April 7, 1959 J. CRAGGS ET AL 2,880,849

COLLAPSIBLE AND EXTENSIBLE CONVEYOR AND LOADER

Filed Nov. 30, 1956 3 Sheets-Sheet 1

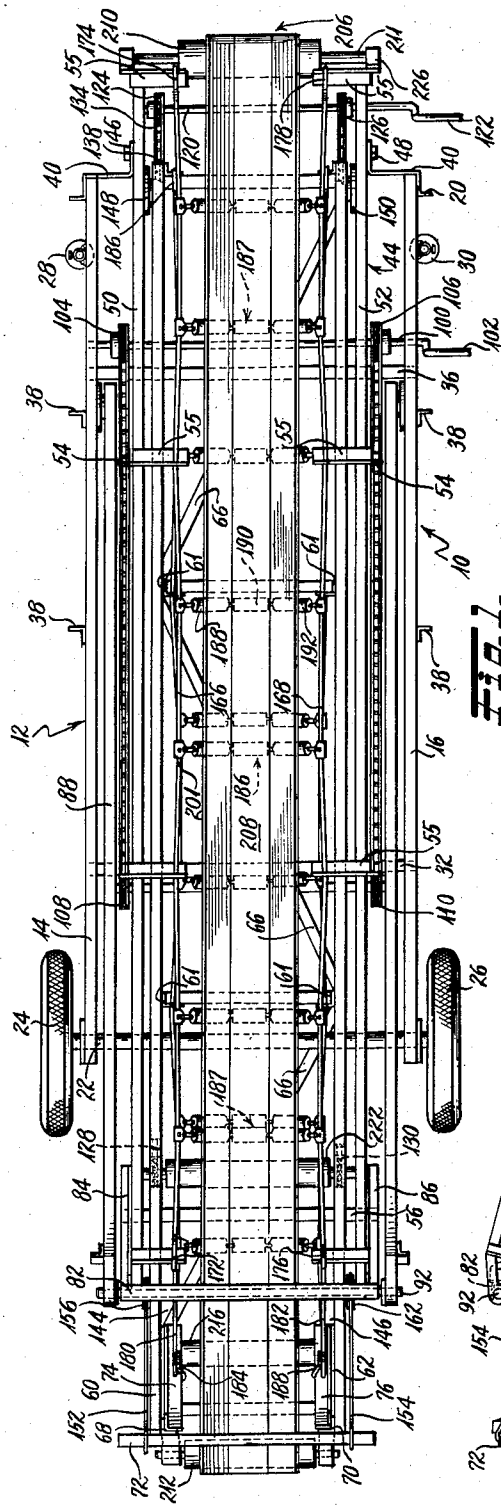


Fig. 1.

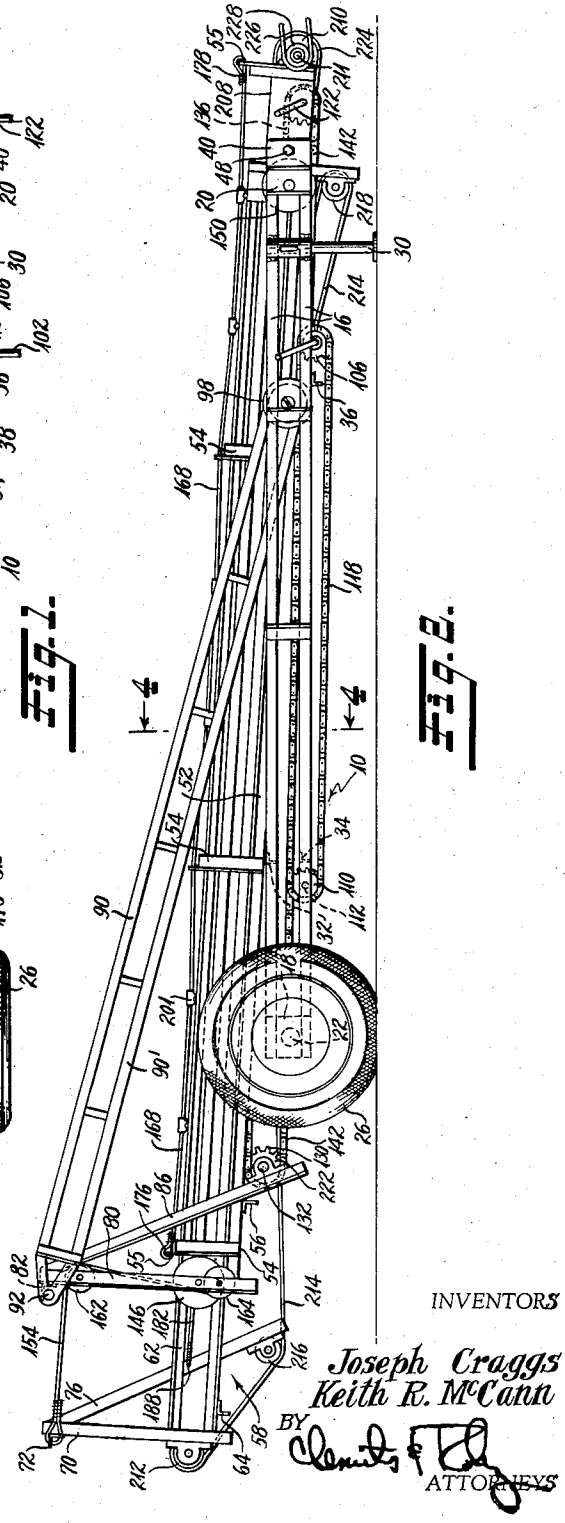


Fig. 2.

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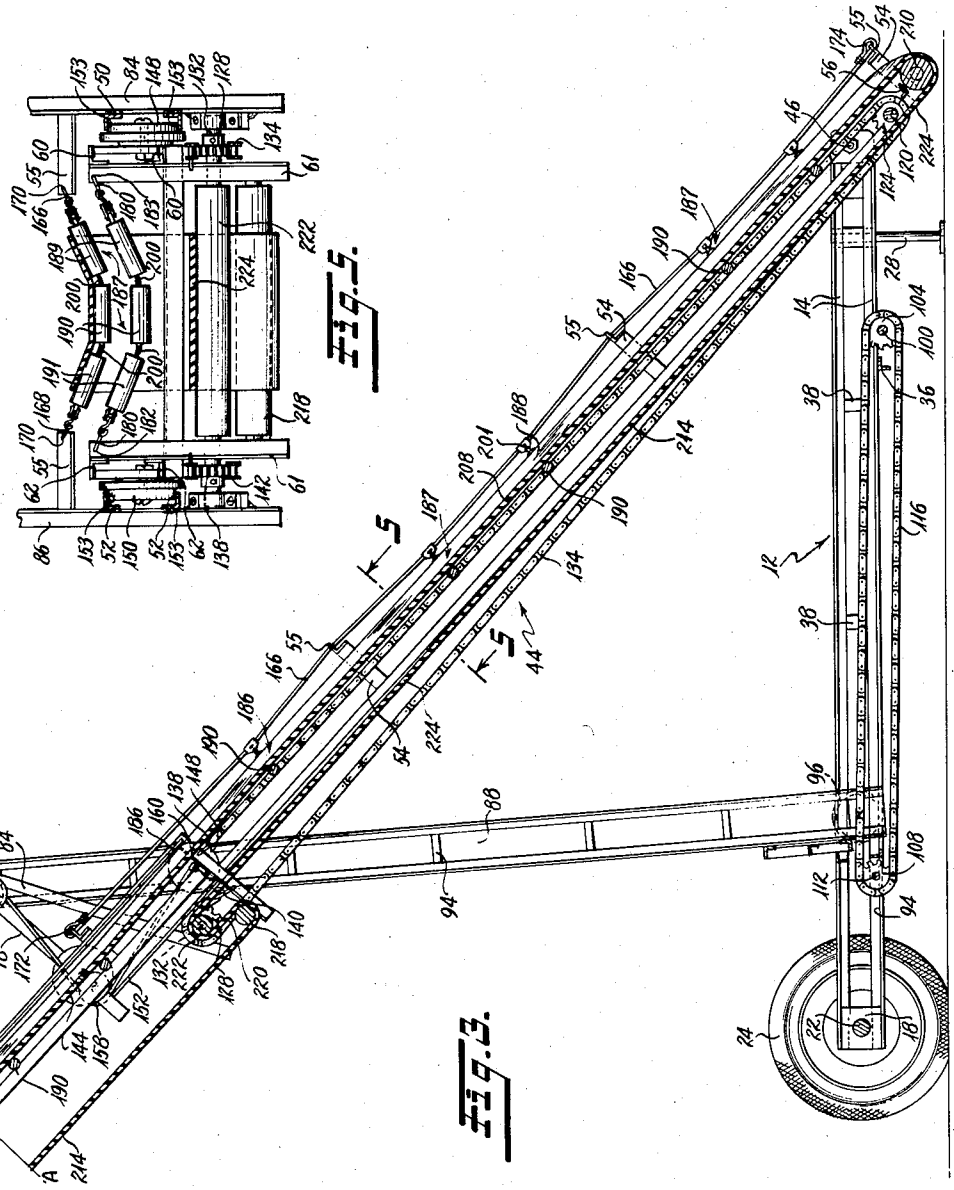


