APPARATUS FOR FEEDING TUBING OR OTHER OBJECTS

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This invention relates to an apparatus for feeding tubing or other objects, and particularly to an apparatus for feeding tubing or wire line into a well under pressure.

An object of this invention is to provide a new and improved apparatus for feeding tubing or other objects, and particularly to a new and improved apparatus for feeding tubing or wire line into a well under pressure.

An important feature of this invention is to provide a new and improved apparatus for feeding tubing or other objects, wherein a pair of endless feeding assemblies are so mounted as to be self-loading.

Another object of this invention is to provide a new and improved apparatus for feeding tubing or other objects, wherein a pair of feeding assemblies have means mounting same for movement towards each other to increase the gripping action on the tubing or other object being fed.

A further object of this invention is to provide a new and improved apparatus for feeding tubing, cables and the like in which each feeding assembly is mounted for pivotal movement with respect to another feeding assembly for changing the gripping force applied to the tubing, cable, and the like being fed.

Still another object of this invention is to provide a new and improved apparatus for feeding tubing, cables, and the like into a well under pressure, including means for imposing a gripping force on the tubing, cables and the like which is sufficient to feed same into the well in opposition to the pressure tending to urge the tubing, cable, or the like upwardly, and means for supporting the weight of the tubing, cable or the like so as to automatically increase the gripping action thereon as such weight increases after the gravity force of such weight exceeds the well pressure.

Another object of this invention is to provide a new and improved apparatus for feeding tubing, cables and the like wherein means are provided for permitting a coupling or other enlargement to pass between the reaches of a pair of endless feeding assemblies.

A particular object of this invention is to provide a new and improved feeding mechanism for tubing, cables and the like, wherein a pair of opposed endless chain feeding assemblies are provided which are adapted to laterally grip the tubing, cable or the like while the chains are only loaded substantially perpendicularly to the direction of the lateral gripping force.

A specific object of this invention is to provide a new and improved feeding mechanism for tubing, cables and the like, including an endless feeding assembly having means for maintaining the endless chain thereof taut but permitting localized flexing or kinking thereof in the event a tubing collar or other enlargement passes through the mechanism.

A further object of this invention is to provide a new and improved feeding mechanism for tubing, cables and the like, including an endless feeding assembly having a gripper back-up means for maintaining the grippers in gripping engagement with the object being fed but permitting a localized flexing or kinking of the grippers in the event a tubing collar or other enlargement passes through the mechanism.

The preferred embodiment of this invention will be described hereinafter, together with other features thereof, and additional objects will become evident from such description.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings forming a part thereof, wherein an example of the invention is shown, and wherein:

FIG. 1 is a view, partly in section and partly in elevation illustrating schematically the apparatus of this invention in position for use on a well head assembly;

FIG. 2 is a vertical sectional view, partly in elevation and partly schematic, illustrating the apparatus of this invention;

FIG. 3 is a horizontal cross-sectional view of the apparatus of FIG. 2 taken on line 3—3 of FIG. 2;

FIG. 4 is a cross-sectional view taken on line 4—4 of FIG. 2;

FIG. 5 is a horizontal sectional view, partly in elevation, illustrating details of the endless gripping assembly and the compensating backup mechanism therewith, taken on line 5—5 of FIG. 2;

FIG. 6 is an elevation of the apparatus of this invention, showing portions thereof schematically;

FIG. 7 is a view, partly in section and partly in elevation illustrating in particular one of the compensator backup mechanisms used in conjunction with the gripping members within the reach of one of the gripping assemblies, and particularly the co-action occurring when an enlargement on the pipe or other object passes through the area between the reaches of the assemblies;

FIG. 8 is a view taken on line 8—8 to illustrate further details of the endless gripping assembly;

FIG. 9 is an exploded view illustrating the components of the endless chain and the gripping members used in the apparatus of this invention; and

FIG. 10 is a schematic view showing the pivotal arrangement of the compensator backup mechanism preferably used in this invention.

In the drawings, the letter A designates generally the apparatus of this invention which is preferably used for feeding, lowering, and/or removing tubing T, wire line, or other elongate object into and/or out of a well through a wellhead control device C. Briefly, the apparatus A of this invention includes at least a pair of endless feeding assemblies F—1 and F—2, each of which is provided with an endless gripping means for gripping the tubing T or other object being fed therebetween.

