United States Patent

Otani et al.

[15] **3,695,526**

[45] **Oct. 3, 1972**

[54] **APPARATUS FOR CONTINUOUSLY WINDING UP LINEAR PRODUCTS SUCH AS WIRE**

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[73] Assignee: **Kobe Steel, Ltd.**, Kobe-shi, Japan

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March 22, 1969 Japan 44/25688

[52] **U.S. Cl.** .....**242/25 A**

[51] **Int. Cl.** **B65h 54/00**

[58] **Field of Search**.....242/25, 18, 18 PW, 18 EW

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Primary Examiner—Stanley N. Gilreath

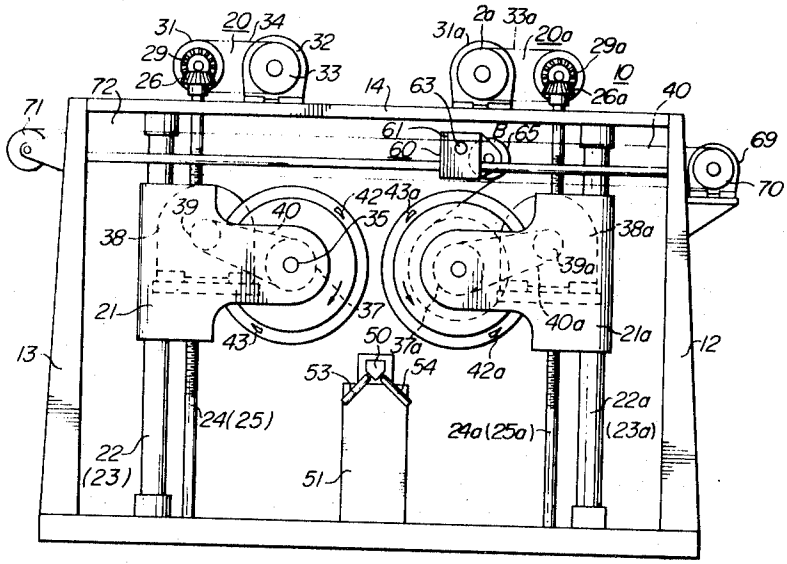
Assistant Examiner—Milton Gerstein

Attorney—John J. Byrne

[57] **ABSTRACT**

A wire take-up apparatus having a pair of reel supporting frames operable in such a manner that one of the frames is moved to its lowermost position when a reel thereon is substantially full of the wire while the other frame is moved upwardly with an empty reel thereon. A wire guiding sheeve is shifted to its axially endmost position above one ends of the reels when one of the reels becomes full of the wire and a wire shifting bar is simultaneously moved axially of the reels for causing the wire to be engaged and arrested on the empty reel by a claw on a rotatable disc provided adjacent said one end of the empty reel whereby the wire is transferred from the full reel to the empty one.

13 Claims, 23 Drawing Figures



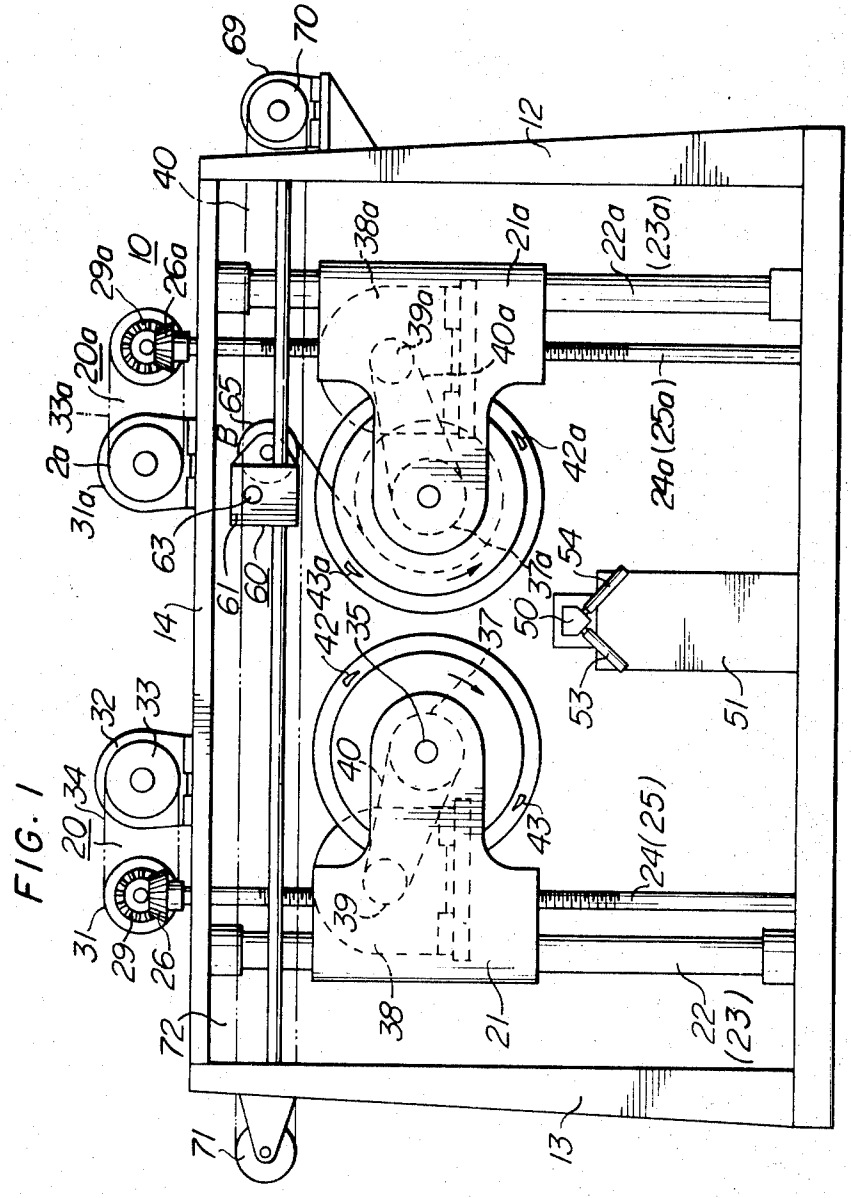

69
70
12
40
10
290
260
380
210
220
(230)
390
400
200
330
65
420
240 (250)
20
310
63
61
60
430
54
316
50
14
42
35
37
53
51
32
33
40
20
34
43
24(25)
31
29
26
39
38
21
22
(23)
72
71
13