FIG. 5.

FIG. 3.

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COLLAPSIBLE AND EXTENSIBLE CONVEYOR AND LOADER

Filed Nov. 30, 1956 3 Sheets-Sheet 3

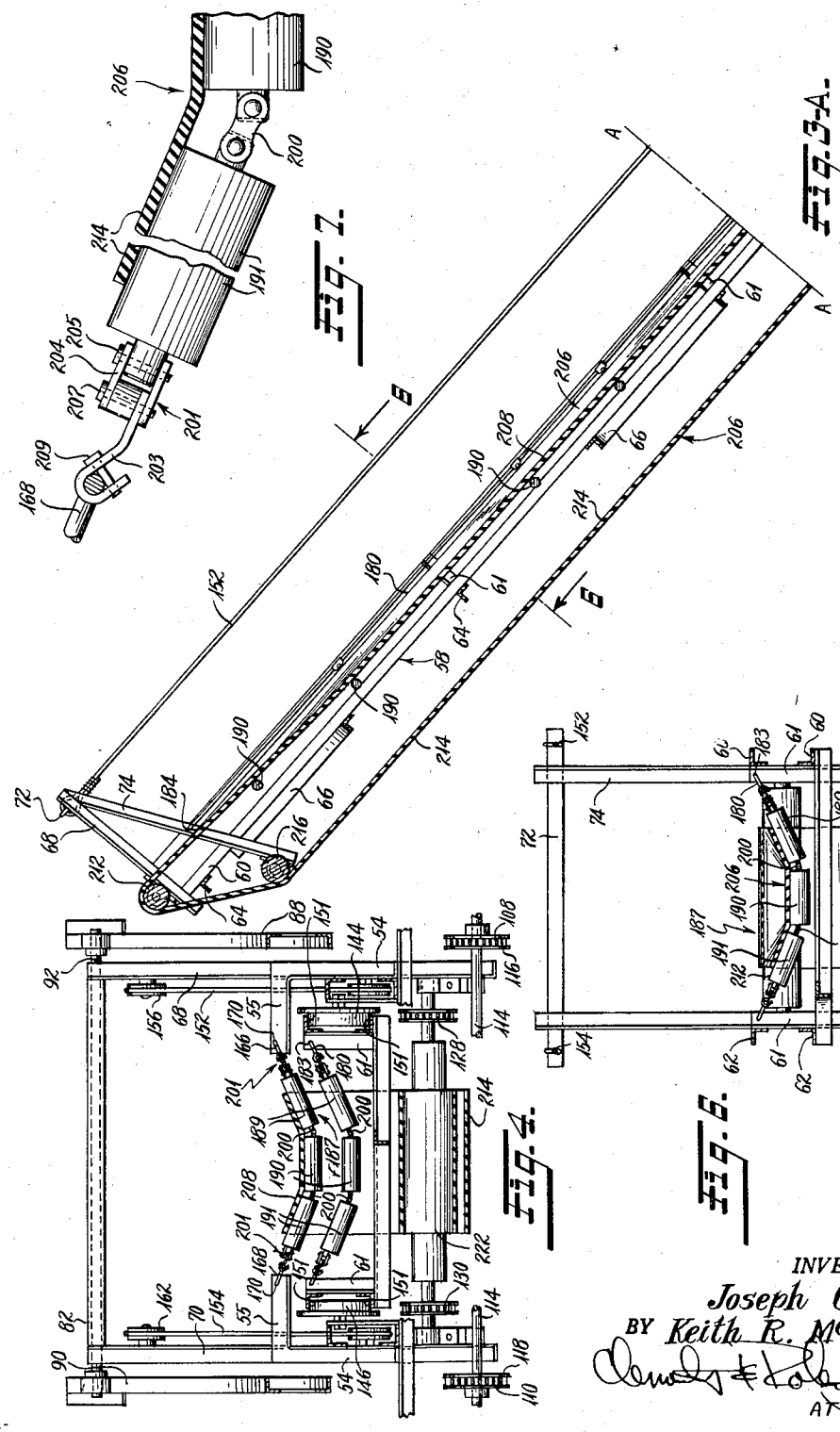


FIG. 7.

FIG. 3-A.

FIG. 4.

FIG. 5.

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COLLAPSIBLE AND EXTENSIBLE CONVEYOR AND LOADER

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Application November 30, 1956, Serial No. 625,490

22 Claims. (Cl. 198—139)

This invention relates to a portable extensible and retractable loader having a self aligning and self troughing endless conveyor, and more particularly to a portable conveyor and loader of the type referred to wherein the endless conveyor adjusts itself automatically to load variations and positions.

It is an object of this invention to provide an extensible and retractable loader which is readily extensible and elevated to any position within its limits, wherein the self aligning and self troughing endless conveyor operates at any point of extension or elevation of the loader.

Another object of this invention is the provision of an extensible and retractable loader having a plurality of flexibly mounted belt supporting and troughing roller assemblies.

A further object of this invention is the provision of flexible and yieldable "side rails" for mounting the belt troughing roller assemblies on the loader.

An additional object of this invention is the provision of an extensible and retractable loader having a pair of telescoping frames each having laterally spaced flexible strands for supporting the troughing roller assemblies.

Another object of this invention is the provision of an extensible and retractable loader having flexible and yieldable side rails and flexible troughing roller assemblies mounted on such side rail, where the side rails are flexible and yieldable relative to each other.

Another object of this invention is the provision of an extensible and retractable loader having rope side rails and flexible troughing assemblies which reduce spillage of materials being loaded thereby.

A further object of this invention is the provision of an extensible and retractable loader having a self troughing conveyor having inherent load pocketing properties.

A general object of the present invention is to provide a loader having the following advantages over the conventional loaders constructed with rigid framing and having rigid troughing roller assemblies spanning the rigid framing:

(*a*) Lower first costs and maintenance, lighter weight, and longer life;

(*b*) The ability to be easily and quickly extended and elevated;

(*c*) Inherent self-alignment, that is, the taut, flexible support strands being trained along parallel courses maintain the troughing roller assemblies in alignment;

(*d*) Impact absorption of a very high order, approaching that of a trampoline, so that it is virtually impossible for a sudden high loading to destroy or over stress the flexible framing and troughing roller assemblies;

(*e*) Improved load retention, spillage of material being loaded being drastically reduced;

(*f*) Troughing roller assemblies which automatically operate to train the belt properly; and

(*g*) Troughing roller assemblies which automatically tend to center the load on the belt.