The feeding assemblies F—1 and F—2 have compensator backup mechanisms B—1 and B—2, respectively, which serve to permit localized flexing of the endless gripping units of each of the assemblies F—1 and F—2 when an enlargement such as a tubing collar passes between the assemblies, as will be more fully explained. Also, as will be pointed out hereinafter, the assemblies F—1 and F—2 are pivotally mounted on a support frame S so as to provide for the gripping and the supporting of the tubing T or other object being fed by the assemblies F—1 and F—2 in accordance with various conditions. It should also be noted that the assemblies F—1 and F—2 each has a means therewith for maintaining the endless chain with the gripping units taut while permitting the localized flexing when the size of the tubing T or other object being fed exceeds a predetermined amount, thereby preventing damage to the chain.

Considering the invention more in detail, the apparatus A of this invention is normally used in connection with wells under pressure, although its use is not limited thereto. In some cases, for example, a tubing T is inserted into the well under pressure for the injection of chemicals or for killing the well. Also, fluid may be introduced through such a tubing T into a well under pressure for washing sand out of gas wells. Various other uses of the apparatus A of this invention will occur to those
skilled in the art. As illustrated in FIG. 1, the apparatus A is shown as being mounted at the upper end of a pressure control device C. In actual practice, the apparatus A is considerably larger in relationship to the control device C than illustrated in FIG. 1, but the general relationship is illustrated merely for showing the manner in which the apparatus A of this invention may be used. The control device C may take various forms but as illustrated, it includes a tubular housing 12 which may have line wipers or sealing elements 14 and 15 for sealing against the material adapted to engage the external surface of the tubing T as it is fed into the well. A sleeve 16 which is urged downwardly by fluid pressure introduced in line 12a to compress spring 16a is provided above the wipers 14 and 15. A conventional lubricator (not shown) is usually mounted below the control device C for the insertion of well tools in the known manner. A blowout preventer P is mounted below lubricator in the known manner for closing off the well while a well tool is being positioned in the lubricator. The blowout preventer P is of course positioned at the upper end of the usual well casing W. The tubing T makes its way through tool at its lower end, which is provided with a one-way check valve which permits the flow of fluid through the tubing T into the well but prevents return flow of fluid through the tubing T. A load indicator X (FIG. 1) may be mounted above the control device C for supporting the barrel of the apparatus A to indicate whether the pipe or other object T is under compression or tension. Thus, if the pipe T is being pulled, or if its weight is being supported, there is an opposite downward force on the support frame S which is transmitted to a piston 17 of the indicator. Such downward movement of the piston 17 forces fluid from the chamber 17a to produce a reading as to the tension on the pipe T on a gauge 18a or other indicator. If, on the other hand, the pipe T is being pushed downwardly so as to overcome well pressure, the apparatus A is urged upwardly which causes the piston 17 to force fluid from the chamber 17a to produce a reading on the compression on the pipe T on a gauge 18b or other indicator.

The details of the apparatus A are shown in composite form in FIG. 2. The feeding assemblies F-1 and F-2 are identical in the preferred form of the invention and therefore details of the assembly F-1 will be described and they will be applicable to the other assembly F-2. Thus, the assembly F-1 includes an endless chain E made up of a plurality of chain links 20 which are connected together with chain pins 21 (see FIG. 9).

As will be explained more in detail, each of the chain links 20 has flanges 20a to which are attached roller blocks 22 and gripping members 23 (FIG. 9). The chain links 20 are connected together in the usual manner to form an endless chain E with the blocks 22 and members 23 mounted and movable therewith. An upper drive sprocket 25 is mounted for rotation on a center shaft 25a which is supported on one or more side plates or mounting plates 26. Such sprocket 25 has the usual sprocket teeth 25b which are adapted to fit between the chain pins 21 of the links 20 to impart rotation or movement to the endless chain upon a rotation of the sprocket 25. Such sprocket 25 may be driven by any suitable power means, but as illustrated, drive gears 27 and 28 are preferably utilized in conjunction with a hydraulic motor (not shown) which is operably connected to the shaft 28a on the gear 28. Such motor is normally mounted on the exterior of one of the side plates 26.

The feeding assembly F-1 also has a lower sprocket 30 which is mounted upon a shaft 30a and which has the usual sprocket teeth 30b which also are adapted to interfit between the chain pins 21. Such sprocket 30 is not driven but moves to keep the movement of the endless chain in the proper position.