FIG. 1

FIG. 2

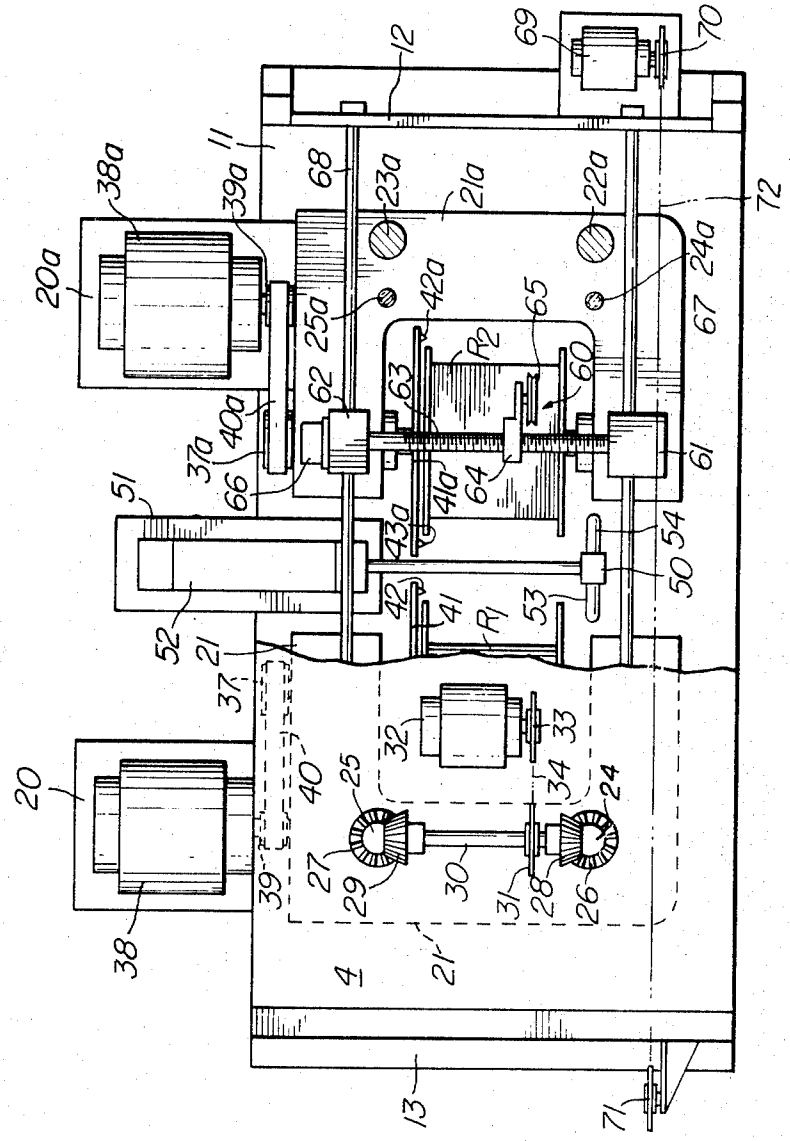

12
69
70
11
38a
39a
68
23a
21a
22a
72
20a
24a
42a
25a
65
67
62
63
60
40a
37a
61
66
64
41a
51
43a
54
50
42
41
53
52
21
37
32
33
20
40
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34
24
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27
29
30
31
28
26
38
4
21'
13
71

FIG. 3

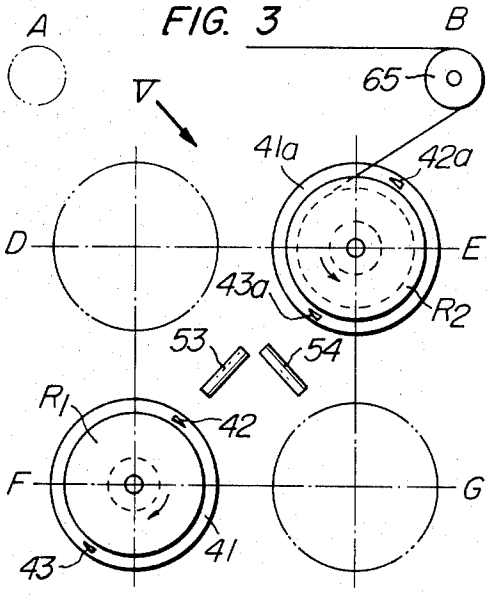


FIG. 4

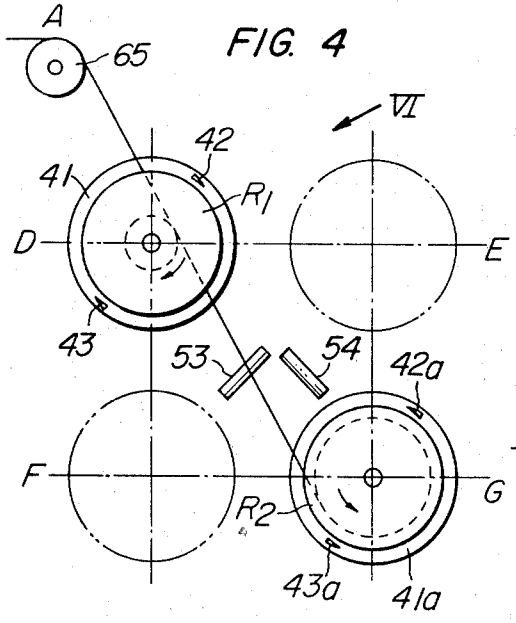


FIG. 5

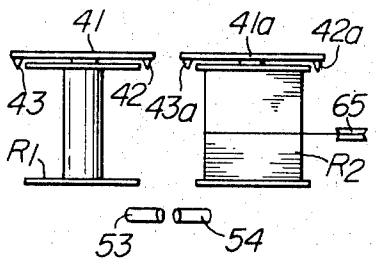


FIG. 6

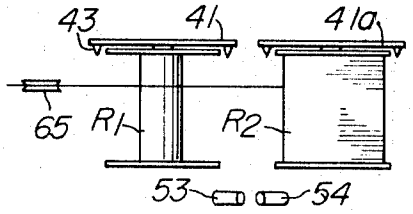


FIG. 7

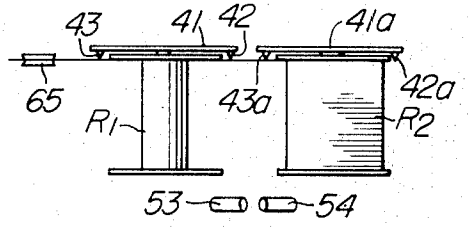
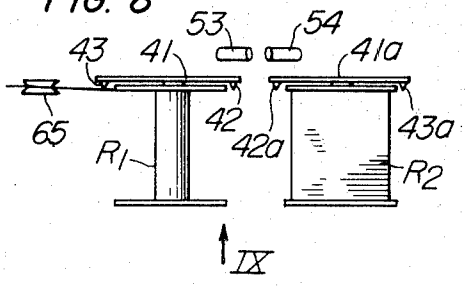