A primary object is to provide a loader having a belt conveyor comprising flexible strand means trainable along a course and being transversely flexible at a place where connected to a transversely flexible belt carrying means or troughing roller assembly for concurrent flexing movements of the strand means and of the belt carrying means under loads applied to the latter to thereby absorb impact by the cumulative flexing of the flexible carrying means and of the flexible strand means. In a preferred form, disclosed herein, the cumulative flexing is achieved by suspending the flexible troughing roller assembly at a location on the strand means which is spaced or remote from the place of support of the strand means relative to the ground.

An important feature, in the nature of a "basic building block" of the present invention, is that a pair of flexible strands are trained along spaced parallel courses on the loader, and a flexible troughing roller assembly is suspended across the strands. The reach of the belt is, in turn, supported on the roller assembly.

Another important feature, in connection with the combination set forth in the previous paragraph is that the roller assembly is connected to the strands at locations spaced towardly or rearwardly from the strand supports of the loader. This provides two-way freedom of movement (vertical and horizontal) for the ends of the roller assembly, resulting in advantages *d* through *g* above.

Another object is the provision of an improved troughing roller assembly in a loader structure, particularly adapted for suspension across flexible strand side frames, which has means permitting freedom of motion at each end in a direction parallel to the belt, to automatically train the belt by urging it to run along the center of the troughing assemblies.

Another object is the provision of an improved troughing roller assembly in a loader having a rope side frame-type conveyor, which is flexible in at least a vertical plane and which is bodily shiftable in a horizontal plane to automatically vary the troughing contour under varying loads, and to vary its horizontal orientation automatically as needed to maintain the belt reach properly trained.

Yet another object is the provision of an improved troughing roller assembly in a loader having a rope side frame-type conveyor in which the ends of the troughing assembly are firmly locked to the ropes to utilize their torsional resistance in supporting the belt as well as in relating the up and down movement of adjacent roller assemblies under varying loads.

Still another object is the provision of a loader having a rope side frame-type conveyor in which impact on the troughing roller assemblies under a moving load is minimized by telegraphing, through the ropes and ahead of the load, a force which depresses the roller assemblies in anticipation of the load carried by the belt.

Another object is the provisions of a loader having a rope side frame-type conveyor in which impact is minimized by use of a troughing roller assembly which has the characteristic of an improved "angle of lift" resulting from the ability of the roller assembly to displace itself in a downward and forward direction, as a load moves over it. Thus, the load is lifted through a smaller angle than is the case for conventional, rigidly mounted troughing roller assemblies.

A further object is the provision of a loader having a rope side frame-type conveyor in which spillage is greatly reduced as the result of a troughing assembly which increases both in volume and in load-retaining angle with increasing loads.

Another object is the provision of a loader having a rope side frame-type conveyor in which the edge portions of the load-caddying run automatically pockets a load to hold it in place with minimum spillage.

Another object is the provision of a loader having a conveyor in which the belt is so flexibly supported that a load is never subjected to large impacts. This results from the favorable load-deflection characteristics of the troughing roller assemblies, which themselves are freely articulated for deflection in a vertical plane and are suspended across flexible strands at locations where the laterally spaced strands are free to deflect vertically and laterally inward.

A further object is the provision of a loader having a rope side frame-type conveyor in which impact absorption characteristics are improved by the ability of the ropes to shift lengthwise, in limited amounts, toward a section of the conveyor on which the load is increasing, and shift away from a section in which the load is decreasing. For example, as a load is fed onto a moving, empty belt, the laterally spaced flexible support strands will shift from the rear end of the conveyor toward the forward end of the moving loader, and as the tail end of the load passes over the belt, the strands will shift in a rearward direction behind the receding load.

In conventional loaders having rigid side frame conveyors, which support the troughing roller assemblies at fixed levels, loads are carried by the belt in an uneven path, up over a roller assembly and then down to the bottom of the catenary of the belt between roller assemblies. In the loaders of the present invention, it is a further object to provide some catenary sag to the belt conveying reach between the troughing roller assemblies so as to provide a path of load movement which would be uneven, as in conventional loaders, except for the concurrent flexing movement of the roller assemblies and the strands or ropes; for the feed-in of strands or ropes toward the loaded portion of the belt, and for the improved angle of lift of the belt; all of these combining to moderate the uneven path of the load movement as the load is carried by the belt along the supporting structure. In fact, this flexible load supporting structure tranquilizes a moving load so effectively that a large lump, constituting in effect almost a point load, can be carried from one end of the extended loader to the other with so little bobbing movement that is not perceptible except on close study.

Other objects and important features of the invention will be apparent from a study of the following specification taken with the accompanying drawings, which together describe and illustrate a preferred embodiment of the invention. Other embodiments may be suggested to those having the benefits of the teachings herein, and such other embodiments are intended to be reserved to the extent they fall within the scope and spirit of the appended claims.

In the drawings:

Fig. 1 is a top plan view of the loader in retracted position;

Fig. 2 is a side elevation of same;

Figs. 3 and 3A, taken together, comprise a longitudinal vertical sectional view of the loader in extended and elevated position;

Fig. 4 is an enlarged fragmentary cross-sectional view taken substantially on the line 4—4 of Fig. 2, looking in the direction of the arrows;

Fig. 5 is an enlarged fragmentary cross-sectional view substantially on the line 5—5 of Fig. 3;

Fig. 6 is an enlarged fragmentary cross-sectional view substantially on the line 6—6 of Fig. 3, and

Fig. 7 is a detailed fragmentary view of the roller assembly suspension means.

Attention is now directed to Figs. 1 and 2 of the drawing wherein there is shown an extensible retractable loader indicated generally by the reference numeral **10**. The loader **10** includes a main body frame or chassis **12** which comprises a pair of laterally spaced longitudinally extending vertically disposed side frame structures **14**, **16** each having rear support plates **18** and lower support plates **20** rigidly secured thereto. The side frame structures **14**, **16** each have the corresponding rear support plates **18** carrying an axle **22** which has ground engaging wheels **24**, **26** rotatably mounted thereon. The other end portions of each frame section **14**, **16** may be supported on a pair of jacks or other suitable type supporting elements **28**, **30** which may be removed or retracted when the loader is to be transported. The side frame structures **14**, **16** are rigidly secured together by longitudinally spaced transversely extending cross members **32**, **34** and **36**. At the forward end of each of the side frames **14**, **16** there is rigidly secured an angle member **40** which permits a main conveyor frame **44** to be relatively vertically pivoted at the forward end thereof to the forward end of the main body frame **12** for vertical pivotal movements of the rear end of the main conveyor frame **44** in relation to the main body frame **12** by bolts **46**, **48** passing through and mounted in the angle members **40**. The main conveyor frame **44** comprises laterally spaced longitudinally extending vertically disposed side members **50**, **52** each including a pair of vertically spaced angle iron members held in spaced relation by a plurality of vertically disposed angle members **54** rigidly secured to the respective angle iron members. The vertical members **54** are provided with similar horizontal inwardly extending angle members **55** for a purpose later to appear.

The front and rear portions of the side frame members **50** and **52** are each supported by plates, not illustrated, but which are similar to the plates **18** and **20** of the main body frame **12**, and transversely extending longitudinally spaced cross beams **56**.

