supported on certain of the upright frames 41. Lower roll mounts 59 are supported on the lower lengthwise roll support frames 57 and 58. A roller 61 is rotatably mounted on each of the lower roll mounts 59. The arrangement of the rollers 61 is shown in FIG. 6. In addition, rolls 61 (FIGS. 6 and 13) are supported on roll mounts 612 carried by roll support frames 613 attached to certain other upright frames 41.

As shown in FIGS. 11 and 12, the first boom 23 includes lengthwise frame channels 63 and 64 and an inverted U-shaped upper portion 66, a part of which forms the top plate 31. Appropriate cross braces 67 (FIG. 16), span the channels 63 and 64. The channels 63 and 64 are supported by the rollers 61, as shown in FIGS. 11 and 12, and are held in aligned position on the
The booms are interconnected to move in and out in unison by chains 106 and 107 (FIG. 9). The chains 106 are mounted on sprockets 108 and 109 (FIG. 16) rotatably mounted on blocks 110 and 1101, respectively, (FIGS. 11 and 12), carried by the first boom 23. The chains 107 are mounted on sprockets 111 and 112 (FIG. 17) rotatably mounted on blocks 1121 and 1122, respectively, (FIGS. 11 and 12), carried by the frame channels of the second boom 24. The chains 106 are attached to chain anchors 113, one of which is shown in FIG. 11, mounted on an angle 114 carried by a support arm 1141, attached to the frame 57 of the base 22. The chains 106 are also attached to chain anchors 116 (FIGS. 9 and 12) mounted on the webs of the frame channels of the second boom 24. The chains 107 are attached to chain anchors 117 (FIGS. 9 and 12) attached to the webs of the frame channels of the third boom 25 and to chain anchors 1171 (FIGS. 11 and 16) carried by cross frames 1172 attached to webs of the frame channels of the first boom 23. The chains 106 and 107 cause the booms 23, 24, and 25 to extend and retract in unison as shown in FIG. 12.

The booms 23, 24, and 25 are extended and retracted by operation of a drive motor 119 (FIGS. 7 and 11). The motor 119 drives a shaft 121 (FIG. 7) which drives reduction gearing (not shown in detail) in a housing 122 which drives a cross shaft 123. The cross shaft 123 carries sprockets 124 which drive chains 126. The chains 126 drive sprockets 127 carried by shafts 128. The shafts 128 carry sprockets 129 on which boom drive chains 131 run. As shown in FIG. 8, the boom drive chains 131 run on idle pulleys 132, 133, 134, 136, 137, and 138. The boom drive chains 131 are attached to chain anchors 139, one of which is shown in FIG. 12, mounted on frame channels of the first boom 23. The boom drive chain 131 drives the first boom 23 to the right and left as shown in FIG. 14 inclusive, and the second and third booms move to the right and left in unison with the first boom.

The shafts 128 (FIGS. 7 and 11) also carry sprockets 142 (FIG. 7) on which chains 143 run. The chains 143 drive sprockets 144 on shafts 146. The shafts 146 carry sprockets 147. Carriage drive chains 148 run on the sprockets 147 and on idle sprockets 149. A belt take-up carriage 151 carries chain anchors 1511, one of which is shown in FIGS. 13 and 14, which are attached to the carriage drive chains 148. The belt take-up carriage 151 includes angle-shaped end frames 152 and 153 (FIG. 14) between which idle rollers 1531, 154, and 155 (FIGS. 13 and 14) are rotatably mounted. As shown, bearing supports 1551 of the rollers 1531, 154, and 155 can be adjustable. Support wheels 156 and 157 are rotatably mounted on the frame 152. The support wheels 156 and 157 run on a track assembly 158 (FIG. 13). The track assembly 158 includes angle-shaped rails 159 and 161 which guide the wheels 156 and 157. The rails 159 and 161 are supported on elongated track frames 163 and 164, which are attached to the base 22 by appropriate fastener plates 166. Support wheels 1561 and 1571 (FIG. 14) which support the angle-shaped frame 153 are similarly supported by a track assembly 1581 (FIG. 6) so that the carriage 151 can travel lengthwise of the boom.

The counterbelt 28 (FIG. 10) is driven by a motor 169 (FIG. 7) which drives a shaft 170. The shaft 170 drives gearing (not shown) in a housing 1701 to drive a shaft 1702 to drive a sprocket 171. The sprocket 171
drives chains 173 which drive a sprocket 174 carried by a shaft 176. The shaft 176 drives a drive pulley 177 (FIG. 10) on which the belt 28 runs. The belt 28 runs from the drive pulley 177 over the carriage roller 1531, a stationary roller 179, the carriage roller 154, a stationary roller 181, the carriage roller 155, an idle roller 182, an idle roller 183, an idle roller 184, an idle roller 185 rotatably mounted adjacent a rear end of the top plate 35, an idle roller 186 rotatably mounted adjacent a front end of the top plate 33, an idle roller 187 rotatably mounted adjacent a free end of the third boom 25, an idle roller 188 rotatably mounted on the second boom 24, an idle roller 189 rotatably mounted on the first boom, and an idle roller 191. The stationary rollers 179 and 181 are rotatably mounted between roller support frames 192 and 193 (FIG. 6) carried by frames of the base 22.

The drives for the boom drive chains 131 and the carriage drive chains 148 are so timed that the belt 28 does not develop slack as the booms 23, 24, and 25 are moved in and out.

As shown in FIGS. 15 and 19, plates 196 and 197 are pivotally mounted on bracket plates 198 (FIG. 19) attached to the free end of the third boom 25. Limit switches 199 and 201 (FIG. 20) are mounted on the third boom 25. As shown in FIG. 19, a switch actuator 202 of the limit switch 199 is engaged by the plate 196 to actuate the limit switch 199 when the plate 196 engages an obstacle as the third boom is being extended. A compression spring 203 mounted on a bolt 204 urges the plate 196 to the position shown in FIG. 19. The limit switch 201 (FIG. 20) can be similarly mounted for actuation by the plate 197 (FIG. 15).

Electrical circuitry of the conveyor is shown in FIG. 20. Electric power is supplied through main leads 207 and 208. The limit switches 199 and 201 are connected in series between the main lead 207 and a power lead 209 so that the power lead 209 is energized unless one of the limit switches 199 and 201 is opened by action of one of the plates 196 and 197 (FIGS. 15 and 19). Stop switches 211, 212, and 213 are connected in series between the power lead 209 and a belt drive power lead 214. When any one of a set of limit advance push button switches 216, 217, and 218 is closed, a forward winding 169F of the motor 169 (FIG. 7) is energized to cause the motor 169 to advance the belt 28 in a forward direction. Motor hold-in relay contacts 219 (FIG. 20) are closed by energizing of the motor forward winding 169F so that the winding 169F continues to be energized. Motor relay contacts 221 are opened when the winding 169F is energized to prevent energizing of a motor reverse winding 169R of the motor 169. A first control relay 222 and a warning lamp 223 are also energized when the motor winding 169F is energized.

When the belt advance is to be reversed, the belt advance can be stopped by opening of one of the stop switches 211, 212, and 213 or by opening of contacts of one of the limit switches 199 and 201. Then, when one of a set of belt reverse push button switches 224, 226, and 227 is closed, the belt reverse winding 169R is energized. Motor hold-in relay contacts 228 are closed when the winding 169R is energized so that the winding 169R continues to be energized. Normally closed motor relay contacts 231 are opened when the winding 169R is energized to prevent energizing of the winding 169F. In addition, a second control relay 232 and a warning lamp 233 are energized when the winding 169R is energized.

When the conveyor booms are to be extended, one of a set of conveyor extending push buttons 236 and 237 is closed to energize a forward winding 119F of the motor 119 (FIG. 7). When the conveyor booms are to be retracted, one of a set of conveyor retracting push buttons 239 and 241 (FIG. 20) is closed to energize a reverse winding 119R of the motor 119. When the forward winding 119F is energized, motor relay contacts 243 are opened to prevent energizing of the winding 119R. When the winding 119R is energized, motor relay contacts 244 are opened to prevent energizing of the winding 119F. Control relay contacts 222 and 231 of the control relays 222 and 232 are mounted in parallel in the circuit to the winding 119F so that the winding 119F can be energized only when one of the control relays 222 and 232 is energized to indicate that the belt 28 is being advanced or retracted. Control relay contacts 222 and 232 of the control relays 222 and 232 are similarly mounted in parallel in the circuit to the winding 119R so that the winding 119R can be energized only when one of the control relays 222 and 232 is energized to indicate that the belt 28 is being advanced or retracted. When the booms reach the limit of outward movement, contacts of the limit switch 73 open to prevent energizing of the forward winding 119F. When the booms have been fully retracted, contacts of the limit switch 78 open to prevent energizing of the reverse winding 119R. A warning lamp 251 indicates when one of the conveyor extending push buttons 236 and 237 is closed. A warning lamp 252 indicates when one of the conveyor retracting push buttons 239 and 241 is closed.

The push button switches can be located where needed for control of the conveyor. As shown in FIG. 15, a set of the push button switches including switches 216, 226, 236, and 239 is mounted at the free end of the third boom 25.

The booms can be extended into a body of a vehicle 2511 (FIG. 3) or the like but does not rest on and requires no support from the vehicle so that inadvertent movement of the vehicle lengthwise of the conveyor booms does not disturb the conveyor. The conveyor can be mounted on a loading dock 2521 or the like where convenient for use with vehicles.

The conveyor structure illustrated in the drawings and described above is subject to structural modifications without departing from the spirit and scope of the appended claims.

Having described my invention, what I claim is new and desire to secure by letters patent is:

1. A conveyor structure which comprises a base having an upper plate, a first boom having an upper plate, means for mounting the first boom on the base for movement between a retracted position in which the upper plate of the first boom underlies the upper plate of the base and an extended position in which the upper plate of the first boom extends outwardly of the upper plate of the base parallel thereto, a second boom having an upper plate, means for mounting the second boom on the first boom for movement parallel to the direction of movement of the first boom between a retracted position in which the upper plate of the second boom underlies the upper plate of the first boom and an extended position, means for advancing the first boom between retracted and extended positions,
means interconnecting the first and second booms to retract and extend together, the means interconnecting the first and second booms including an elongated second boom driving means mounted on sprockets rotatably mounted adjacent opposite ends of the first boom, and means for attaching the second boom driving means to the second boom and to the base so that the second boom is extended and retracted on the first boom as the first boom is extended and retracted, an endless belt, means for directing the belt onto the upper plates of the base and of the first and second booms, means for advancing the belt and belt take-up means connected to the means for advancing the first boom for increasing the length of the portion of the belt on the upper plates as the booms are extended and for reducing the length of the portion of the belt on the upper plates as the booms are retracted, the belt take-up means and the boom extending and retracting means being so timed as to prevent development of slack in the belt.

2. A conveyor structure as in claim 1 wherein there is a third boom having an upper plate, means for mounting the third boom on the second boom for movement parallel to the direction of movement of the first and second booms between a retracted position in which the upper plate of the third boom underlies the upper plate of the second boom and an extended position, and the means for directing the belt over the upper plates of the first and second booms directs the belt over the upper plate of the third boom and includes first roller means mounted on the third boom adjacent a free end of the third boom, second roller means mounted on the second boom, third roller means mounted on the first boom, and fourth roller means mounted on the base, the belt passing in series over the first, second, third and fourth roller means.

3. A conveyor as in claim 2 wherein there is means interconnecting the second and third booms to cause the third boom to be extended and retracted in unison with the first and second booms.

4. A conveyor as in claim 2 wherein there is means interconnecting the second and third booms including an endless third boom driving means mounted on sprockets rotatably mounted adjacent opposite ends of the second boom and means for attaching the third boom driving means to the first boom and the third boom so that the third boom is extended and retracted on the second boom as the second boom is extended and retracted on the first boom.

5. A conveyor as in claim 1 wherein the belt take-up means includes a carriage mounted on the base for movement parallel to the direction of extension of the booms, roller means on the carriage, stationary roller means mounted on the base, means for directing the belt over the roller means, and means for moving the carriage in a direction to increase the distance between the roller means when the booms are retracted and in a direction to decrease the distance between the roller means when the booms are extended.

6. A conveyor as in claim 5 wherein there is a plurality of rollers on the carriage and a plurality of stationary rollers and the belt is directed successively to carriage rollers and stationary rollers.