FIG. 8



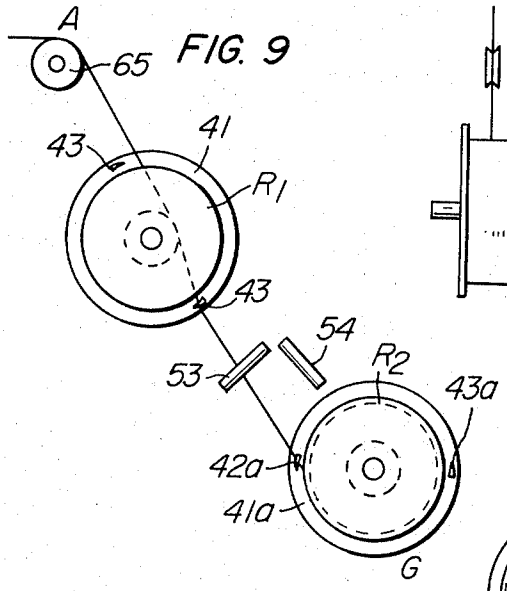


FIG. 9

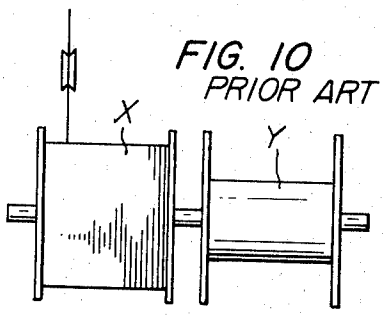


FIG. 10
PRIOR ART

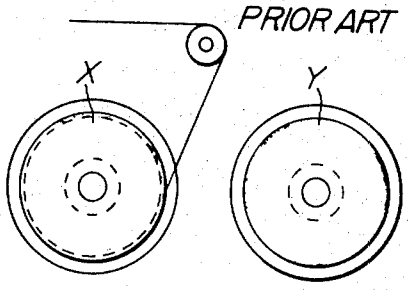


FIG. 11
PRIOR ART

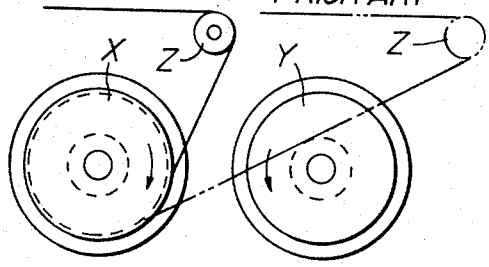


FIG. 12 PRIOR ART

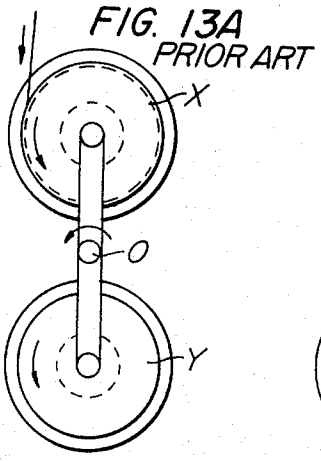


FIG. 13A
PRIOR ART

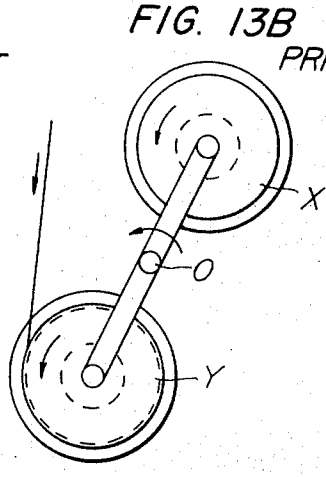


FIG. 13B
PRIOR ART

FIG. 14
PRIORART

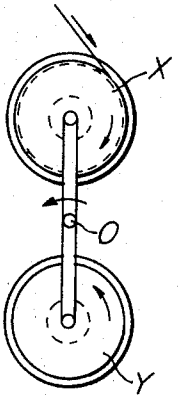


FIG. 14a
PRIORART

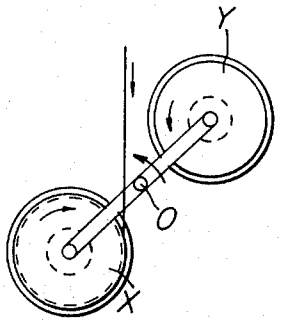


FIG. 14b
PRIORART

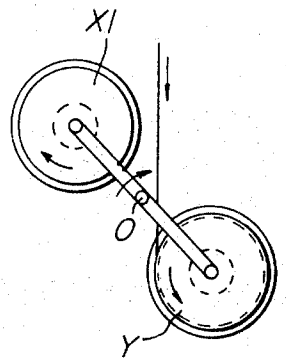
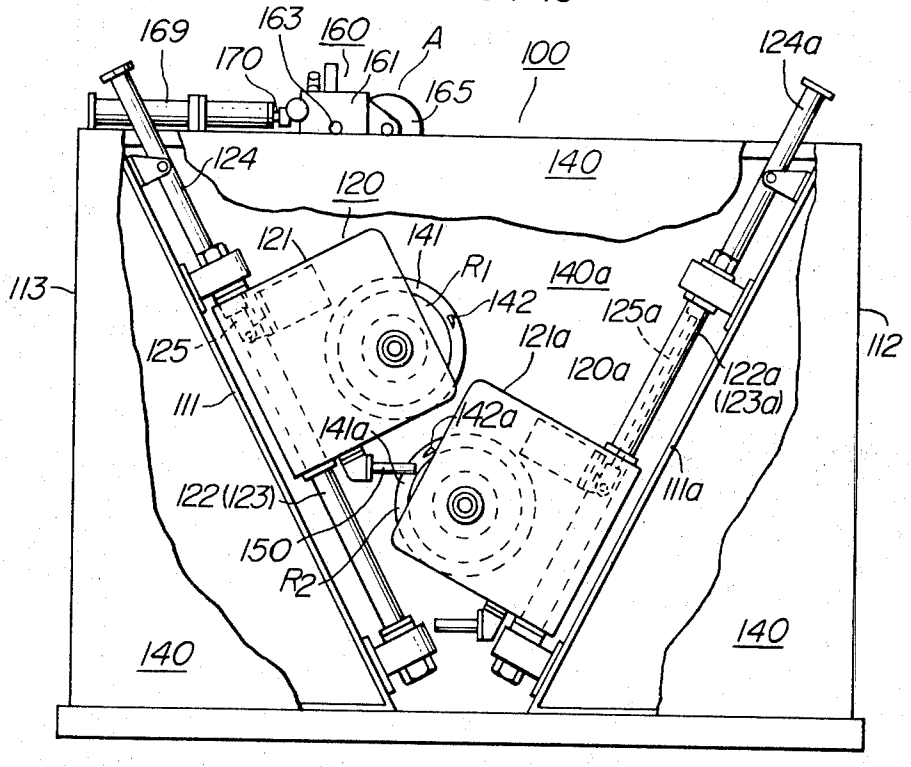