An extension or secondary conveyor frame **58** is slidably mounted for longitudinal movement in the main conveyor frame **44**. The extension conveyor frame **58** comprises laterally spaced longitudinally extending vertically disposed side frame members **60**, **62** constructed in a manner similar to the construction described for side frame members **50** and **52** of the main conveyor frame **44**. The extension conveyor frame **58** is braced by longitudinally spaced transversely extending cross beams **64** and diagonal beams **66**. At the rear end of the extension conveyor frame **58** there is a pair of uprights **68**, **70** secured to the side frames **60**, **62**, respectively, and rigidly braced by beams **74**, **76**, respectively. At the rear end of the main frame **44** there is a similar beam **82** and inclined braces **84**, **86**, which are rigidly secured to the side frame structures **50**, **52**. The function of the two upright frame structures will be set forth in detail hereinafter.

Each of the side frame structures **14**, **16**; **50**, **52**; **60**, **62**, so far described, is of substantially lazy U-shape in cross section. This specific cross sectional form provides track or guide means for roller means later to be described. Such roller means provide for the extensibility and retractability of the respective frame structures relative to each other.

A pair of frame arms **88**, **90** constructed similarly to the side frame structures **14**, **16**; **50**, **52**; **60**, **62** are pivoted on a shaft **92** which is mounted in the upper ends of the upright beams **78**, **80** at the rear ends thereof and supported by the cross beam **82**, and are provided at their forward ends with flanged rollers **96**, **98**, respectively, riding on the lower guide surfaces or tracks **94** of the side frame members **14** and **16** of the main frame **12**. Near the forward end of the main body frame **12** and slightly in advance of the forward ends of the arms **88**, **90**, when in retracted position, there is a shaft **100** having a crank **102** thereon. A pair of sprockets **104**, **106** are fixed on the shaft **100**. Near the rear of the main body frame **12** are mounted a pair of sprockets **108**, **110** rotatable on a shaft **112** carried by the side frame structure **14**, **16**. An endless sprocket chain **116** is trained

over the sprockets 104 and 108, and a similar endless sprocket chain 118 is trained over the sprockets 106 and 110. The chains 116 and 118 comprise traction means for the arms 88 and 90 and are suitably connected respectively to the forward ends of said arms. It will be apparent from the above that counterclockwise rotation of the shaft 100 will move the upper reaches of the chains 116 and 118 rearwardly causing forward ends of the arms 88, 90 to move rearwardly to elevate the rear ends thereof which are rotatably mounted on the shaft 92 to cause the main conveyor frame 44 to be elevated and pivotal about bolts 46, 48.

A shaft 120 is mounted near the forward end of the main conveyor frame 44 and is provided with a crank 122. A pair of sprockets 124, 126 is mounted on the shaft 120. A further pair of sprockets 128, 130 is rotatably mounted on a shaft 132 near the end of the conveyor frame 44. A sprocket chain 134 has one end thereof attached as at 138 to the forward end of the side frame member 60 of the extensible frame 58. The chain 134 extends forwardly about the sprocket 124 and thence rearwardly to the lower portion of the sprocket 128, about the sprocket 128 and thence forwardly to the forward end of the side frame member 60, where the other end of the chain 34 is attached as at 140. A similar chain 142 is trained in a like manner about the sprockets 126 and 130 and is likewise attached in a similar manner, by its end, to the forward end of the side frame 62 of the extensible frame 58. Rotation of the shaft 120 in a counterclockwise direction will extend or pull the extensible frame 58 rearwardly into the extended portion, while clockwise rotation will retract the frame 58 from its extended portion to the normal retracted position thereof. In the extending and retracting movement, the extensible frame 58 rides on and is guided by rollers 144, 146 rotatably mounted at the rear of the main conveyor frame 44 and on rollers 148, 150 rotatably mounted on the forward end of the extensible frame 58. The rollers 144, 146 ride on the guide surface 151 of side frame members 60, 62, see Fig. 4, and the rollers 148, 150 ride on the guide surfaces 153 on the side frame members 50, 52, see Fig. 5.

The specific relationship of the pivotal means with respect to each other and to the cables will be described in more detail hereinafter.

A pair of strengthening cables 152 and 154 for supporting the extension conveyor frame 58 in extended position are each attached at one end to the cross beam 72. The support cable 152 is trained forwardly over a pulley rotatably mounted near the upper end of the upright 78, and then downwardly and under a further pulley 158 rotatably mounted adjacent the lower end of the upright 78 thence forwardly and is attached in taut condition at the forward end of the extensible frame 58 as at 160, note Fig. 3. The support cable 154 is trained over pulleys 162 and 164, respectively, in a manner like that described for the cable 152, it being also attached in taut condition to the forward end of the extensible frame 58. The support cables 152 and 154 stabilize the extensible frame 58 in its forward and rearward movements.

A pair of troughing roller assembly supporting flexible cables 166 and 168 are mounted in the main conveyor frame 44 as by passing through openings 170 in the horizontally disposed inwardly extending angle members 55 of the vertical angle members 54, the ends of the cable 166 being attached as at 172 and 174, respectively, in angle members 55 at the rear and forward ends of the main conveyor frame 44. The cable 168 is likewise attached to corresponding angle members 55 at 176 and 178. Similar cables 180, 182 are mounted in suitable openings 183 in the vertical angle bars 61 forming part of the side frame 60, 62. The cable 180 is anchored at 184 to the brace 74 and at 186 in an angle member 61 at the forward end of the side frame 60. The cable 182 is similarly anchored at 188 in the brace 76 and at a suitable point, not shown, in an angle bar 61 at the forward end of the extensible frame 58.

Each troughing roller assembly 187 consists of a plurality of idler rollers which can vary in number according to the width of the belt. In this case three idler rollers are shown, each assembly including a pair of inclined or wing rollers 189 and 191, and a center or load supporting roller 190. Each of the rollers is arranged to turn upon a dead shaft 194 and the adjacent ends of the shafts 194 are doubly articulately interconnected at 200 by links so that the rollers 189, 190 and 191 are freely movable relative to each other in a vertical plane common to the longitudinal axis of the rollers and shafts to accommodate the variations in a load on the conveying reach 208.

The wing rollers 189 and 191 are connected respectively at 201 to the adjacent flexible support cables 166, 168, and 180, 182 by means of a link 204 connected by a pin 205 to the end of the adjacent respective dead shaft 194 and by a pin 207 passing through the ear 203 of a U-shaped clamp 202, the bight of which closely grips the cable 166, 168 or 180, 182, as the case may be, with the clamp retained by a pin 209 passing through a suitable opening therein.

The clamps 202 are longitudinally spaced in relation to and positioned at intervals between the bars 55 and the angle members 61, preferably two clamps between each pair of longitudinally spaced cable supporting positions defined by the bars 55 and the angle members 61. The double articulated connection 201 permits relative shifting movement in a substantially horizontal plane which is normal to the vertical plane of relative vertical movement between the rollers 189, 190 and 191 and common to the longitudinal axis of the shafts 194 between the ends of the troughing roller assemblies 187 and the respective support cables 166, 168 and 180, 182. This shifting movement of the ends of the roller assemblies 187 in relation to the respective support cables permits self training of the belt, as will appear in more detail hereinafter.

The troughing roller assemblies 187 are placed in a position normal to the longitudinal axis of the conveying reach 208 as can be determined by the eye. However, such placement may be at angles other than right angles to the cables 166, 168 and 180, 182 and to the longitudinal axis of the conveying reach 208 without disturbing the self training feature of the troughing roller assemblies 187.

Each troughing roller assembly 187 is free to shift in a horizontal plane in directions to correct to a small degree any misalignment of the conveying reach of a belt. It has been found that the training effect is primarily caused by the center load supporting roller 190, and in actual test conditions the center load supporting roller 190 has been found to be hunting back and forth at each of its ends a distance of from 1/8 to 3/16". This swing or hunting of the ends of the load supporting roller 190 shifts the belt at that point in a direction towards the center of the conveyor. The troughing roller assemblies are commonly mounted at distances approximately five feet apart, and the sum total effect of many such troughing roller assemblies is equal to or greater than the effect of a conventional training roller located every two hundred feet.