In order to maintain the endless gripping element or assembly taut, particularly in the longitudinally extending reach R-1 which extends substantially from the upper sprocket 25 to the lower sprocket 30 in the area gripping the tubing T or other object, an eccentrically mounted idler roller 32 and 32a is extended to be concentrically mounted on any suitable shaft 32b which is eccentrically positioned with respect to the center of the sprocket 32 (see FIGS. 2 and 4). The eccentric shaft 32a extends through the side plates or mounting plates 26 as best seen in FIG. 4 and there is connected with rotatable heads 33 and 33a which are provided with a central opening 43a in alignment with the opening 37a for the insertion of a tubing between

assembly 44. The stud 35b extends through the lever arm 34 and is maintained in a predetermined position by suitable lock nuts 35d. The lower threaded stud 35c is also adjusted on a line or projection 35e and stud 35c is maintained in the predetermined position by suitable lock nuts 35f. As will be more evident herein, the spring 35 not only maintains the endless chain taut for normal gripping action by the feeding assembly F-1, but on the lower end thereof may be clamped or locked against the spring and this would be compensated for in part at least by the compression of the spring 35. Thus, the inclusion of the spring 35 and its related mechanism including the eccentrically disposed sprocket 32 provides a means for preventing breakage or other damage to the chain in the event the object being passed between the reaches R-1 and R-2 of the assemblies exceeds a predetermined width.

The support frame S may be of any suitable construction, but as illustrated includes a base plate 37, vertical risers 38 and an upper connecting plate 39. The base plate 37 is adapted to be attached to a well head assembly such as illustrated in FIG. 1 diagrammatically. Also, it is to be noted that the base plate 37 has an opening 37a extending through the center thereof and the upper plate 39 has an opening 39a which is in alignment with the opening 37a for the passage of the tubing T or other object vertically as the assemblies F-1 and F-2 feed same vertically.

The support frame S includes support arms 40 which extend upwardly and outwardly from the vertical risers 38 and normally are welded or otherwise secured thereto. However, it is to be noted that the support arms 40 are not attached to the side plates 26. Normally, there are two support arms 40 for each of the assemblies F-1 and F-2, only two of which are visible in FIG. 6. The support arms 40 in the front as viewed in FIGS. 3 and 6, carry bearing blocks 40a which are adapted to receive main pivot shafts 41. The rear support arms 40 have smaller bearing rings 40b (FIG. 3) welded or otherwise secured therewith for supporting the opposite ends of the main pivot shafts 41. These pivot shafts 41 are held together for lateral strength by a frame plate 42 which is welded or otherwise secured to the bearing blocks 40a and also to the arms 40. Similarly, a frame plate 43 is provided at the rear of the apparatus A (FIG. 3) and is welded or otherwise secured to the bearing rings 40b. Such plate 43 is either separated into two sections or is provided with a central opening 43a in alignment with the opening 37a for the insertion of the tubing between
the reaches of the assemblies as will be more evident hereinafter.

The main pivot support pin 41 of each of the assemblies F–1 and F–2 is preferably mounted in the bearing block 40a and the bearing ring 40b by the use of retaining flanges 41c which are held in place by retaining bolts 41b.

Considering still just the feeding assembly F–1, which is of course identical with the assembly F–2, the main pivot shaft 41 is connected to a control arm 43 which is disposed outwardly of the bearing block 40a and is confined inside of the retaining plate 41a. Preferably, the control arm 43 is rigidly secured to the shaft 41 by one or more keys 45a, or any other suitable securing means.

The main pivot support pin 41 imparts a rotation to the shaft 41. The movement of the shaft 41 is imparted to one or more load support links 46. Each of the load support links 46 is connected to the main pivot shaft 41 by a connecting key 46a or any other suitable connecting means. Each of the load support links 46 has an opening 46b therethrough for receiving a master pivot pin 48 which also extends through suitable openings 26a in the side plates or mounting plates 26. Thus, as rotation is imparted to the shaft 41 by a movement of the control arm 45, the load support link or links 46a are caused to pivot and this in turn transmits the pivotal movement through the master pin 48 to the side plates or mounting plates 26 for a pivotal movement about the shaft 41. During such movement of the plates 26, the plates 26 shift with respect to the shaft 41 and for this purpose suitable openings 26b are provided which are indicated in FIGS. 2 and 3.