FIG. 15



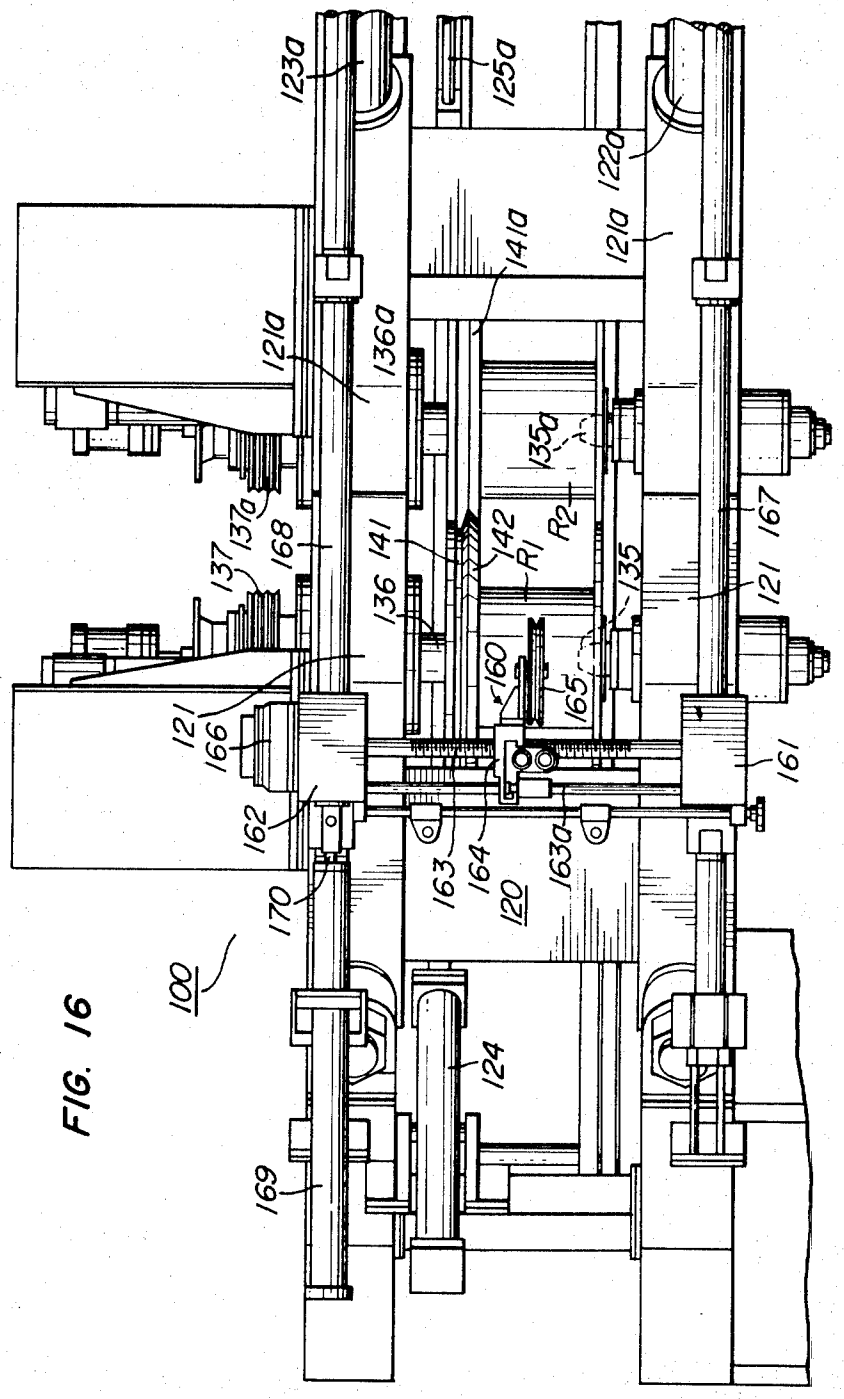

123a
125a
122a
121a
141a
136a
135a
137a
137
168
141
142
R1
R2
135
167
121
136
160
165
121
166
161
162
163
164
163a
120
170
100
124
169

FIG. 16

FIG. 17A

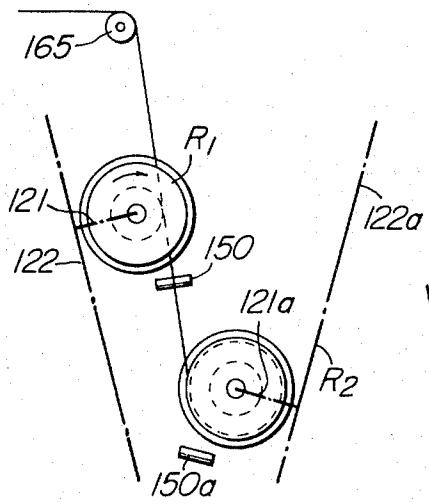


FIG. 18

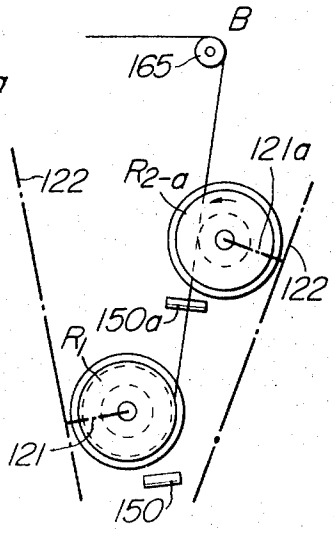


FIG. 19

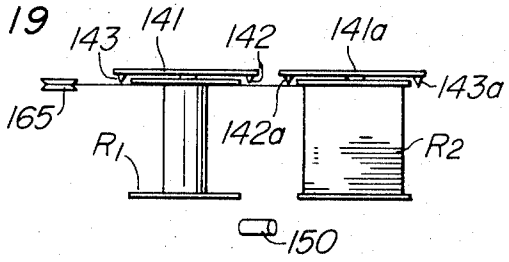
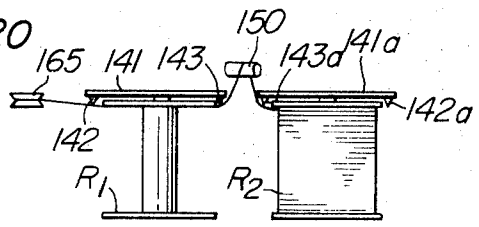


FIG. 20



APPARATUS FOR CONTINUOUSLY WINDING UP LINEAR PRODUCTS SUCH AS WIRE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to an apparatus for continuously winding up linear products such as wire and, particularly, to a mechanism for transferring such linear product being taken-up on a reel to another empty one.

2. Description of Prior Art

In this kind of apparatus, it is well known that more than two reels are mounted on the apparatus (a wire take-up machine utilizes two reels in general) and, when one of the reels becomes full of the linear product, the product is transferred from the one feel to another empty one so that the delivery of the product is not stopped but the latter is continuously taken-up on reels. It is important that the transfer mechanism is capable of transferring the linear product from a full reel to another empty one without any possibility of breakage of the product. In order to satisfy this requirement, there have been proposed transfer mechanisms for use with the machines of this kind. In one of such prior art transfer mechanisms, reels are mounted for rotation about a single and common axis in side by side relationship to one another. This kind of transfer mechanism is not suited for high speed take-up operation and currently is not utilized for this purpose. In another kind of prior art transfer mechanism, reels are mounted on separate parallel shafts supported on a frame which is adapted to be either rotated or swung together with the reels thereon when one of the reels is substantially full of the linear product so as to bring the periphery of the reel take-up drum of another empty reel into slinding contact with the running product whereby the latter is arrested on the empty reel by an appropriate engaging and arresting means for thereby carrying out a transfer of the linear product from the full reel to the empty one. This kind of prior art transfer mechanism is applicable to a high speed take-up operation and provides advantages to some extent on one hand but is accompanied with some drawbacks on the other hand. Particularly, rotational or swinging movement of the reel supporting frame of the transfer mechanism of this kind requires not only a large-sized mechanical arrangement but also complicated drive mechanisms therefor. In addition, substantial space is needed to allow the reel supporting frame to be rotated or swung together with reels of considerable weight and bulkness.