The troughing roller assemblies 187 thus prevents an accumulative misalignment of the belt by making a correction of any misalignment at each assembly.

The swivel connection 201 at the outermost ends of each troughing roller assembly 187 is rigid against movement in a vertical plane, as has been described, and by reason of the clamping action afforded by the clamp 202 and the locking pin 209, a load carried by the conveying reach 208 will be transmitted into the side supporting flexible cables 166, 168 and 180, 182, and the torsional

resistance thereof will prevent undue sagging of the assembly by reason of such load. In fact, it has been observed that the twisting of the side supporting flexible strands by reason of such load will be transmitted into the next adjacent troughing roller assembly, so that it will deform in a vertical plane an amount which is related to the deformation in a vertical plane at an adjacent loaded troughing roller assembly, the net effect being to provide smooth travel of the load over the troughing roller assemblies.

In order to limit the torsional strain to which the cables **166, 168** and **180, 182** are subject under load the bights of the U-shaped clamps **202** will be preferably small enough to grip the strand firmly so as to limit the strain to that portion of the strand between the adjacent supporting positions of the cables. By this construction it is possible to regulate the hardness or the softness of the "ride" of material on the conveying reach by changing the initial tension placed on the support strands.

It will be observed, of course, that the interconnections **200** of the center load supporting roller **190** and the inclined wing rollers **189** and **191** are such as to permit the movement of the rollers with respect to each other in a vertical plane but are rigid against relative horizontal movement. In other words, the rollers may orient themselves with respect to each other in accordance with the load thereat, limited only by the tension in and the torsional resistance of supporting cables **166, 168** and **180, 182.**

The structure disclosed herein presents some unusual phenomena which are strikingly unusual considering the simplicity of the assemblies making up the total combination of our loader. A number of these phenomena have been recited in the objects of this invention, and conceivably could not be apparent nor understood without explanation of phenomena taking place in actual use of the structure described and claimed herein.

One of the important features of the invention is the fact that the structure embraced thereby tends to sense the oncoming of a load on the belt of the loader. Stated conversely, the load on the belt in effect "telegraphs" the oncoming thereof so as to cause portions of the structure remote from the load to adapt itself to the oncoming load.

Referring now to the drawings, the phenomena existing in the laterally spaced support cables **166, 168** and **180, 182** and also in the troughing roller assemblies **187** which span the support strands will now be explained. A load placed on the lower end of the conveying reach **208** and moving from the right to the left in Fig. 3 in a direction towards the first or lowermost troughing roller assembly **187** causes the assembly to be displaced downward. The force transmitted to the troughing roller assembly **187** by the load causes its deflection downward causing the support cables **180, 182** to be displaced downward and inward.

The displacement or deformation of the supporting cables **180, 182** will increase as the load comes closer to the first troughing roller assembly **187.** This increasing displacement in a downward and inward direction of the support cables **180, 182** will cause a displacement of the support strands at the next troughing assembly **187,** the second one from the right as seen in Fig. 3. This latter troughing roller assembly **187** will likewise be displaced downwardly, and as the load moves past the first troughing roller assembly and to positions closer to the second assembly, the second assembly will displace increasing amounts in accordance with the proximity of the load. Obviously, the deflection of the support cables **180** and **182** will increase to a maximum as the load is directly above the assembly, decreasing from such maximums as the load moves away from the assembly.

The phenomena have been described with reference to what might be considered a point load, and in addition to the described displacement of the troughing assembly and the support cables, there is what may be called a "pocketing" effect where the belt partly encloses the load by inward displacement of the support strands.

The phenomena described may be likened to the casting of a shadow by the load or the "telegraphing" thereof of its imminence to the next proximate troughing roller assembly. This "telegraphing" or "shadow" effect causes the flexible cable strands to yield as has been described in accordance with the then loading on the conveyor of the loader or the imminent loading thereon; so the roller assemblies actually begin to duck down to receive a load before the load, or even its shadow effect, reaches it, thereby minimizing shock or impact as the load passes over the roller assembly.

The foregoing phenomena of the flexible strands and the troughing roller assemblies also result in what might be described as a smooth "ride" of the material moving on the conveyor of the loader. Heretofore, where rigid side framing was employed with rigid troughing assemblies, the sag vertically of the conveying reach between the troughing assemblies caused the loads on the belt, particularly spot loads, to bump over the assembly. On the other hand it has been found, in operations employing a loader having a conveyor of the type disclosed herein the "ride" is so smooth that spillage is materially minimized.

It may be noted that a load changes the troughing contour of the conveying reach, to increase the load carrying capacity. This change in contour of the conveying reach "pockets" the increased load, as heretofore explained, and greatly reduced spillage.

It has also been found that the mounting of troughing roller assemblies **187** in the manner as shown in Figs. 4 to 7, inclusive, makes use of the torsional resistance of the flexible strands. It will be remembered that the U-shaped clamps **202** are held tightly to the flexible strands by means of the pins **209,** the swivel connection **201** at the links **204** being rigid in a vertical plane but free to swivel or shift in a horizontal plane.

The connections **201** are rigid against relative movement in a vertical plane, and the wing rollers are of rigid construction and act as cantilever arms between the interconnection **200** and the connections **201** in transmitting the force created by a load at the assemblies **187** to the cables through the effective cantilevers of the wing roller shafts **194** and the connections **201.**

At the forward end of the main conveyor frame **44,** the upper reach **208** of an endless belt conveyor **206** passes over a supporting and driving roller **210** and travels rearwardly to the roller **212** at the rear of the extension frame **58,** where it now becomes the lowermost reach of the belt **206,** travelling downwardly and rearwardly under the idle roller **216** rotatably mounted on the lower ends of the braces **74** and **76.** The belt **206** thence passes to the roller **218** rotatably mounted on the forward end of the extension frame **58** about the roller **218,** making a 180° turn to travel rearwardly as an intermediate reach **220.** The length of this reach **220** will vary, as will the others mentioned, according to the extension or retraction of the extension frame **58** relative to the main conveyor frame **44.** Passing rearwardly the intermediate reach **220** bends about the roller **222** rotatably mounted on the shaft **132** and makes a 180° turn to become the return reach **224** back to the drive roller **210.**

The conveyor loader of this invention may be operated at any elevation within the limits of the arms **88, 90,** and at any extension within the limits of the length of the extension frame **58.** At extreme extensions, the outer or rearward end of the extension frame is stabilized and supported by the cables **152, 154.**

Power to drive the conveyor belt **206** may be applied by means of a belt **226** passing about a pulley **228** on the shaft **211** of the roller **210.** The belt **226** may be connected to any suitable or convenient source of power or prime mover.

While the shafts **100** and **120** are shown as operated manually by cranks **102** and **122,** respectively, any suit-

able power source or prime mover and reduction gear may be used in lieu thereof.

Having now described our invention and its mode of operation, we claim:

1. A loader assembly comprising a rigid main frame structure, a rigid extensible frame structure telescopically mounted on said main frame structure for movement thereon between an extended and a retracted position, flexible strand means trained along each of said frame structures, said strand means being secured adjacent the end portions thereof to the respective frame structure with an intermediate portion of each strand means being transversely deflectable, an elongated belt carrying anti-friction means adapted to support a conveying reach of a belt for movement thereacross, said anti-friction means being flexible in a direction transverse to the length thereof while varying the spacing between the ends thereof, and connecting means between said intermediate portions of the strand means and the respective ends of said anti-friction means permitting limited freedom of movement of said ends toward and away from one another for flexing movements of said intermediate portions of the strand means and said anti-friction means under loads applied to said anti-friction means, said flexible strand means, flexible anti-friction means and connecting means constituting a structure which is yieldable to absorb impact by the flexing of said deflectable intermediate portions of the strand means and of said flexible anti-friction means.