In order to control the movement of the side plates 26 so that they remain substantially vertically as the assemblies F–1 and F–2 move towards and away from each other, a balance link 50 (FIG. 6) is provided, preferably with each of the mounting plates 26. Each balance link 50 has one end thereof connected to the support frame 5 by means of a balance link pin 50a and the other end thereof connected to one of the plates 26 by a balance link pin 50b. It should be pointed out that the balance link 50 is parallel to the load support link 46. In other words, the central axes of the pivotal pins 50a and 50b are in a line which is parallel to a line passing through the central axes of the shaft 41 and the pin 48. The control arms 45 extending from the assemblies F–1 and F–2 meet in an area approximately midway between the two assemblies and are mounted in a connector 52 which permits a pivotal action of the inner ends 45a of the arms 45 during longitudinal or vertical movement. The various pivot pins in the connector 52 are pivotally mounted to a piston shaft 53 having a conventional piston 53a therewith. Such piston 53a operates within a cylinder 54 which is likewise of conventional construction and which is adapted to be operated with any suitable fluid, preferably a hydraulic fluid. The cylinder 54 has tubes 54a and 54b connected therewith for the admission of fluid under pressure and the exhaust of fluid from the cylinder on the opposite side of the piston 53a. The fluid under pressure may be supplied to the cylinder 54 for moving the piston 53 in the direction desired and by any suitable means, but as shown in FIG. 6 schematically, a reservoir or sump 55 with the hydraulic liquid or other fluid is provided and such fluid is pumped with a conventional pump 56 into an accumulator 57. The accumulator has an outlet line 57a which passes to a valve 58 to which the lines 54a and 54b connect. Also, a return line 55b connects with the valve 58. A plurality of valves may be used in the place of the valve 58, it being understood that the illustration in FIG. 6 is merely schematic. It is to be noted that the accumulator 57 has the upper portion thereof filled with a gas such as air which is confined above the liquid level and is adapted to be compressed during the use of the apparatus. Such accumulator is desirable because the gas is adapted to be compressed in the accumulator 57 when the liquid in the system is forced upwardly and back into the accumulator by the piston 53a. Such forcing of the fluid back to the accumulator 57 occurs, as will be more evident hereinafter, that in the event a tubing or other object of a size in excess of the gap between the reaches of the assemblies is attempted to be passed therethrough. Thus, should an enlarged pipe or well be passed downwardly or upwardly through the space between the reaches R–1 and R–2 of the assemblies F–1 and F–2 which is of such a size that it attempts to move the assemblies outwardly, such action will cause a pivoting upwardly of the load support links 46 and the control arms 45 and will thereby cause a movement upwardly of the piston 53a. Such upward movement of the piston 53a will force liquid back through the line 54a and into the accumulator 57 to compress the gas. If the gas were not present, the liquid would prevent any movement of the piston 53a and such might result in damage to the assemblies or other parts of the equipment.

Referring now to the backup mechanism B–1 which is illustrated in FIGS. 2, 3, 5 and 7–10, such mechanism B–1 includes a master arm 60 which is pivotally mounted on the master pivot pin 48, thereby mounting the master arm 60 on the load support link 46. Preferably, the master arm 60 extends upwardly and downwardly substantially equal distances and is provided with pivot pins 60a at or near its extremities. The upper portion of the master arm 60 thus has a master pivot pin 60b for a group of rollers while the lower extension or portion of the master arm 60 has the other pivot pin 60a for mounting a second identical group of rollers. The upper group of rollers is mounted with an angular pivot bracket 62 which has a pivot pin 62a at its upper end and another pivot pin 62b at its lower end. The pivot pin 62b carries a set of rollers D, whereas the pivot pin 62a carries a pivot plate 63 which in turn pivotally carries a pair of roller sets D–1 and D–2.