SUMMARY OF THE INVENTION

It is a primary object of the present invention to provide an improved apparatus for continuously winding up linear product which is free from any of the above-mentioned prior art drawbacks.

It is another object of the present invention to provide a continuous take-up apparatus of the above-mentioned class and in which reels are mounted on frames which are supported for rectilinear reciprocal movements in such a manner that one of the reel supporting frames is moved down to its lowermost position when the reel on the one frame is substantially full of the linear product while the other reel supporting frame is moved upwardly to its upper-most position with an empty reel mounted thereon.

It is a further object of the present invention to provide an apparatus for continuously winding up a linear product which comprises a pair of frame members for supporting take-up reels for rotation about parallel axes, respectively, drive means for rotating reels on said frame members, said drive means being mounted on said reel supporting frame members for movement therewith, shaft members supporting and guiding said frame members for upward and downward sliding movements thereon, respectively, power means for moving said frame members along said shaft members in such a manner that one of said frame members is moved downwardly to its lowermost position when a working reel on said one frame member becomes substantially full of said linear product while the other frame member is moved upwardly to its upper most position with an empty reel mounted thereon, means for guiding said linear product from its delivery position to said working reel, said product guiding means being movable in a plane above said reel supporting frame members in two directions parallel and perpendicular to said axes of rotation of reels, second power means for moving said product guiding means in a direction perpendicular to said axes, third power means for moving said product guiding means in a direction parallel to said axes, said product guiding means being adapted to be moved axially of the reels to a position substantially above one end of the reels when the working reel becomes substantially full of said product, means below said reel supporting frame members for shifting said linear product axially beyond said one ends of the reels, disc members on said frame members adjacent said one ends of the reels, respectively, said disc members being rotatable with the reels and having thereon means for engaging the thus shifted linear product and arresting same on the empty reel to thereby transfer said linear product from the full reel to the empty one.

Each of the frame members is preferably of a generally U-shaped structure to provide a pair of legs or side walls between which a reel is supported for rotation. The shaft members for supporting and guiding the U-shaped frame structures may preferably extend either vertically or obliquely within a box-like housing or machine frame of the apparatus. The first power means may be either electric motors and associated drive mechanisms for converting the torque of the motors into rectilinear force to move the frame members up and down, or fluid-actuated piston and cylinder assemblies for directly transmit pressurized fluid force to the frame members for the linear movements thereof. The second power means may be either a motor and chain drive mechanism having a run of the chain directly secured to the linear product guiding means, or a fluid-actuated cylinder and piston assembly having a piston rod operatively connected to the product guiding means. The third power means may preferably be a servo-motor mounted on the product guiding means. The linear product shifting means may preferably include fluid-actuated power means for moving the shifting means along a linear path. The means on the disc members may preferably be claws mounted on the inner surfaces of the discs so as to engage the linear product when it is shifted by said shifting means axially beyond one ends of the reels and to arrest or hold down the thus shifted product on an empty reel for thereby

transfer the linear product from a full reel to the empty one while the product is continuously advanced.

The above and other objects and features of the present invention will become more apparent from the following detailed description with reference to the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view of the wire take-up apparatus according to a first embodiment of the present invention;

FIG. **2** is a plan vie of the apparatus shown in FIG. **1** with a part of the top thereof being cut away to show a part of the inner construction of the apparatus;

FIGS. **3** through **9**, inclusive, are schematical illustrations of the operation of the apparatus in FIG. **1**, and in which;

FIG. **3** schematically illustrates the arrangement of wire take-up reels, clawed discs, wire shifter and wire guiding sheave when the wire is being wound-up on one of the reels and the sheave is in a working position,

FIG. **4** is a view similar to FIG. **3** but illustrates the arrangement of the components when the one reel is almost full of the wire and the wire guiding sheave has been moved to a different working position for the preparation of the transfer of the wire from the one reel to the other,

FIG. **5** is a schematic illustration of the arrangement of the components as viewed in a direction indicated by an arrow V in FIG. **3**,

FIG. **6** is a view similar to FIG. **5** but illustrates the arrangement of the components as viewed in another direction indicated by an arrow VI in FIG. **4**,

FIG. **7** is a view similar to FIG. **6** but illustrates the wire guiding sheave which has been moved to a position which is in a vertical plane substantially the same as that of one ends of the reels,

FIG. **8** is a view similar to FIG. **7** but illustrates the wire shifter which has been moved axially beyond said one ends of the reels, and

FIG. **9** is a view similar to FIG. **4** but illustrates the reels and the associated discs which have been further rotated and one of the claws on the disc for said the other reel engaging the wire which is still being wound-up on said one reel;

FIGS. **10** through **14B**, inclusive, schematically illustrate the arrangements and operations of reels and associated components employed in prior art wire take-up machines;

FIG. **15** is a side elevation of the wire take-up apparatus according to another embodiment of the present invention with a part being cut away to show inner construction thereof;

FIG. **16** is an enlarged top plan view of the apparatus shown in FIG. **15** with a part being broken away;

FIGS. **17** through **20**, inclusive, schematically illustrate the operation of the apparatus shown in FIG. **15**, and in which;

FIG. **17** schematically illustrates the arrangement of wire take-up reels, wire shifting bars and wire guiding sheave when the wire is being wound-up on one of the reels and the sheave is in a working position,

FIG. **18** is a view similar to FIG. **17** but schematically illustrates the arrangement of the components when the wire is being taken up by the other of the reels and the sheave is in a different or second working position, the empty reel shown being a newly loaded one,

FIG. **19** is a schematical illustration as taken substantially in a direction indicated by an arrow XIX, the wire guiding sheave being in operation at an axially endmost position, and

FIG. **20** is a view similar to FIG. **19** but illustrates the wire shifting bar which has been moved to its axially endmost position beyond one ends of the wire take-up reels.

DESCRIPTION OF PREFERRED EMBODIMENTS

The present invention will be described hereinunder in connection with preferred embodiments which are directed to wire take-up apparatuses. It is, however, to be understood that the application of the invention will not limited to take-up of wire.

Referring first to FIGS. **1** through **9** of the drawings and, particularly, to FIGS. **1** and **2** thereof, there is illustrated a wire take-up apparatus according to a first embodiment of the present invention. The apparatus is indicated generally at **10** and comprises a generally rectangular box-like frame structure having a base **11**, upright end walls **12** and **13** extending upwardly from the base and a top **14**. The apparatus has a pair of symmetrically arranged wire take-up units **20** and **20***a* mounted in the box-like structure.

The wire take-up units **20** and **20***a* are of identical construction. Thus, a description will be made with reference to one of the units **20** only, but a clear understanding may be obtained from the illustration in the drawings of both of the units **20** and **20***a*. The components of the unit **20***a* are represented by numerals the same as those for the corresponding components of the other unit **20** and followed by a character *a*.

