United States Patent

Otani

[15] **3,693,898**

[45] **Sept. 26, 1972**

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

[72] Inventor: **Yashuhiko Otani,** Kobe, Japan

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

[22] Filed: **March 18, 1970**

[21] Appl. No.: **20,755**

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

[51] **Int. Cl.** **B65h 54/02**

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

[56] **References Cited**

UNITED STATES PATENTS

3,596,844	8/1971	Engmann	242/25 A
3,051,403	8/1962	Johnson	242/25 A

FOREIGN PATENTS OR APPLICATIONS

1,380,550	10/1964	France	242/25 A
948,298	1/1964	Great Britain	242/25 A

Primary Examiner—Stanley N. Gilreath
Assistant Examiner—Milton S. Gerstein
Attorney—John J. Byrne

[57] **ABSTRACT**

A continuous take-up apparatus for wire having upright reel supporting frames rigidly mounted on a base. A sheave is provided above the take-up reels to guide the wire to one of the reels. A plurality of upwardly extending rods are provided and are movable between the reels axially thereof so as to shift the wire beyond one ends of the reels when said one reel has become almost full of the wire. Discs are rotatably mounted adjacent said one ends of the reels. The discs have claws which engage the thus shifted wire and arrest it on the discs whereby the wire is cut between the claws. The cut end of the wire arrested on the disc associated with the other empty reel causes a further continuous length of the wire to be wound up on the empty reel for thereby completing transfer of the wire from the full reel to the empty one.

3 Claims, 6 Drawing Figures

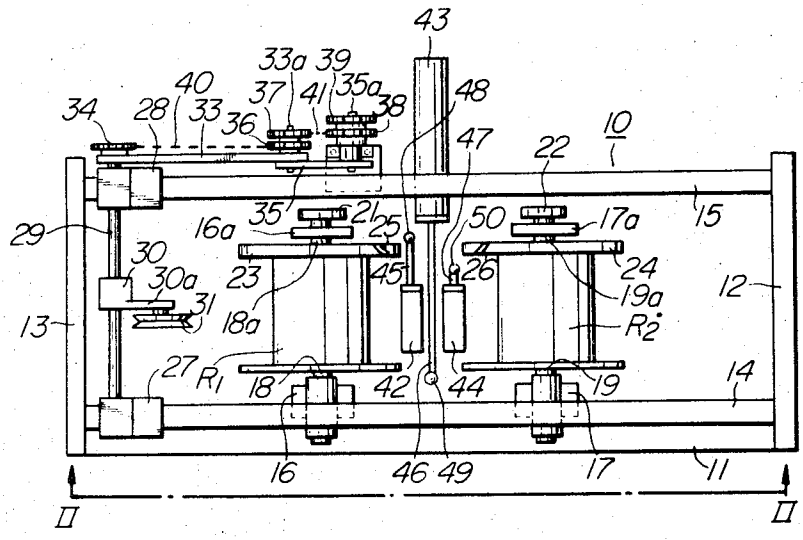


FIG. 1

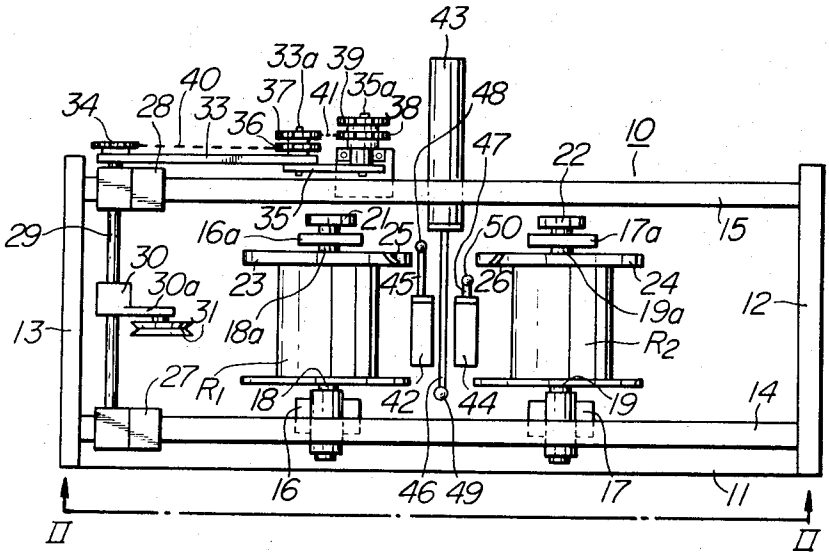

43
33a
39
40
37
41
35a
38
48
34
28
33
36
47
22
10
29
16a
35
21
25
50
17a
15
30
23
45
26
24
19a
12
30a
31
18a
R2
13
27
R1
18
42
44
19
14
16
46
49
17
11
II
II

FIG. 2

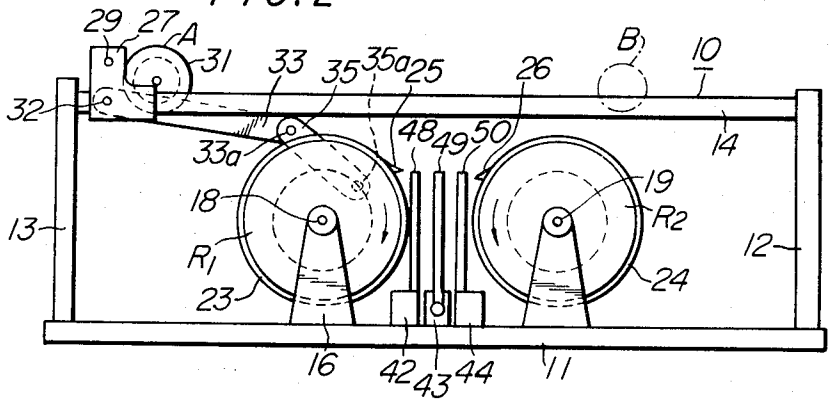

29
27
A
31
33
35
35a
25
26
B
10
32
48
49
50
14
33a
19
18
R2
13
R1
12
23
24
16
42
43
44
11

FIG. 3

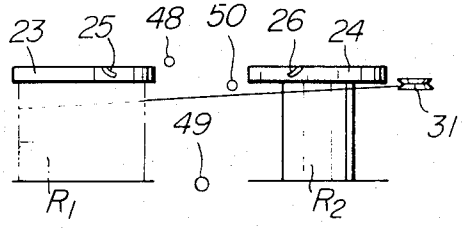


FIG. 4

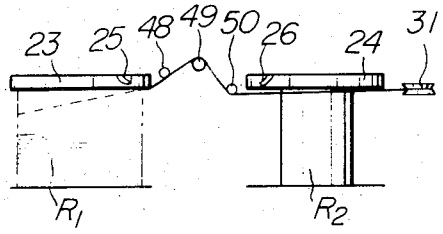


FIG. 5

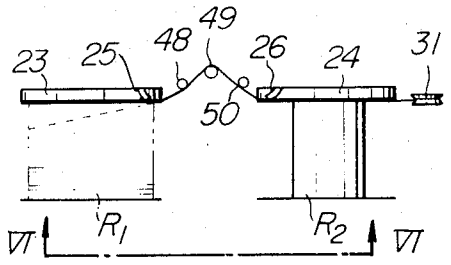
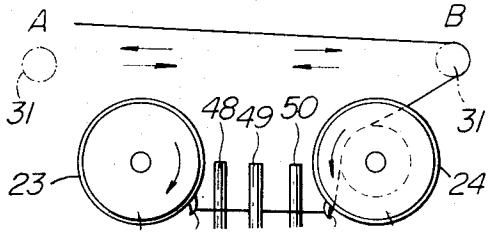


FIG. 6



APPARATUS FOR CONTINUOUSLY WINDING UP A LINEAR PRODUCT SUCH AS WIRE

The invention of the present application relates generally to an apparatus for continuously winding up a linear product such as wire and, particularly, to an apparatus of this kind and in which, on completion of winding up of the linear product on a reel, the product is automatically transferred from the full reel to another empty one and is continuously wound up thereon.

In the apparatus of this kind, various types of automatic linear product transferring mechanisms have heretofore been employed. However, they do not provide satisfactory operation. For example, some of the conventional mechanisms have a shortcoming that, when in use for high speed winding operation, the conventional mechanisms fail to transfer the linear product from a full reel to an empty one. With the conventional linear product transfer mechanisms, moreover, it is required for the apparatuses for use with large-sized take up reels correspondingly to have large-sized constructions in their entirety so as to be adapted for the large reels.

It is an object of the present invention to provide an improved apparatus for continuously winding up a linear product which apparatus is free from the problems or drawbacks mentioned in the above.

It is another object of the present invention to provide an apparatus of the class mentioned in the above and which assures reliable and smooth operation in transferring the linear product from a full reel to another empty one.

It is a further object of the present invention to provide an apparatus of the class mentioned in the above and which provides linear product take-up and transfer operation in stable manner.

It is a still further object of the present invention to provide an apparatus of the class mentioned in the above and which is designed to be adapted for take-up reels of relatively larger size as compared with the size of the apparatus in its entirety.

A still further object of the present invention is to provide an apparatus of the class mentioned in the above and which employs simplified driving mechanisms.

In order to achieve the above objects, there is provided an apparatus for continuously winding up a linear product which comprises pairs of upright frame members rigidly mounted on a base, each pair of said upright frame members being adapted to detachably and rotatably support a take up reel thereon, motor means for rotating reels on said pairs of frame members in opposite directions, a disc member mounted on each pair of frame members adjacent one end of the real thereon for rotation therewith, means for guiding said linear product from its delivery position to one of the reels on said pairs of frame members, said guiding means being movable in a horizontal plane above said reels in directions parallel and perpendicular, respectively, to the axes of rotation of said reels, means on said base between said pairs of frame members movable in a direction parallel to said axes for shifting a part of the length of said linear product axially of said reels beyond said disc members when said one reel has taken up said linear product substantially to its full capacity, said part of the length of said product extending between said reels, and at least one claw member on the periphery of each of said disc members, said claw members being adapted to engage the thus shifted part of said linear product and arrest it on said disc members to cause said linear product to be cut between said claw members whereby the cut end of said product arrested on the disc associated with the full reel enables a further continuous length of said product to be continuously wound up on the other empty reel.

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

FIG. 1 is a top plan view of a continuous wire take-up apparatus according to one embodiment of the present invention;

FIG. 2 is a side view of the apparatus as seen along line II—II in FIG. 1;

FIGS. 3 to 6 are schematic illustrations of the operation of the wire transferring mechanism employed in the apparatus of FIG. 1, and in which;

FIG. 3 schematically illustrates the arrangement of the components of the wire transferring mechanism in normal position,

FIG. 4 is a view similar to FIG. 3 but schematically illustrates the arrangement of the components of the wire transferring mechanism at a first stage of the wire transferring operation,

FIG. 5 is a view similar to FIG. 4 but schematically illustrates the arrangement of the wire transferring mechanism at a second stage of the wire transferring operation, and

FIG. 6 is a schematic side view of the wire transferring mechanism as viewed substantially along line VI—VI in FIG. 5.

The present invention will be described hereinunder in detail with reference to an illustrated embodiment of the invention which is designed to be operable to wind up a continuous length of wire. It is, however, to be understood that those skilled in the art may easily apply the illustrated embodiment of the invention to taking up of other similar linear products.

Referring to FIGS. 1 and 2 of the drawings, there is shown an embodiment of the linear product take-up apparatus, generally designated at **10**, of the present invention. The apparatus **10** includes a base **11**, a pair of upright walls or frames **12** and **13** projecting upwardly from the opposite ends of the base **11**. A pair of bars or shafts **14** and **15** extend horizontally and are secured at their opposite ends to the frames **12** and **13** adjacent the upper ends thereof.

Two pairs of upright frames **16** and **16***a* and **17** and **17***a* are rigidly mounted at their bottom ends on the base **11** substantially centrally thereof. The frames **16** and **17** carry thereon relatively shorter axles or shafts **18** and **19**, respectively, which may be slidably retracted outwardly by appropriate conventional power means (not shown) mounted on these frames. The frames **16***a* and **17***a* rotatably support axles **18***a* and **19***a*, respectively, which have pulleys **21** and **22** mounted on the outer ends of these axles. These pulleys **21** and **22** are operatively connected by means of belts or the like to conventional motor means (not shown) so that the pulleys **21** and **22** are driven thereby.

The pairs of the upright frames **16** and **16***a* and **17** and **17***a* are adapted to support linear product take-up reels indicated by R1 and R2, respectively, on the pairs of the shafts **18** and **18***a* and **19** and **19***a*, respectively. Discs **23** and **24** are rigidly mounted on the shafts **18***a* and **19***a* adjacent their inner ends, respectively. These discs have circular recesses (not shown) facing inwardly and snugly receiving therein flanges on one ends of the reels R1 and R2. Thus, it will be appreciated that reels R1 and R2 will be rotated by the pulleys **21** and **22** which in turn are driven by the conventional motor means, as mentioned in the above. The discs **23** and **24** have claws **25** and **26** provided on the peripheries of the discs, respectively, for the purpose which will become apparent later.

Blocks **27** and **28**, which are generally L-shaped in side view, are slidably mounted on the horizontal shafts **14** and **15**, respectively A transverse shaft **29** extends between the blocks **27** and **28** and are secured at the opposite ends to the blocks. A block or slide **30** having a bracket **30***a* thereon is slidably mounted on the transverse shaft **29**. The slide **30** has a sheave **31** rotatably mounted on the bracket **30***a*. The sheave **31** is adapted to guide the linear product or wire to a working reel. The slide **30** has an internally threaded through-hole (not shown) through which extends a second transverse shaft **32** having formed thereon turns of screw threads which engage the internal screw threads in the slide **30**. The externally threaded shaft **32** is rotatably received at one end by the block **27** and rotatably extends at the other end through and beyond the other block **28**.

The said other end of the threaded shaft **32** loosely extends through one end of a link **33**. A sprocket **34** is rigidly mounted on the end of the shaft **32** outwardly of the link **33**. The link **33** is hinged at the other end to a second link **35** by means of a hinge pin **33***a* on which rotatably mounted are sprockets **36** and **37** which are connected together into a unitary structure. The second link **35** is pivotally mounted at the other end on a stationary shaft **35***a* on which rotatably mounted are sprockets **38** and **39** connected together into a unitary structure. The sprocket **34** is driven through a chain **40** by the sprocket **36** which is connected to the sprocket **37** which in turn is driven through a chain **41** by the sprocket **38**. The latter is connected to the sprocket **39** which is driven either by the above-mentioned motor means for the reels or by a separately provided motor.

Means (not shown) are provided to move the blocks **27** and **28** and thus the sheave **31** from the solid line position (A) in FIG. **2** to a broken line position (B) in a direction substantially perpendicular to the axes of rotation of the reels R1 and R2 substantially in a plane defined by the two horizontal shafts **14** and **15**. A suitable means for shifting the blocks from the A to the B position is the sprocket and chain arrangement disclosed in my copending application Ser. No. 19,679, filed Mar. 16, 1970, entitled "An Apparatus For Continuously Winding Up Linear products." The upper end of the link **33** is loosely mounted on the outer end of the externally threaded shaft **32**, as described in the above, so that the link **33** will follow the movement of the blocks **27** and **28**. This movement of the link **33** causes the second link **35** to be swung or oscillated about the axle **35***a* while the drive connection between the shaft **32** and the motor means therefor is maintained by means of the chains and the sprocket wheels. Thus, it will be appreciated that the torque of the motor means is transmitted through the sprocket wheels and chains on the links **33** and **35** to the threaded shaft **32** which in turn moves the slide **30** and the sheave **31** in either direction along the shafts **29** and **32** in whichever position the blocks **27** and **28** may be with respect to the axis of rotation of the sprocket wheels **38** and **39**.

Between two pairs of reel supporting frames **16** and **16***a* and **17** and **17***a* are provided three fluid-actuated horizontal cylinders **42, 43** and **44** suitably mounted on the base **11**, the intermediate cylinder **43** being arranged to extend in a direction opposite to the others **42** and **44**. The pistons of these cylinders have piston rods **45, 46** and **47**, respectively, which have upright rods **48, 49** and **50**, respectively. These upright rods are adapted to be actuated by corresponding cylinders **42, 43** and **44** to move along respective paths parallel to the axes of rotation of the reels R1 and R2 for thereby biassing the portion of the running linear product or wire extending between the reels for the purpose which will become apparent later.

In operation, the reels R1 and R2 are rotated in opposite directions as indicated by arrows in FIG. **2**.

A further description will be made in reference to FIGS. **3** to **6** of the drawings.

The sheave **31** guides the wire from its delivery source to one (R1) of the reels while the sheave is movable in either direction parallel to the axes of rotation of the reels by the externally threaded transverse shaft **32** which is continuously driven through the sprocket wheels **34, 36, 37, 38** and **39** and the chains **40** and **41** by the above-stated motor which is operatively connected to the sprocket wheel **39**. The sheave **31** is also movable by any conventional power means (not shown) from the position (A) to the position (B) in FIG. **6**. As described in the above, the drive connection between the externally threaded shaft **32** and the sprocket wheel **39** driven by the not shown motor is formed by the chain **40** extending around the sprocket wheels **34** and **36** and by the chain **41** extending around the sprocket wheels **37** and **38**. The sprocket wheels **36** and **37** are mounted on the pin **33***a* by means of which the two links **33** and **35** are hinged together. Thus, it will be appreciated that the threaded shaft **32** is continuously driven by the not shown motor to cause the sheave **31** to be moved or shifted on the shafts **29** and **32** in either direction parallel to the axes of rotation of the reels R1 and R2 in whichever position the blocks **27** and **28** and thus the shaft **32** may be with respect to the axis of rotation of the sprocket wheel **39**.

FIG. **3** illustrates the reel R1 as having taken up thereon the wire almost to its full capacity. At this stage of the operation, it is required to transfer the wire from the full reel R1 to another empty reel R2. The latter is thus started its rotation and the peripheral speed thereof is adjusted so as to be substantially the same as the linear speed of the wire being taken up on the reel R1. Then, the blocks **27** and **28** are slid on the horizontal shafts **14** and **15** so that the sheave **31** is moved from the position A to the position B shown in FIGS. **2** and **6**. At this time, the upright rods **48** and **50** are held in the positions adjacent the discs **23** and **24** in such a manner that one of the rods **48** is positioned slightly outwardly

of the corresponding disc **23** while the other rod **50** is located slightly inwardly of the associated disc **24**, as will be seen in FIG. **3**. At the same time, the wire guiding sheave **31** is kept positioned in a vertical plane adjacent the disc **24**, as illustrated in FIG. **3**. Then, the fluid-actuated cylinder **43** is actuated to shift the remaining upright rod **49** axially of the reels beyond the other rods **48** and **50**, as seen in FIG. **4**. Thus, while the wire is prevented by the rod **50** from being engaged by the claw **26** on the disc **24**, the wire is allowed by the position of the rod **48** to be shifted by the rod **49** to a position in which the wire is engaged by the claw **25** on the disc **23**. Instantaneously, the rod **50** is actuated to move to a position, shown in FIG. **5**, in which the rod **50** allows the wire to be engaged by the claw **26** on the disc **24**. Thus, the length of the wire is engaged by both of the claws **25** and **26** and arrested thereby on the discs **23** and **24**, as best seen in FIG. **6**, with the result that the wire is cut between the claws **25** and **26**. The cut end of the wire arrested by the claw **26** on the disc **24**, which is associated with the empty reel **R2**, enables further length of the wire to be wound up on this reel. Thus, the transfer of the wire from the full reel (**R1**) to the empty reel **R2** is completed smoothly and, when the reel **R2** has become full of the wire, the sheave **31** may be again moved to the position A in order to further transfer the wire from the reel **R2** to a further new empty reel which has been substituted for the reel **R1**. The operation is further continued in similar manner.

It is particularly to be noted that, with the construction of the apparatus of the present invention, the wire shifting upright rods **48**, **49** and **50** are utilized in combination to cause the wire to be engaged by the claws **25** and **26** on the discs **23** and **24**. This feature of the invention assures more reliable and smooth operation in transferring the wire from one reel to another as compared with conventional turret type take-up machine. In addition, the cut ends of the wire are arrested or held on the discs **23** and **24** by the claws **25** and **26** thereon so that the cut ends of the wire can be easily dealt with. Furthermore, reels are mounted horizontally at a relatively lower positions and in parallel relationship to one another on two pairs of reel supporting frames and are rotated in this position. This feature of the invention makes it possible to assure stable operation of the apparatus, minimize the size of the apparatus in its entirety and simplify the driving mechanisms for reels.

What is claimed is:

1. An apparatus for continuously winding up a linear product comprising a pair of upright frame members rigidly mounted on a base, a pair of take-up reels detachably and rotatably supported in parallel relationship in said frame members respectively, motor means for rotating reels on said frame members in opposite directions, a pair of disc members mounted on said frame members respectively adjacent one end of each of the reels respectively thereon for rotation therewith, a source means for said linear product, means for guiding said linear product from said source means to one of the reels on one of said frame members, said guiding means being movable in a horizontal plane above said reels in directions parallel and perpendicular, respectively, to the axes of rotation of said reels, said guiding means comprising a pair of block members, a pair of horizontal shaft members extending in parallel relationship to one another in a direction perpendicular to said axes of rotation of reels, said block members slidably mounted on said shaft members respectively, a transverse shaft member rotatably extending through said block members, a sheave member mounted on said transverse shaft member for movement therealong, means for moving said sheave member along said transverse shaft member including screw threads formed externally on said transverse shaft member, a slide member mounted on said transverse shaft member by means of an internally threaded opening therein through which said shaft member extends, said sheave being journalled for free rotation on said slide member, a second motor means, and drive means operatively connecting said second motor means with said transverse shaft member for rotating said shaft member, said drive means including a first and second link member, a pin member, said first and second link members loosely hinged together at their ends by said pin member, said first link member being pivotally mounted at the other end on said transverse shaft member, a second pin member, said second link member being loosely pivoted at the other end to said second pin member, a first sprocket wheel rigidly mounted on said transverse shaft member, a second sprocket wheel rotatably mounted on said first pin member, a first chain member drivingly interconnecting said first and second sprocket wheels, a third sprocket wheel mounted on said first pin member and connected to said second sprocket wheel for rotation therewith, fourth and fifth sprocket wheels connected together and rotatably mounted on said second pin member, a second chain member drivingly interconnecting said third and fourth sprocket wheels, said fifth sprocket wheel being operatively connected to the output shaft of said second motor means, means for moving said block members along said horizontal shaft members, means on said base between said frame members movable in a direction parallel to said axes of said reels for shifting said linear product axially of said reels beyond said disc members when a predetermined length of said linear product has been taken up by said one reel, and at least one claw member on the periphery of each of said disc members, said claw member being adapted to engage the thus shifted part of said linear product and arrest it on said disc member.

2. An apparatus as defined in claim **1** wherein said shifting means comprises a plurality of power actuated reciprocating assemblies mounted on said base between said power actuated reciprocating assemblies mounted on said base between said reel supporting frame members and extending in parallel relationship with said axes of rotation of reels, and upright rods connected to the piston rods of said assemblies, respectively, at least one of said upright rods serving to shift the linear product being wound up on a reel axially beyond said disc members and at least one of the remaining upright rods serving first to prevent said product from being engaged by said claw member and then to allow said product to be engaged by said claw member whereby said product is arrested on said disc members and immediately cut between said claw member by the continuous rotation of said reels.

3. An apparatus as defined in claim **2** wherein said power actuated reciprocating assemblies are fluid actuated piston and cylinder assemblies.

* * * * *