The lower portion of the arm 60 likewise has a set of rollers D which is mounted at the lower end of a pivot bracket 64 which corresponds with the bracket 62. Such set of rollers D pivots about the pivot pin 64a. The upper shorter portion of the bracket 64 has a pivot pin 64b which corresponds with the pivot pin 62b and which carries a pivot plate 65 corresponding with the plate 63, on which are pivotally mounted a pair of sets of roller sets D–1 and D–2. The rollers 70 in each of the sets D, D–1 and D–2 are identical and are mounted with any suitable axles 71 (FIG. 5). By reason of such construction of the backup mechanism B–1, the gripping members 23 are adapted to flex locally by causing a pivoting about any of the pivot brackets 62 and 64 in a manner such as is illustrated in particular in FIG. 7. Thus, the gripping members 23 in contact with, and adjacent to, an enlargement such as the tubing collar T indicated in FIG. 7 shift inwardly and cause a pivoting of such gripping members as the tubing and its enlargement T move longitudinally. In this connection, it is to be noted that each of the gripping members 23 preferably is formed with a central curvature or surface 23a which has a radius preferably corresponding with the radius of the tubing T or other elongate element being fed. Outwardly of the curved surface 23a, smaller segmental curved surfaces 23b are provided which are of a central curvature, usually corresponding with the radius of curvature of a tubing collar such as T shown in FIG. 7. Thus, the gripping elements 23 are in constant engagement with the external surface of the tubing T, including the tubing collar T or other enlargements thereof, as the tubing T is fed with the feeding assemblies of this invention.

Referring now to FIGS. 3 and 5, it can be seen that the rollers 70 engage the roller blocks 22 but do not engage the chain links 29 or the chain pins 21. Thus, a lateral gripping force is imparted to the gripping members 23 through the blocks 22 without transmitting the lateral load to the endless chain E. The endless chain
E therefore is loaded only in a vertical direction by the weight of the tubing T or other object being fed by the apparatus A.

The gripping units, each of which includes a gripping element 22 and a pair of roller blocks 22, are secured to the flanges 20a of the links 20 by screws 75 (FIG. 3) or other suitable attaching means. In order to permit the localized flexing of the gripping units due to enlargements of increased size or diameters passing through the assemblies, the gripping units are movably mounted in the channel E so that there is a space therebetween. Preferably, the roller blocks 22 have a portion of greater width to provide pivot contact areas or points 22a on each side thereof for contact with similar points or areas on adjacent roller blocks. Such contact points 22a are at the widest portion of each gripping unit and facilitate a pivoting in the vicinity of such contact points or areas. Also, it is to be noted that each chain pivot pin 21 preferably has its central axis in alignment with a plane passing through adjacent contact points 22a (see FIG. 7 wherein a few of the pivot pins 21 are shown in dotted lines). Stated differently, the central axis of each of the chain link pins 21 is intersected by a plane passing between the adjacent gripping members 22.

Each of the roller blocks 22 has an inner surface 22b which is contacted by the rollers 70. Preferably, each surface 22b of the gripping units passes through the reach (R-1 for assembly F-1 and R-2 for assembly F-2) are in the same plane and are disposed to form a substantially continuous surface for the rollers 70 even when locally flexed. Also, the surfaces 22b preferably lie in the same plane as the pivot or contact points 22a. An upstanding ridge or rib 22c is also provided with each of the roller blocks 22 for preventing any lateral shifting of the gripping units as they move relative to the rollers 70.

In the operation or use of the apparatus A of this invention it is normally positioned as shown in FIG. 1 at the upper end of a well, normally above the load indicator X as indicated in FIG. 1. The tubing T is fed through the apparatus A from any suitable source of supply such as a large drum (not shown). Such tubing T may have a wear tool on its lower end which is inserted in the known manner into a lubricator or the control device C. If no wear tool is provided at the lower end of the tubing T, a one-way check valve is usually used to permit the injection of fluid through the tubing into the well for preventing the escape of the well pressure through the tubing. It will be understood of course that a wire line, cable or other elongate objects are also adapted to be used in the apparatus A of this invention.

The endless driving or feeding assemblies F-1 and F-2 are operated by any suitable power source such as a motor which drives the gears 28 and 27 to thus drive the sprocket 25, as previously explained. The driving of the sprocket 25 imparts movement to the endless chain E comprised of the links 20 and the gripping units thereon. The tubing T is gripped by the gripping members 23 as they move through the vertically extending reach portions R-1 and R-2.

The assemblies F-1 and F-2 may be initially separated or spread apart from each other by using the hydraulic system of this invention illustrated. In this system, the piston 53 is moved upwardly to pivot the control arms 45 and cause a rotation of the main pivot shafts 41. Such movement, as previously explained cause a lateral shifting of the side plates 26 and the assemblies F-1 and F-2 therewith away from each other to increase the space between the reaches R-1 and R-2. The tubing T or other element to be fed by the assemblies may then be easily positioned between the assemblies. By then reversing the hydraulic system to lower the piston 53, the assemblies F-1 and F-2 may be brought towards each other to bring the gripping elements 23 of each of the assemblies into contact throughout the extent of their reaches R-1 and R-2.

With the tubing T thus positioned for feeding, the sprocket 25 may be rotated, with the sprocket 25 of the assembly F-1 being rotated in a clockwise direction and the sprocket 25 of the assembly F-2 being rotated in a counterclockwise direction for a downward feeding of the tubing T into the well or other area.

When the well is under extremely high pressure, or sufficient pressure to resist the insertion of the tubing T or other object into the well, the gripping action with the assemblies F-1 and F-2 is insufficient and the feeding is accomplished with sufficient downward force by reason of the particular construction of the assemblies so as to overcome the well pressure in the well tending to urge the tubing T upwardly. Such increased pressure is accomplished by the hydraulic system which is shown in particular in FIG. 6 and which directs the fluid inside of the piston 53a to cause it to move downwardly. The downward movement of the piston 53a is transmitted through the control arms 45 to the load support links 46 to cause an inward movement of the plates 25 of the assemblies F-1 and F-2 towards each other so as to provide an extremely powerful gripping action and gripping force which forces the tubing T downwardly in opposition to the well pressure tending to urge same upwardly and out of the well.

The pressure is maintained on the pipe T as it is fed into the well, but gradually, the weight of the tubing T increases as the load support links 46 increases so that less hydraulic force on the piston 53a is required until the weight of the pipe T is great enough to overcome the force of the well pressure tending to move the tubing T upwardly. When such condition occurs, the assemblies A then perform the function of supporting the tubing T and preventing it from falling into the well. The apparatus A of this invention is self-loading in that the increased weight of the tubing T or other object being fed causes the gripping assemblies F-1 and F-2 to move towards each other to increase the gripping action as the weight of the load supported by the assemblies increases. Such inward movement occurs because the load support links 46 extend upwardly and inwardly and tend to rock downwardly as the load of the pipe T increases. The balance links 50 keep the reaches R-1 and R-2 substantially vertical at all times as they are shifting inwardly and outwardly.

The backup mechanisms B-1 and B-2 provide for local flexing in the event a tubing collar T' or other enlargement passes between the reaches R-1 and R-2, as previously explained. Also, if the enlargement is sufficiently greater, this invention is substantially prevented. In each of the assemblies F-1 and F-2, the spring 35 of the eccentric tightening means 32 is compressed to prevent any breakage or damage to the chain.

When it is desired to remove the tubing T from the well, the direction of movement of the sprockets 25 is reversed so that the sprocket 25 with the assembly F-1 is rotated in a counterclockwise direction while the sprocket 25 on the assembly F-2 is rotated in a clockwise direction. Again, as the tubing T is being pulled out of the well and the weight of the tubing T is sufficient to overcome the pressure in the well, the self-loading feature previously described maintains a secure gripping force on the tubing T in accordance with the amount of weight of the tubing suspended therefrom. When the tubing T reaches a point at which the well pressure is tending to force the tubing T upwardly, the hydraulic system may be used to apply some hydraulic force to the piston 53 downwardly in opposition to the tubing T. In any event, the removal of the tubing T may be controlled by controlling the amount of the hydraulic pressure applied to the piston 53 in either direction. When the tubing T has been completely removed, the assemblies F-1 and F-2 may be separated by applying fluid pressure inwardly through the inlet tube 54b to the cylinder 54 to cause the piston 53a to move upwardly to open the space.
between the reaches R-1 and R-2 as widely as permitted by the pivotal movement of the load support links 46. Although the tubing T may be fed inwardly through the opening 39c of the support frame plate 39, it may also be inserted and removed from the area between the reaches R-1 and R-2 laterally by providing a removable gate 36 which is detachably mounted on the vertical risers 38 with removable pins 36d.