The wire take-up unit **20** includes a substantially U-shaped frame **21** which has a pair of side walls or legs of U extending inwardly and which is slidably mounted at the bottom of U on a pair of upright guide shafts **22** and **23** which are rigidly secured at the opposite ends to the bottom **11** and top **14** of the box-like frame structure. A pair of externally threaded shafts **24** and **25** are rotatably mounted at lower ends on the base **14** and extend through holes (not shown) in the frame **21** in the bottom of U. The holes in the frame **21** have inner screw threads which are in meshing engagement with the external threads on the shafts **24** and **25**. The shafts **24** and **25** further extend through the top **14** and have bevel gears **26** and **27**, respectively. The bevel gears are in meshing engagement with bevel gears **28** and **29**, respectively, which are interconnected together by a shaft **30** rotatably mounted on the top **14**. The shaft **30** has rigidly mounted thereon a sprocket wheel **31**. Also mounted on top **14** is a reversible motor **32** whose output shaft has thereon a second sprocket wheel **33** which is drivingly connected by a drive chain **34** with the first sprocket wheel **31**. The arrangement is such that when the motor **32** is energized to rotate in a direction, the U-shaped frame structure is moved upwardly and vice-versa.

The U-shaped frame structure has a pair of relatively shorter shaft **35** and **36** in the opposite side walls or legs of the U-frame for supporting a wire take-up reel **R1** therebetween. The shaft **35** is retractable outwardly by any conventional power means such as fluid-operated

cylinder and piston assembly mounted on the side wall of the U-frame associated with the shaft **35**. The purpose for this is to facilitate taking-off or unloading of the reel R1 when it is full of wire. The other shaft **36** rotatable extends through the associated side wall of the U-frame **21** and has its outer end rigidly connected with a pulley **37**. A motor **38** is mounted on the U-frame at the side adjacent the shaft **36** so that the motor is movable up and down together with the frame **21**. The output shaft of the motor **38** has connected thereto a second pulley **39** which is drivingly connected by a belt **40** with the above-mentioned pulley **37** on the shaft **36**. The inner end portion of the shaft **36** is so shaped as to transmit the drive force from the motor **38** to the reel R1.

The shaft **36** has rigidly secured thereto a disc **41** adjacent a near end or a flange of the reel R1. The disc has a pair of claws **42** and **43** provided on the inner surface adjacent the periphery thereof.

The wire take-up unit **20***a* is illustrated as carrying thereon another reel R2.

Between the opposite wire take-up units **20** and **20***a*, is provided a wire shifter **50** mounted on a support **51**. The wire shifter includes a fluid-operated cylinder and piston assembly **52** and a pair of wire shifting bars **53** and **54** extending downwardly and outwardly from the forward end of the piston of the assembly **52**. The assembly is adapted to be actuated, when required, to move the wire shifting bars **53** and **54** along paths parallel with the axes of rotation of the reels R1 and R2.

Traverse means, indicated generally at **60**, are disposed beneath the top **14** of the box-like machine frame for movements in a horizontal plane above the reels R1 and R2. The traverse means **60** includes a pair of blocks or housing **61** and **62** through which opposite ends of an externally threaded shaft **63** rotatably extends. A traverser **64** is slidably supported on a traverser guide bar (not appearing in the drawings) secured at the opposite ends to the housings **61** and **62**. The traverser **64** has formed therein a hole which is formed with an internal screw thread which engages the external screw threads on the shaft **63**. The traverser **64** has a stud on which a wire guiding sheave **65** is rotatably mounted to guide the wire from its delivery position to a working reel. The threaded shaft **63** is adapted to be driven, during winding, by any conventional drive means such as reversible servo motor **66** so as to shift or move the traverser **64** and the sheave **65** in a direction parallel to the axes of rotation of the reels R1 and R2.

The blocks **61** and **62** are mounted for movement on a pair of horizantal bars **67** and **68** extending between the opposite upright end walls **12** and **13** of the box-like machine frame. A stepless variable speed motor **69** having a sprocket wheel **70** fixed to the output shaft of the motor is mounted on one of the end walls **12** at substantially the same vertical position as the housing **61** of the traverse means **60**. Another sprocket wheel **71** is mounted on the other of the end walls **13** of the machine frame. A drive chain **72** runs around the sprocket wheels **70** and **71**. The chain **72** has its upper run secured to the housing **61** of the traverse means **60** so that the housing **61** is moved leftwards together with the components **62**, **63**, **64**, **65** and **66** to a broken line position (A) from the solid line position (B) in FIG. **1** when the motor **69** is energized to rotate in counterclockwise direction as viewed in FIG. **1**.

Then, a description will be made with respect to the operation of the wire take-up apparatus of the present invention. FIG. **3** schematically illustrates the arrangement of reels R1 and R2, associated discs **41** and **41***a*, wire guiding sheave **65** and wire shifting bars **53** and **54** when the wire is being wound-up on a reel R2. As will be seen in this figure, the reel R2 is working at an elevated position E and the wire guiding sheave **65** is in the position B and the reel R1 is an empty one newly prepared or loaded on the wire take-up unit **20** at a lowered position F. This position of the members is viewed in a direction generally indicated by an arrow V and schematically illustrated in FIG. **5**. Assume that the reel R2 has become substantially or almost full of the wire and it is required to change-over the wire from the reel R2 to the new empty reel R1. The latter is driven to start rotation by the motor **38** and the associated drive connections. The peripheral speed of the wire take-up drum of the reel R1 is gradually increased to conform with the linear speed of the wire being taken up by the reel R2. At the same time, the wire guiding sheave **65** is moved by the motor **69** and the associated drive members **70**, **71** and **72** and the housing **61** in a direction perpendicular to the axes of rotation of the reels from the position B to the position A. Furthermore, the reel supporting U-frame **21** is elevated by the operation of the motor **32** and the associated drive mechanism to lift the empty reel R1 from the lowered position F to an elevated position D while the reel supporting U-frame **21***a* for the reel R2 is lowered by the operation of the motor **38***a* and the associated drive mechanism from the position E to a position G, as shown in FIG. **4**. In this position of the apparatus, the wire is advanced in contact with the periphery of the wire take-up drum of the empty reel R1 and is still being wound-up on the reel R2. This position of the related components is viewed in a direction generally indicated by an arrow VI in FIG. **4** and schematically illustrated in FIG. **6**. When the reel R2 has become completely full of the wire, or in other words, when the turns of the wire wound-up on the reel R2 has become reached by a predetermined amount of the capacity of this reel, the servo motor **66** of the traverse means **60** through suitable control means interrupts its regular traversing motion to quickly to move the wire guiding sheave **65**, regardless of its position when the reel reaches capacity, to the position shown in FIG. **7**, which is in a vertical plane close to that in which the clawed discs **41** and **41***a* extend. When this movement of the wire guiding sheave **65** is completed, the fluid-operated cylinder and piston assembly **51** of the wire shifter **50** is energized to move the wire shifting bars **53** and **54** in a direction parallel to the axes of rotation of the reels from the position shown in FIGS. **2**, **5**, **6** and **7** to a position shown in FIG. **8** so that one of the wire shifting bars **53** shifts or biasses the wire axially beyond the clawed discs **41** and **41***a*, with the result that one of the claws **42** on the disc **41** for the reel R1 engages the wire and arrests it on the wire take-up drum of this reel, as shown in FIG. **9**. Then, the wire is cut between the reels R1 and R2 and the cut end of the wire arrested on the disc **41** enables further continuous length of the wire to

be wound up on the new reel R1. The full reel R2 is taken off the U-frame 21*a* at the lowered position G and a new empty reel is mounted on this frame. The operation may be further continued in a similar manner.