2. A loader assembly comprising a rigid main frame structure, a rigid extensible frame structure telescopically mounted on said main frame structure for movement thereon between an extended and a retracted position, an endless belt trained around both of the frame structures, each of said rigid frame structures having a plurality of flexible strands trained along generally parallel courses, each of said strands being secured adjacent the end portions thereof to the respective rigid frame structure, supporting means on each of said rigid frame structures for supporting the respective strands, and an elongated troughing roller assembly being flexible in a direction transverse to the length thereof and connected to said strands at locations spaced from said supporting means, said belt having the load carrying reach thereof running along and being supported by the troughing roller assembly, said flexible strand and flexible troughing roller assembly being effective to yieldably support loads applied to and carried by the belt.

3. A loader assembly comprising a rigid main frame structure, a rigid extensible frame structure telescopically mounted on said main frame structure for movement thereon between an extended and a retracted position, at least one pair of flexible strands for each frame structure, said strands each having the end portions thereof secured to the respective frame structure with each pair of strands being trained along generally parallel courses, supporting means for each pair of strands carried by each of said frame structures and effective to maintain the respective strands spaced a fixed distance apart at the respective supporting means but relatively free for transverse movement relative to one another at a location remote from said supporting means, a troughing roller assembly extending between each pair of strands adapted to support a conveying reach of a belt trained between both of said structures comprising a series of roller-supporting members, an interconnection between adjacent of said members enabling said adjacent members to move relative to one another about said interconnection in a plane normal to said strands at said remote location, a pair of brackets, each of said brackets supported at a respective one of said strands at said remote location, and connections between said roller supporting members at opposite ends of said series and respective ones of said brackets, said connections being rigid against substantial relative movement between said roller-supporting members and the respective brackets in said plane normal to the strands at said remote location whereby a load on said troughing roller assembly can be supported at least in part by said rigid connections in the direction of said plane.

4. A loader assembly comprising a rigid main frame structure, a rigid extensible frame structure telescopically mounted on said main frame structure for movement thereon between an extended and a retracted position, each of said frame structures having a pair of laterally spaced flexible strands, said strands each being secured adjacent the end portions thereof to the respective frame structure, at least one elongated troughing assembly extending transversely between each pair of said strands adapted to support a conveying reach of a belt trained between both of said structures, said troughing assembly being flexible in a plane normal to the strands to vary the spacing between the ends thereof, said troughing assembly having belt engaging elements which are movable relative to one another in a plane normal to said strands, said ends of the troughing assembly being secured to said flexible strands at locations where said strands are relatively movable to vary the spacing therebetween, whereby loads applied to said troughing assembly are absorbed by flexing of the flexible strands and the troughing assembly.

5. A loader assembly comprising a rigid main frame structure, a rigid extensible frame structure telescopically mounted on said main frame structure for movement thereon between an extended and a retracted position, said frame structures each having a plurality of flexible strands, said strands each having the end portions thereof secured to the respective frame structure, a plurality of supporting means on each of said frame structures for supporting the respective flexible strands thereon in pairs which are disposed along generally parallel courses, said supporting means being positioned at intervals along said respective strands and effective to maintain the respective strands at a predetermined spacing at said intervals, said strands of each pair being transversely deflectable toward and away from one another at positions intermediate said supporting means within limits determined by the tension in the respective strands, an articulated troughing roller assembly connected across each pair of said strands at each of said intermediate positions, each of said roller assemblies comprising a plurality of shafts freely pivotally interconnected on a pivotal axis parallel to said strands, the end shafts of each assembly being connected to said strands by freely movable double articulated connections permitting swinging of each roller assembly as a unit in a plane parallel to said strands, a roller rotatably journalled on each shaft adapted to support a load-carrying reach of a belt, whereby a suddenly increasing load on the roller assemblies may be cushioned against impact by the flexing of the roller assemblies and of the strands at said intermediate positions where the roller assemblies are connected thereto.

6. A loader assembly comprising a rigid main frame structure, a rigid extensible frame structure telescopically mounted on said main frame structure for movement thereon between an extended and a retracted position, an endless belt trained around both of the frame structures, a pair of laterally spaced flexible strands on each frame structure, said strands each having the end portions thereof secured to the respective frame structure, support means carried by each frame structure for supporting the respective strands thereon, said support means including means holding each of said strands against rotation relative to said support means, an elongated troughing roller assembly transversely flexible along the length thereof and extending transversely between said strands and supporting the conveying reach of the belt, said troughing roller assembly being spaced along said strands from said support means to provide twistable lengths of said strands between said support means and said troughing roller assembly, a clamp connection between each of

said flexible strands and a corresponding end of the said roller assembly, whereby downward swinging movement of each end of said troughing roller assembly about the respective strand is resisted by twisting of at least one of said twistable lengths of strands to thereby limit the transverse flexing movement of said troughing roller assembly so the load on said troughing roller assembly is supported at least in part by the torsional resistance of said flexible strands.

7. A loader assembly comprising a rigid main frame structure, a rigid extensible frame structure telescopically mounted on said main frame structure for movement thereon between an extended and a retracted position, a pair of laterally spaced flexible strands carried by each of said frame structures, each of said strands being secured adjacent the end portions thereof to the respective frame structure, at least one elongated troughing roller assembly extending transversely between each pair of said strands adapted to support a conveying reach of a belt trained between both of said structures, each of said troughing roller assemblies being flexible along the longitudinal axis thereof in a generally vertical direction, and a connection between each end of the respective troughing roller assemblies and the respective adjacent flexible strand, each of said strands being free at said connections to deflect generally vertically and horizontally in accordance with the load on said troughing roller assembly, said flexible strand and flexible troughing roller assemblies being yieldable to absorb impact loads on the troughing roller assemblies.

8. A loader assembly comprising a rigid main frame structure, a rigid extensible frame structure telescopically mounted on said main frame structure for movement thereon between an extended and a retracted position, an endless belt trained around both of the frame structures, a pair of laterally spaced flexible strands on each frame structure, said strands each having the end portions thereof secured to the respective frame structure, support means on each of said frame structures for supporting said strands, first and second troughing roller assemblies extending transversely between and attached to each pair of said strands for supporting the conveying reach of the belt, each of said troughing roller assemblies being transversely flexible along the length thereof, said troughing roller assemblies being spaced from each other along each of the respective strands to provide a twistable length of each respective strand therebetween, each troughing roller assembly including end portions, each of said end portions being clamped to one of the respective strands against rotation relative thereto, whereby flexing of the first troughing roller assembly under a coming load on the conveyor belt swings the end portions of the first troughing roller assembly in directions to twist said twistable lengths of the respective strands to swing the end portions of the second troughing roller assembly in directions to increase the troughing volume and side wall retaining angle of the conveyor belt at said second troughing roller assembly before the load reaches it.

9. A loader assembly comprising a rigid main frame structure, a rigid extensible frame structure telescopically mounted on said main frame structure for movement thereon between an extended and a retracted position, an endless conveyor belt trained around both of the frame structures, a pair of laterally spaced, substantially horizontal, flexible strands for each frame structure, each of said strands having the end portions thereof secured to the respective frame structure, at least one elongated troughing roller assembly extending transversely between each pair of strands and supporting the conveying reach of the conveyor belt, said roller assembly being flexible for substantially vertical flexible movement, and a connection between each of said flexible strands and the respective end of the roller assembly at locations where said strands are transversely movable toward and away from one another, said connections restraining swinging movement in a substantially vertical plane of each end of said roller assembly relative to the respective strand to which it is connected but permitting greater relative movement therebetween in a substantially horizontal plane whereby a load on the roller assembly is supported at least in part by the torsional resistance of said flexible strands while said roller assembly is free to shift in said substantially horizontal plane to maintain said conveyor belt centered thereon.

10. A loader assembly comprising a rigid main frame structure, a rigid extensible frame structure telescopically mounted on said main frame structure for movement thereon between an extended and a retracted position, an endless belt trained around both of the frame structures, a pair of flexible strand means for each frame structure, each of said strand means being secured adjacent the end portions thereof to the respective frame structure, troughing roller assemblies for supporting the load carrying reach of the belt, each of said roller assemblies comprising a plurality of rollers, means interconnecting said rollers for flexing movement thereof in a substantially vertical direction and for shifting movement thereof as a unit in a substantially horizontal direction, a bracket for connecting each of the roller assemblies to one pair of the flexible strand means, and a connection between each bracket and an end of the respective roller assembly enabling the shifting movement of the rollers as a unit relative to the bracket whereby each roller assembly will have a self-training effect on the belt passing over it by the shifting of the ends of each roller assembly.

11. A loader assembly comprising a rigid main frame structure, a rigid extensible frame structure telescopically mounted on said main frame structure for movement thereon between an extended and a retracted position, an endless belt trained around both of the frame structures, a pair of flexible strand means for each frame structure, each of said strand means being secured adjacent the end portions thereof to the respective frame structure, troughing roller assemblies carried by each pair of strand means and supporting the load carrying reach of the belt, each troughing roller assembly comprising a series of elongated roller-supporting members arranged in end-to-end relationship along a longitudinal axis, a bracket at each end of said series of members connecting the respective ends thereof to the respective strand means, and an interconnection between adjacent members providing for freely pivotal relative movement of said members about a first transverse axis which transversely intersects said longitudinal axis, said interconnection being relatively rigid aaginst relative movement in the direction of said first transverse axis, each of said brackets having a double pivotal connection with a respective end member of said series providing for freely shiftable movement of said end member relative to said bracket about spaced, parallel second and third transverse axes, respectively, which transversely intersect said longitudinal axis, said connection being relatively rigid against relative movement in the direction of said second and third transverse axes, and said first axis intersecting said longitudinal axis in a direction which is substantially at right angles to the direction of the second and third axes.

12. A loader assembly comprising a rigid main frame structure, a rigid extensible frame structure telescopically mounted on said main frame structure for movement thereon between an extended and a retracted position, a pair of laterally spaced flexible strands for each frame structure, each of said strand means being secured adjacent the end portions thereof to the respective frame structure, at least one elongated troughing roller assembly extending transversely between each pair of strands adapted to support a conveying reach of a belt trained between both of said structures, each troughing roller assembly being flexible along the longitudinal axis thereof in a vertical direction and comprising a series of roller-supporting members having vertically flexible interconnections therebetween and a connection between the

roller-supporting member at each end of the troughing roller assembly and the respective adjacent flexible strand, each of said roller-supporting members at each end of the troughing roller assembly constituting a vertically rigid cantilever member extending from the respective strand inward to the first interconnection, each of the respective strands being free at said connections to deflect vertically and horizontally in accordance with a load on the troughing roller assembly whereby flexing movements of the respective strands at said connections and of the troughing roller assembly are effective to absorb impact load on the troughing roller assembly, and whereby further flexing of the troughing roller assembly at each interconnection is resisted at least in part by the vertical rigidity of the cantilever members.

13. A loader assembly comprising a rigid main frame structure, a rigid extensible frame structure telescopically mounted on said main frame structure for movement thereon between an extended and a retracted position, an endless belt trained around both of the frame structures, a pair of flexible strand means for each frame structure, each of said strand means being secured adjacent the end portions thereof to the respective frame structure, troughing assemblies secured to each pair of the flexible strand means by mounting means, the troughing assemblies supporting the load carrying reach of the belt, each of said troughing assemblies comprising a plurality of anti-friction members disposed along a longitudinal axis, means interconnecting said anti-friction members along said axis for individual relative movement of each member in relation to each other in one plane and unitary movement of the anti-friction members in another plane which is disposed substantially normal to said one plane and common with said axis, and a connecting means connecting the respective mounting means to each end of the respective troughing assemblies for relative movement of each mounting means in relation to the respective end of said troughing assembly in said another plane, said connecting means being relatively rigid against relative movement of each mounting means in relation to the respective ends of said troughing assembly in said one plane whereby as the belt passes over the anti-friction members in a direction substantially parallel to the one plane the belt will be supported at least in part in the direction of another plane by the relative rigid connection between the mounting means and the respective ends of the troughing assembly.

14. A loader assembly comprising a wheel mounted chassis, a rigid main frame structure pivotally mounted at one end thereof adjacent the forward end of the chassis and extending rearwardly therefrom with the other end of the rigid main frame being free and movable in a substantially vertical plane relative to the chassis, means for moving the free end in the vertical plane including a pair of spaced apart arms each having one end pivotal to the main frame adjacent the free end thereof with the other end of each arm engaging the chassis, a rigid extensible frame structure telescopically mounted to the free end of said main frame structure for sliding movement thereon between an extended and a retracted position, means for moving said extensible frame structure between said positions, flexible strand means trained along each of the frame structures, said strand means each being secured adjacent the end portions thereof to the respective frame structure supporting means on each of the frame structures supporting said flexible strand means, elongated belt carrying anti-friction means adapted to support a conveying reach of a belt trained about both of the frame structures, said anti-friction means being flexible in a direction transverse to the length thereof and connecting means connecting the anti-friction means to the respective strand means remote from said supporting means for flexing movements of the respective strand means and anti-friction means under loads applied to said anti-friction means.

15. A loader assembly comprising a wheel mounted chassis, a rigid main frame structure pivotally mounted at one end thereof adjacent the forward end of the chassis and extending rearwardly therefrom with the other end of the rigid main frame being free and movable in a substantially vertical plane relative to the chassis, means for moving the free end in the vertical plane including a pair of spaced apart arms each having one end pivotal to the main frame adjacent the free end thereof with the other free end of each arm engaging the chassis, a rigid extensible frame structure telescopically mounted to the free end of said main frame structure for sliding movement thereon between an extended and retracted position, means for moving said extensible frame structure between said positions, a single endless belt trained around both of the frame structures, a pair of flexible strands on each of said frame structures, each of said strands being secured adjacent the end portions thereof to the respective frame structure, means carried by each of said frame structures for supporting said strands thereon and to limit relative transverse movement of each respective pair of strands at one location yet providing greater relative transverse movement at another location spaced along the strands from said one location, and a troughing roller assembly flexible at least in a plane normal to the respective strands and suspended across each pair of strands at another location thereon, said belt having the load carrying reach thereof running along and being supported by the troughing roller assemblies, each pair of flexible strands and the respective flexible troughing roller assembly constituting yieldable support means effective to absorb loads applied to the belt.

16. A loader assembly comprising a wheel mounted chassis, a rigid main frame structure pivotally mounted at one end thereof adjacent the forward end of the chassis and extending rearwardly therefrom with the other end of the rigid main frame being free and movable in a substantially vertical plane relative to the chassis, means for moving the free end in the vertical plane including a pair of spaced apart arms each having one end pivotal to the main frame adjacent the free end thereof with the other free end of each arm engaging the chassis, a rigid extensible frame structure telescopically mounted to the free end of said main frame structure for sliding movement thereon between an extended and retracted position, means for moving said extensible frame structure between said positions, a pair of flexible strands carried by each of said frame structures, each pair of strands being secured adjacent the end portions thereof to the respective frame structure and trained along generally parallel courses with the adjacent portions thereof being transversely deflectable to vary the spacing between said portions under loads applied transversely thereto, troughing means adapted to support a conveying reach of a belt trained about both of the frame structures, said troughing means being transversely flexible along the length thereof to vary the spacing between the ends thereof when deflected, said troughing means having belt engaging elements which are adjustable relative to one another in a plane normal to the strands, and connecting means connecting said troughing means to said portions of the respective pairs of flexible strands whereby flexing movements of the said portions of said respective flexible strands and of said troughing means are effective to support loads applied to said troughing means.