Although the invention has been described with both of the back-up mechanisms B-1 and B-2 movably mounted on the shafts 41, it will be understood that only one of such mechanisms B-1 and B-2 may be movable, so long as there is relative movement of such mechanisms towards and away from each other. Also, it will be appreciated that a pair of endless chains B may be used for each row of the gripping members 23 and with a single row of the rollers 70 between such chains so that a reversal of the illustrated construction is provided.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof and various changes in the size, shape and materials, as well as the details of the illustrated construction, may be made within the scope of the appended claims without departing from the spirit of the invention.

What is claimed is:

1. An endless feeding assembly for use in feeding tubing, cables and the like, comprising:
   (a) an endless flexible element having a plurality of gripping members mounted thereon for movement therewith,
   (b) drive means for driving said element,
   (c) said element having a longitudinally extending reach wherein said gripping members are adapted to engage a tubing, cable or the like,
   (d) backup means adapted to engage at least some of said gripping members within the extent of said reach for limiting lateral movement of said members when gripping a tubing, cable or the like but being adapted for localized flexing when an enlargement engages gripping members in said reach, and
   (e) said backup means including:
      (1) a pivotally mounted support bar,
      (2) a first group of pairs of rollers pivotally attached to said support bar,
      (3) a second group of pairs of rollers pivotally attached to the other end of said support bar, and
      (4) said first group and said second group each including
         a link arm pivotally connected to said support bar,
         a single set of rollers pivotally mounted on an outer section of said link arm,
         two pairs of roller sets pivotally mounted on an inner section of said link arm, and
         said pairs of rollers being in engagement with the rear surfaces of some of said gripping members in said reach.

2. A feeding apparatus for feeding tubing, cables and the like, comprising:
   (a) a support frame,
   (b) a pair of endless feeding assemblies,
   (c) a pair of sprockets for each of said endless feeding assemblies,
   (d) a mounting plate for one of the pairs of sprockets and having an opening therethrough,
   (e) a first pivot pin pivotally mounted in said support frame and extending through said opening in the mounting plate,
   (f) a load support link secured to said pivot pin and pivotable therewith,
   (g) a second pivot pin pivotally connected to said mounting plate and said load support link for laterally moving said mounting plate in response to pivotal movements of said load support link, and
   (h) power means operably connected to said first pivot pin for causing a pivoting thereof and a resultant lateral movement of the mounting plate and the endless feeding assembly therewith.

3. A feeding apparatus for feeding tubing, cables and the like, comprising:
   (a) a support frame,
   (b) a pair of endless feeding assemblies,
   (c) a pair of sprockets for each of said endless feeding assemblies,
   (d) a mounting plate for one of the pairs of sprockets and having an opening therethrough,
   (e) a first pivot pin pivotally mounted in said support frame and extending through said opening in the mounting plate,
   (f) a load support link secured to said pivot pin and pivotable therewith,
   (g) a second pivot pin pivotally connected to said mounting plate and said load support link for laterally moving said mounting plate in response to pivotal movements of said load support link, and
   (h) power means operably connected to both of said first pivot pins for causing co-ordinated pivoting thereof and resultant lateral movements of the
mounting plates and endless feeding assemblies therewith.

6. A feeding apparatus for feeding tubing, cables and the like, comprising:
(a) a pair of endless feeding assemblies each of which has a reach opposite to the reach on the other feeding assembly for feeding tubing, cable or the like therebetween and a back-up mechanism for each reach,
(b) support means for each of said feeding assemblies,
(c) pivotal mounting means mounting at least one of said support means for the movement of the support means and the entire endless assembly therewith laterally with respect to the other assembly for decreasing the width of the space between said reaches in response to an increase in the weight of the tubing, cable or the like supported by said assemblies, and
(d) means for maintaining the opposite reaches on said endless feeding assemblies parallel to each other at all times as they are moved laterally to decrease the width of the space therebetween.

7. A feeding apparatus for feeding tubing, cables and the like, comprising:
(a) a pair of endless feeding assemblies each of which has a reach opposite to the reach on the other feeding assembly for feeding tubing, cable or the like therebetween and a back-up mechanism for each reach,
(b) support means for each of said feeding assemblies,
(c) pivotal mounting means mounting each of said support means for the movement of the support means and the endless assembly therewith laterally with respect to each other for decreasing or increasing the width of the space between said reaches, and
(d) means for maintaining the opposite reaches on said endless feeding assemblies parallel to each other at all times as they are moved laterally towards and away from each other.

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