In order that the advantages of the above-described wire take-up apparatus of the present invention may be clearly understood, a brief description will be made hereunder with respect to kinds of the arrangements and operations of reels and associated mechancal components employed in prior art wire take-up machines. The reel arrangements of prior art machines of this kind are briefly classified into two kinds in one of which a pair of reels X and Y are mounted on a common shaft as shown in FIG. **10**. In the other kind, two reels X and Y are mounted on two parallel shafts, respectively, as shown in FIG. **11**. The second kind of the reel arrangement is suited for wire winding-up operation at a high speed (about 1,000 meters/minute) because, in this kind of reel arrangement, a wire breakage due to difference in peripheral speeds of take-up drums of reels during transfer of wire from one reel to another is less liable to take place as compared with the first mentioned reel arrangement shown in FIG. **10**. The second kind, therefore, is more employed today. The wire take-up machines employing the second kind reel arrangement are further classified into two types in terms of the manners in which wire transfer mechanisms operate. In a first type, reels X and Y are rotated at fixed positions during wire transfer and a wire traverser is moved to transfer the wire from a full reel (X) to empty one (Y), as shown in FIG. **12**. In a second type, reels X and Y are mounted on parallel shafts which are secured together by a straight frame which is pivotally or rotatably supported at a central point of the length of the frame. The second type is further divided into two styles. In a first style, reels X and Y are mounted for rotation in the same direction as shown in FIG. **13** and, when it is required to transfer the wire from a full reel (X) to another empty one (Y), the frame is rotated about the pivot point (O) for substantially **180** degrees, as shown in FIG. 13A, to bring the periphery of the wire rotated drum of the empty reel (Y) into contact wit the running wire. The frame will be further rotated for additional 180° for a further transfer of the wire when the reel (Y) is full of the wire. This style, therefore, may be called as a "rotatable frame style." In a second style, reels X and Y are mounted for rotation in opposite directions as shown in FIG. **14** and, when such wire transfer is required, the frame is swung about the pivot point (O) in one direction to bring the periphery of the wire take-up drum of an empty reel (Y) into contact with the running wire as shown in FIG. 14A. In a next transfer of the wire from the reel (Y) to a further empty reel (XI), the frame will be swung in the reversed direction to bring the periphery of the wire take-up drum of the reel (XI) into contact with the running wire. Thus, the second style may be called as a "swingable frame style."

The prior art wire take-up machines of all of the above-stated types and styles have some advantages on one hand and have some drawbacks on the other hand. Particularly, the machines of the "rotatable frame style" and "swingable frame style" require not only large-sized mechanical structures but also complicated driving mechanisms. In addition, the prior art wire take-up machines of the above-state kinds require substantial spaces within which frames with heavy and bulky reels thereon are to be rotated or swung.

To the contrary, the present invention employs reel supporting frames which are adapted to be moved in rectilinear paths. This makes it possible that wire take-up machines have compact designs and simplified driving mechanisms. In addition, the fact that most of the movable sections of the apparatus of the present invention can assure smooth, cheerful and relatively silent operation of the apparatus. Furthermore, the provision of wire guiding traverse means and wire shifting means which are both capable of being moved axially of wire take-up reels enables the wire being wound-up on one reel to be engaged by a claw on a disc for another reel and arrested on its whereby transfer of the wire from the one reel to the another one may be smoothly carried out.

FIG. **15** and **16** illustrate a wire take-up apparatus according to another or second embodiment of the present invention. The apparatus is generally designated at **100** and comprises a box-like topless housing having two sets of pairs of support structures **111** and **111***a* each having an inwardly and downwardly slanting surface, and walls **112** and **113** and side walls **140** and **140***a*. It will be seen in FIG. **15** that the slanting faces of the two sets of the support structures cooperate together to define a generally V-shaped space within the housing of the apparatus **100**. The side wall **140** is partially cut away to show the inner construction of the apparatus **100**. The latter has a pair of symmetrically arranged wire take-up units **120** and **120***a* mounted within the box-like housing.

The wire take-up unit **120** includes a generally U-shaped frame **121** which has a pair of legs or side wall extending inwardly as will be seen in FIG. **16** and which is slidably mounted at the bottom of U on a pair of inwardly and downwardly slanting oblique guide shafts **122** and **123** rigidly secured at their opposite ends to the pair of slanting support structures **111**. A fluid-actuated cylinder **124** is pivotally mounted on appropriate frame member within the box-like housing above the U-shaped frame **121**. The cylinder **124** has a piston whose piston rod **125** is operatively connected at the free end to a part of the U-frame **121**. It will be appreciated that the cylinder **124**, when hydraulically or pneumatically actuated, will move the U-frame upwardly or downwardly along the slanting guide shafts **122** and **123**.

The U-shaped frame **121** has relatively shorter shafts **135** and **136** mounted in the opposite side walls or legs of the U-frame for supporting thereon a wire take-up reel R1. The shaft **135** can be retracted outwardly by any conventional power means such as a pneumatic cylinder mounted on the associated side wall of the U-frame. The pneumatic cylinder will be actuated by air under pressure from an appropriate pressurized air source not shown so as to retract the shaft **135** from the reel R1 when this reel has completely wound up the thereon so that the reel may be taken off the U-frame **121**. The other shaft **136** rotatably extends through the associated side wall of the U-frame **121** and has its outer end adapted to be driven by conventional motor means which may be either a servo motor directly con-

nected to the outer end of the shaft **136** or an electrical motor which is operatively connected by means of belt or belts to a pulley **137** secured to the outer end of the shaft **136**. The inner end of the shaft **136** is shaped so as to transmit the torque of the motor means to the reel R1 to rotate same together with the shaft **136**.

A disc **141** having thereon a pair of claws **142** and **143** is rigidly mounted on the rotatable shaft **136** between the associated side wall of the frame **121** and an adjacent end of reel mounted thereon. Thus, the disc is rotatable together with the shaft **136** and a mounted reel R1. In the illustrated embodiment, the disc **141** has a generally cup-like shape to receive therein one end of a reel.

On the undersurface of the U-frame **121** is supported a wire shifting bar **150** extending in a direction generally perpendicular to the axis of rotation of the reel mounted on the U-frame **121**. The wire shifting bar **150** is secured at its one end to a piston rod (not shown) of a fluid-actuated cylinder (not shown) provided within the space defined by the pair of side walls of the U-frame **121**.

The wire take-up unit **120***a* is identifical in structure with the above-described wire take-up unit **120**. The structural components of the unit **120***a* are represented by the same numerals as those for the corresponding components of the unit **120** and followed by a character *a*.