17. A loader assembly comprising a wheel mounted chassis, a rigid main frame structure pivotally mounted at one end thereof adjacent the forward end of the chassis and extending rearwardly therefrom with the other end of the rigid main frame being free and movable in a substantially vertical plane relative to the chassis, means for moving the free end in the vertical plane including a pair of spaced apart arms each having one end pivotal to the main frame adjacent the free end thereof with the other free end of each arm engaging the chassis,

a rigid extensible frame structure telescopically mounted to the free end of said main frame structure for sliding movement thereon between an extended and retracted position, means for moving said extensible frame structure between said positions, a single endless belt trained around both of the frame structures, a pair of flexible strands tensioned along generally parallel courses for each frame structure, said strands each having the end portions thereof secured to the respective frame structure, a plurality of supporting means on each of said frame structures for supporting the respective flexible strands thereon, said supporting means benig positioned at intervals along said respective strands and effective to maintain the respective strands at a predetermined spacing, each pair of strands being transversely deflectable to vary the spacing therebetween at positions intermediate the supporting means within limits determined by the tensions in said respective strands, an articulated troughing roller assembly connected across each pair of said respective strands at each of said intermediate positions, each articulated troughing roller assembly comprising a series of shafts, each having a roller rotatably journalled thereon and supporting the load carrying reach of the belt, adjacent shafts being pivotally interconnected in end-to-end relationship for relative flexing movement about a pivotal axis running longitudinally of said strands, bracket means clamped to each of said respective strands at said intermediate positions, and swivel connections between said bracket means and the respective ends of said series of shafts for shifting said articulated troughing roller assemblies in a plane parallel to the respective strands, responsive to movement of an off-center conveying reach of the belt thereacross, to a position to restrain said reach toward the center of the respective strands.

18. A loader assembly comprising a wheel mounted chassis, a rigid main frame structure pivotally mounted at one end thereof adjacent the forward end of the chassis and extending rearwardly therefrom with the other end of the rigid main frame being free and movable in a substantially vertical plane relative to the chassis, means for moving the free end in the vertical plane including a pair of spaced apart arms each having one end pivotal to the main frame adjacent the free end thereof with the other free end of each arm engaging the chassis, a rigid extensible frame structure telescopically mounted to the free end of said main frame structure for sliding movement thereon between an extended and retracted position, means for moving said extensible frame structure between said positions, a pair of flexible strands tensioned along generally parallel courses on each of said frame structures, said strands each having the end portions thereof secured to the respective frame structure, supporting means on each of said frame structures for supporting the respective pair of strands thereon, said supporting means being effective to maintain the respective strands at a predetermined spacing at said supporting means, the respective pair of strands being transversely deflectable to vary the spacing therebetween at positions remote from said supporting means within limits determined by the tension in said strands and the proximity of said supporting means, at least one roller assembly comprising a series of shafts each having a roller rotatably journalled thereon adapted to support a load carrying reach of a conveyor belt, adjacent shafts being pivotally interconnected in end-to-end relationship for articulating movement about a pivotal axis running longitudinally of the frame structures and connecting means on each of the respective strands at said position remote from the supporting means forming a connection between the respective strands and the respective end of said series of shafts, said connecting means including a double pivotal link pivotable about spaced parallel axes normal to a plane including the adjacent respective strand thereby enabling the ends of said roller assembly to shift forward and backward.

19. A loader assembly comprising a rigid main frame structure, a rigid extensible frame structure telescopically mounted on said main frame structure for movement thereon between an extended and a retracted position, an endless belt trained around both of the frame structures, a pair of laterally spaced flexible strands trained over generally parallel courses on each of said frame structures, each of said strands being secured adjacent the end portions thereof to the respective frame structure, supporting means on each of said frame structures for supporting the respective strands thereon at spaced locations, said strands being longitudinally shiftable relative to said locations while being so supported, a flexible troughing roller assembly suspended across each respective pair of strands intermediate the supporting means and effective to pull said strands downward and inward when loaded, said troughing roller assemblies carrying the conveying reach of said belt with a loaded portion of the conveying reach requiring greater lengths of the respective flexible strands than an unloaded portion thereof, whereby said strands are longitudinally shiftable toward a loaded portion of said belt in response to downward movement of the troughing roller assemblies accompanied by increased downward and inward deflections of said strands when loaded.

20. A loader assembly comprising a rigid main frame structure, a rigid extensible frame structure telescopically mounted on said main frame structure for movement thereon between an extended and a retracted position, an endless belt trained around both of the frame structures, a pair of laterally spaced flexible strands for each frame structure, said strands each being secured adjacent the end portions thereof to the respective frame structure, supports on the frame structure for supporting the respective flexible strands thereon with the supports being spaced along the lengths of said respective flexible strands, troughing assemblies spaced along the lengths of each pair of said flexible strands at locations remote from said supports for guiding the conveying reach of the belt, each troughing assembly comprising a plurality of flexible interconnected rollers and means for connecting the end rollers of each troughing assembly to the respective adjacent flexible strand, said means comprising a hanger supported on the respective flexible strand and a double articulated connection between the hanger and the respective end roller, whereby upon movement of an off-center conveying reach thereacross said troughing assemblies are automatically shiftable to a position to retain such reach toward the center of said strands.

21. A loader assembly comprising a wheel mounted chassis, a rigid main frame structure pivotally mounted at one end thereof adjacent the forward end of the chassis and extending rearwardly therefrom with the other end of the rigid main frame being free and movable in a substantially vertical plane relative to the chassis, means for moving the free end in the vertical plane including a pair of spaced apart arms each having one end pivotal to the main frame adjacent the free end thereof with the other free end of each arm engaging the chassis, a rigid extensible frame structure telescopically mounted to the free end of said main frame structure for sliding movement thereon between an extended and retracted position, means for moving said extensible frame structure between said positions, a single endless belt trained around both of the frame structures, a pair of laterally spaced flexible strands for each frame structure, each of said strands having the end portions thereof secured to the respective frame structure, support means on each frame structure for supporting the respective strands thereon, said support means including means clamping the respective strands against relative rotation, a plurality of elongated troughing roller assemblies are transversely flexible along the length thereof and extending transversely between and attached to the respective pair of strands for supporting the conveying reach of the belt,

said troughing roller assemblies being spaced along the respective strands from the support means to provide twistable length of the strands between the support means and the troughing roller assemblies, each of said troughing roller assemblies including a pair of end lever members each having a portion clamped to respective ones of the strands against rotation relative thereto and having means interconnecting opposite portions of said lever members, whereby flexing of the troughing roller assemblies under transversely applied load is resisted by twisting of the twistable lengths of the strands by said lever members so said load is supported at least in part by the torsional resistance of the flexible strands.

22. A loader assembly comprising a rigid main frame structure, a rigid extensible frame structure telescopically mounted on said main frame structure for movement thereon between an extended and a retracted position, each of said frame structures having flexible strand means trained therealong, each of said strand means being secured adjacent the end portions thereof to the respective frame structure, supporting means on each of the frame structures for supporting the respective strand means, an elongated belt carrying anti-friction means adapted to support a conveying reach of a conveyor belt for movement thereacross, said anti-friction means being flexible in a direction generally transverse to the length thereof and connecting means connecting said anti-friction means to said strand means remote from said supporting means for flexing movements of the strand means and anti-friction means under loads applied to the anti-friction means.

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