The wire take-up apparatus **100** has traverse means generally indicated at **160**. The traverse means **160** are substantially identical with the traverse means **60** of the preceding embodiment with the exception that, instead of the motor and chain drive (**69** – **72**) of the first embodiment, a pneumatic or hydraulic cylinder **169** is employed by the instant embodiment to actuate or move the traverse means **160** in a direction perpendicular to the axes of rotation of the reels on the U-frames **121** and **121***a*. The cylinder **169** has operatively mounted therein a piston whose free end **170** is operatively connected to a part of the traverse means **160** as is in the case of preceding embodiment. It will be appreciated that the cylinder and piston assembly **169**, when actuated by a pressurized fluid, is operably to move the traverse means **160** in a direction perpendicular to the axes of rotation of the reels on the U-frames **121** and **121***a*.

The remaining structural components of the traverse means **160** are represented by numerals **161–168** the same as those for the corresponding elements of the preceding embodiment but added with 100.

As will be appreciated from the comparison of the set of FIGS. **3** to **9** with that of FIGS. **17** to **20**, the apparatus **100** operates in a manner substantially similar to that in which the apparatus **10** of the preceding embodiment operates. In comparison with the apparatus **10** of the first embodiment of the invention, however, the apparatus **100** is more advantages in that its reel supporting U-frames **121** and **121***a* are alternatively moved up and down along inwardly and downwardly inclined substantially V-shaped paths provided by two sets of the slanting guide shafts **122**, **123** and **122***a* and **123***a* so that reel loading and unloading operation for both of the reel supporting U-frames **121** and **121***a* can be carried out substantially at a single or common position. This is particularly important in view of the fact that a full reel is of a considerable weight and, therefore, must be conveyed by means of fixed or installed conveyor means from the unloading position to another place. In addition, since the apparatus **100** employs fluid-actuated cylinders for shifting the rectilinearly movable members, it is assured that the apparatus operates in speedy and relatively quiet manner.

It is to be understood that the elements of this invention are actuated by any suitable conventional electrohydraulic or electromechanical means well known to those skilled in the art. The operation may be manual whereby the operator closes selected electrical switches to shift the sheave **31** and cause actuation of the cylinders **42**, **43** and **44** upon observance of the reel nearing capacity. The operation can easily be rendered automatic by utilizing a suitable detector to determine when a reel is full. For example, a revolution counter may be employed.

What is claimed is:

1. An apparatus for continuously winding up a linear product comprising a pair of frame members for supporting take-up reels for rotation about parallel axes, respectively, drive means for rotating reels on said frame members, said drive means being mounted on said reel supporting frame members for movement therewith, shaft members supporting and guiding said frame members for upward and downward sliding movements thereon, respectively, power means for moving said frame members vertically along said shaft members, a source for said linear product, means for guiding said linear product, from said source to one of said reels, said product guiding means being movable in a plane above said reel supporting frame members in two directions parallel and perpendicular to said axes of rotation of said reels, respectively, second power means for moving said product guiding means in a direction perpendicular to said axes, third power means for moving said product guiding means in a direction parallel to said axes, said product guiding means being adapted to be moved axially of the reels to a position substantially above one end of the reels when said one of said reels becomes substantially full of said product, means between said reel supporting frame members for shifting said linear product axially beyond said one end of the reels, disc members on said frame members adjacent said one end of the reels, respectively, said disc members being rotatable with the reels and having thereon means for engaging the thus shifted linear product and arresting same on the empty reel to thereby transfer said linear product from said one of said reels to the other of said reels.

2. An apparatus as defined in claim **1** in which said shaft members include two sets of substantially vertically extending shafts.

3. An apparatus as defined in claim **1** in which said shaft members include two sets of downwardly and inwardly obliquely extending shafts, the sets of shafts supporting said reel supporting frame members in opposite relationship to one another, the sets of shafts defining therebetween a generally V-shaped space within which said reel supporting frame members are movable up and down along respective sets of shafts.

4. An apparatus as defined in claim **2** in which said first power means include electric motors and drive mechanisms operatively interconnecting said motors

and said reel supporting frame members, said drive mechanisms converting the torque of said motors into rectilinear force by which said frame members are moved up and down.

5. An apparatus as defined in claim 4 in which second power means include an electric motor, an output shaft for said motor, a first sprocket member connected to said output shaft, a second sprocket member remote from said first sprocket member and a chain extending around both sprocket members, said chain having its upper run secured at a portion to said product guiding means.

6. An apparatus as defined in claim 5 in which said product guiding means include horizontal bars extending laterally of said axes of rotation of reels in a plane above said reel supporting frames, a pair of block members slidably mounted on said horizontal bars, an externally threaded shaft having opposite ends rotatably received in said block members, the upper run of said chain being secured to one of said block members, and a traverse member threadably engaging the external threads on last mentioned shaft, said traverse member having a sheave member mounted thereon for free rotation, said sheave member guiding said linear product to a working reel, and in which said third power means comprise a reversible servo motor mounted on the other of said block members, said servo motor being operatively connected to one end of said externally threaded shaft whereby upon rotation of said servo motor said traverse member and said sheave member are shifted along said externally threaded shaft.

7. An apparatus as defined in claim 6 in which said product shifting means include a fluid-actuated piston and cylinder assembly disposed between said reel supporting frame members between said sets of vertically extending shafts, a bar extending generally laterally of said axes of rotation of reels, said assembly having its piston rod connected with said bar.

8. An apparatus as defined in claim 7 in which said linear product engaging means comprises a plurality of claw members mounted on and projecting from said disc members.

9. An apparatus as defined in claim 3 in which said first power means comprise fluid-actuated piston and cylinder assemblies having their piston rods operatively connected at the free ends to said reel supporting frame members, respectively, whereby, upon actuation of said piston and cylinder assemblies, said frame members are caused to move along said obliquely extending sets of shafts.

10. An apparatus as defined in claim 9 in which said second power means comprise a fluid-actuated piston and cylinder assembly having its piston rod operatively connected to said product guiding means.

11. An apparatus as defined in claim 10 in which said product guiding means include horizontal bars extending laterally of said axes of rotation of reels in a plane above said reel supporting frame, slidably mounted on said horizontal bars, an externally threaded shaft having opposite ends rotatably received in said block members, and a traverse member threadably engaging the external threads on last mentioned shaft, said traverse member having a sheave member mounted thereon for free rotation, said sheave member guiding said linear product to one of said reels, and in which said third power means comprise a reversible motor mounted on one of said block members, said motor being operatively connected to one end of said externally threaded shaft whereby upon rotation of said servo motor, said traverse member and said sheave member are shifted along said externally threaded shaft.

12. An apparatus as defined in claim 11 in which said product shifting means include a pair of fluid-actuated piston and cylinder assemblies each mounted on one of said reel supporting members, a bar extending below said one of said reel supporting frame members in a direction generally laterally of said axes of rotation of an associated reel, each of the last said piston and cylinder assemblies having its piston rod connected with said bar.

13. An apparatus as defined in claim 12 in which said linear product engaging means comprises a plurality of claws on said disc members.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,695,526 Dated October 3, 1972

Inventor(s) Yasuhiko Otani and Yoshio Ikegami

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

The identification of the priority documents on which Patent No. 3,695,526 is based should be corrected from:

"March 22, 1969 Japan .....44,25688"

to read:

--March 22, 1969 Japan.....44/25688
September 29, 1969 Japan.....93811/69--

Signed and sealed this 22nd day of January 1974.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents