

[72] Inventor **Harlan D. Olson**
Portland, Oreg.
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 [73] Assignee **Cascade Corporation**
Portland, Oreg.
a corporation of Oregon

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Primary Examiner—Dorsey Newton
 Attorney—Kolisch & Hartwell

[54] LIFT TRUCK WITH LINE TAKE-UP UNIT 3 Claims, 7 Drawing Figs.

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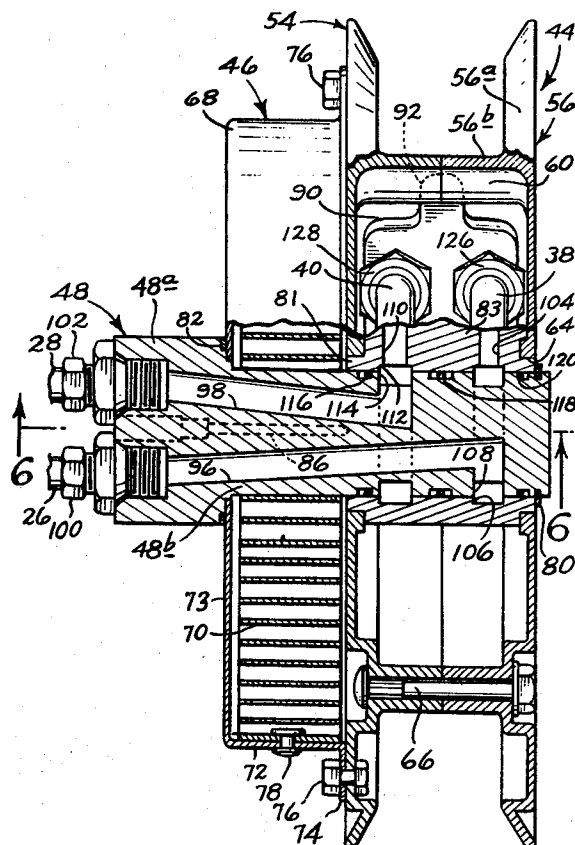
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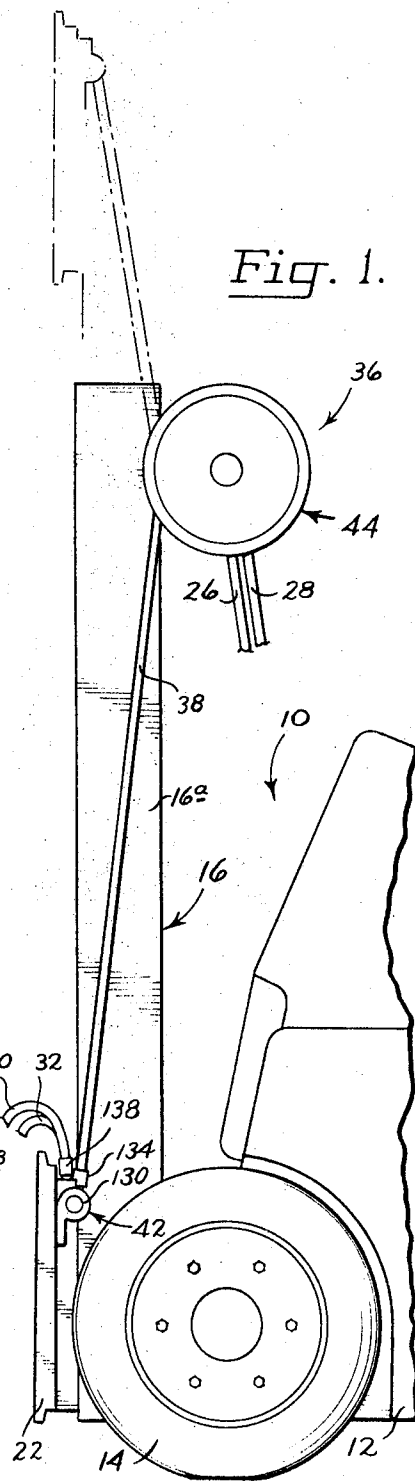
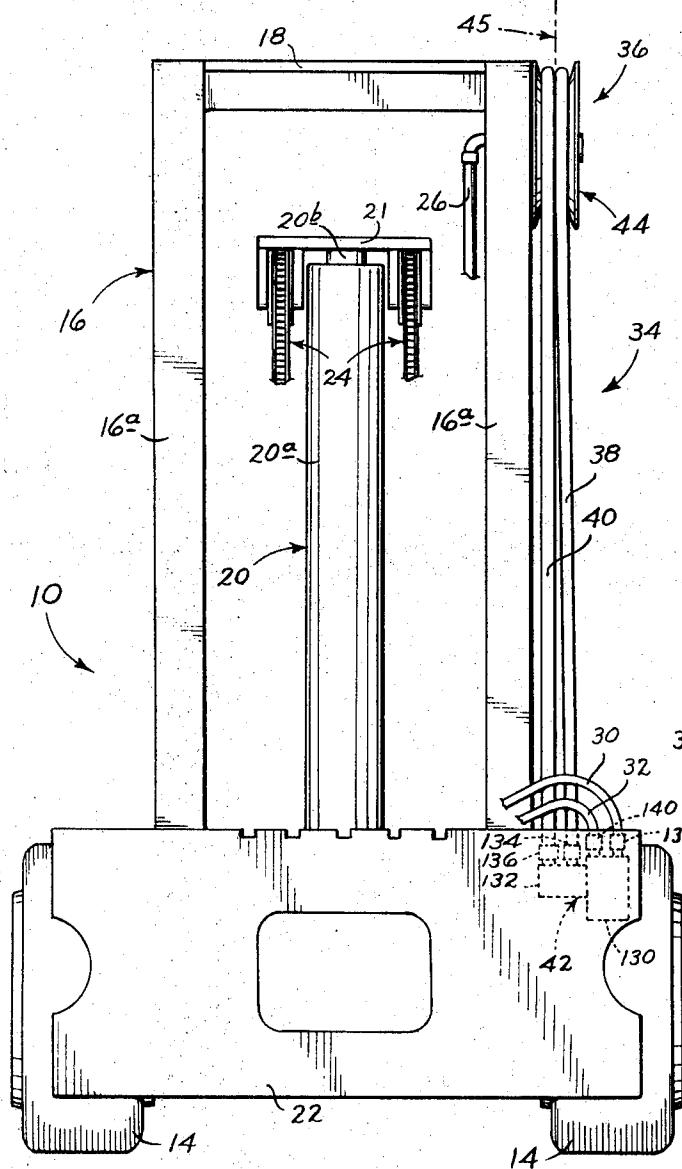
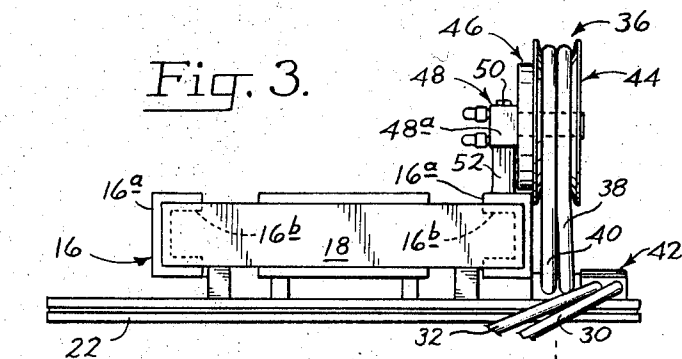
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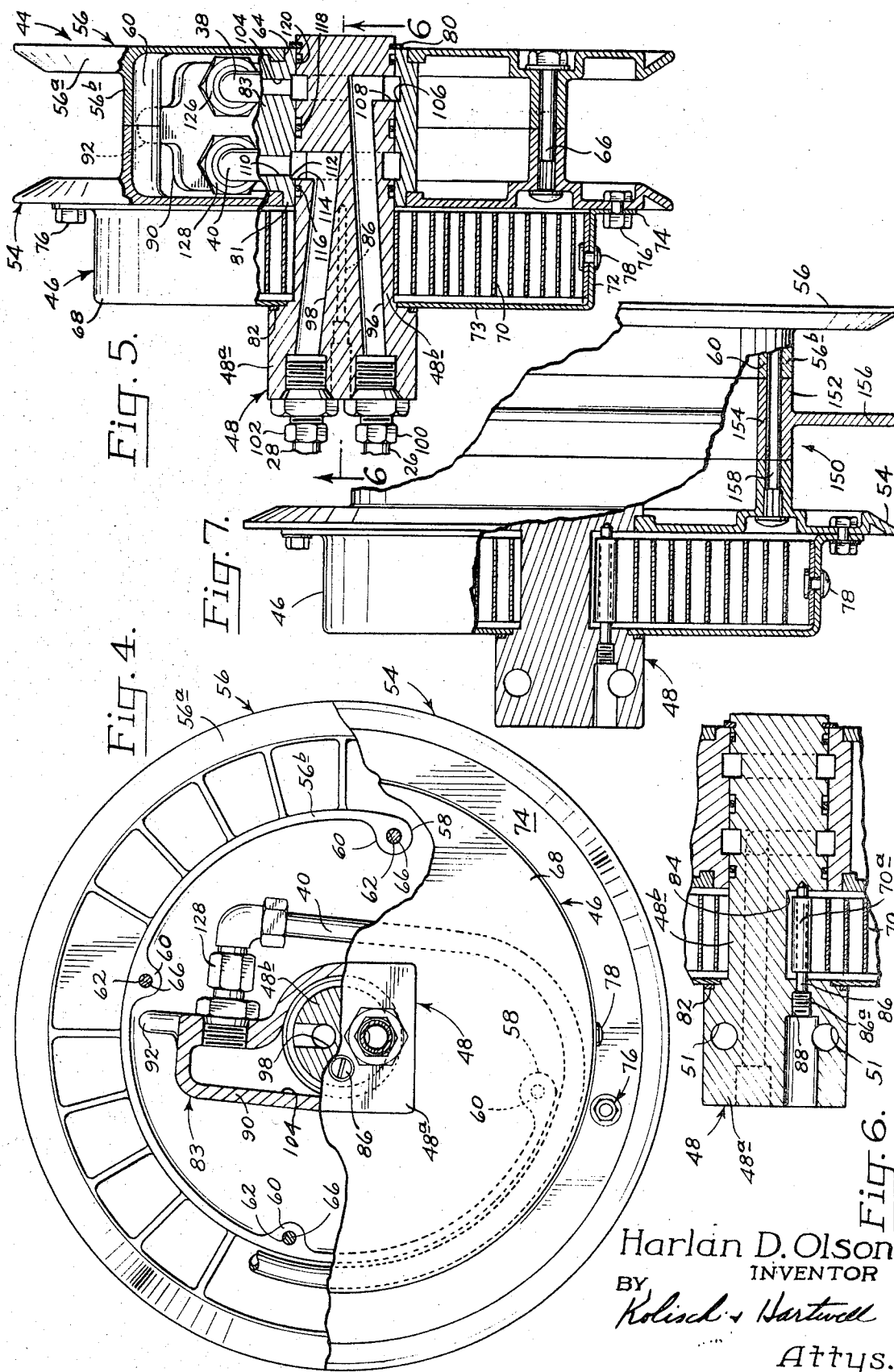
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ABSTRACT: A lift truck with mast assembly having a line take-up unit mounted on the outer mast section in the assembly for handling line extending between the truck and components on the carriage carried on the assembly. The take-up unit includes a pair of oppositely disposed shroud sections, which are matching counterparts, connected by bolts extending in an axial direction through internal bosses integral with hub parts in the reel. The hub parts are integral with the shroud sections and together define an internal chamber which is opened up on separation of the shroud sections. A spring assembly mounted on one shroud section remains undisturbed on separating the other shroud sections. Line is connected to a connector disposed within the chamber and journaled on a journal member which extends from inside the hub outwardly beyond the spring assembly to a mounting on the outer mast section.





Harlan D. Olson
INVENTOR
BY *Kolisch & Hartwell*
Attys.



Harlan D. Olson
INVENTOR
BY *Kolisch & Hartwell*
Attys.

LIFT TRUCK WITH LINE TAKE-UP UNIT

The present invention relates to apparatus for taking up and paying out line. More particularly, it relates to such apparatus which may be used on an industrial vehicle, such as a lift truck, to take up and pay out line connected to power-operated equipment mounted on an elevatable carriage on the vehicle.

The usual lift truck includes a vertically disposed telescopic mast assembly, including an outer stationary mast section and at least one inner mast section mounted on and vertically extensible relative to the outer mast section. A carriage is mounted for vertical movement on the inner mast section, adapted to carry such power-operated equipment as a side shifter, clamping arms, a vacuum grab, remotely operated solenoid devices, etc.

Power for operating such equipment commonly is supplied through flexible lines which may be pressure fluid hoses, vacuum hoses or electrical conductor cables that extend between the carriage and the line takeup unit, mounted ordinarily near the top of the stationary mast section. The takeup unit takes in line upon the carriage moving up on the mast assembly to a position closer to the takeup unit, and pays out line upon the carriage moving away from the takeup unit either above or below it, whereby the line is maintained taut at all times.

A number of problems have been encountered with known takeup units. For one thing, their construction has been such that line connected to the takeup unit has tended to wear adjacent its connection to operating parts in the unit. Flexible line, be it flexible hoses or electrical conductor cables, must be replaced periodically as it has a limited service life, and replacement of such line with conventional takeup units has been time consuming and difficult to perform. A particular problem encountered with known devices is that an operating connection between the end of a line and components in the reel has been established in a relatively confined space which, in addition to being inconvenient, has limited the size of line that can be conveniently handled on the reel. The usual takeup unit is mounted in a relatively exposed position on the outside upper part of the stationary mast section in the mast assembly, and being exposed, and with normal use of a lift truck, some damage of the unit may be expected. Another deficiency of existing units is that when such damage does occur, it is difficult to repair the units and replace any parts that need replacement.

A general object of this invention is to provide novel apparatus for controlling line as by paying it out and taking it in, which takes care of the above-indicated difficulties in a satisfactory and practical manner.

Another object is to provide a novel takeup unit, including a reel, so constructed that line connections with the reel are readily made.

Another feature and object of the invention is the provision of a takeup unit capable of partial disassembly without disturbing the mounting of the reel and connections of a spring assembly which serve to bias the reel, and which, when partially disassembled, provides for the easy and rapid connection of lines to operating parts in the reel.

Yet another object is to provide a takeup unit including a reel wherein the reel has inner and outer shroud sections with integrally formed hub portions, and such two sections are matching counterparts in the reel. These sections are interchangeable, which is a factor in simplifying manufacture of the reel and reducing parts that must be held in inventory for replacement purposes.

Another feature of the reel is the provision of a construction which enables one type of reel to be modified to an extent to include a divider section between shroud sections in the reel, whereby two lines may be connected to the reel with each contained, when wound on the hub of the reel, in separate regions.

A further object is to provide a takeup unit of the type described which is readily adaptable to handle different sizes and kinds of lines.

These and other objects and advantages of the invention will become more fully apparent as the description which follows is read in conjunction with the accompanying drawings, wherein:

FIG. 1 is a simplified side elevation, illustrating portions of the front of a lift truck equipped with line-handling apparatus constructed according to the invention, such apparatus including a takeup unit disposed at the top of a mast assembly;

FIG. 2 is a front elevation of the truck shown in FIG. 1;

FIG. 3 is a top plan view of the structure shown in FIG. 2;

FIG. 4 is a side view, on a larger scale than FIGS. 1—3, of the takeup unit of the invention, with portions of the unit broken away to illustrate details of internal construction;

FIG. 5 is a view, partly in cross section, viewing the right side of FIG. 4;

FIG. 6 is a cross-sectional view taken along the line 6-6 in FIG. 5; and

FIG. 7 is a fragmentary view, similar to FIG. 5, but illustrating another modification of the takeup unit of the invention.

Turning now to the drawings, and considering first of all FIGS. 1—3, indicated generally at 10 is the front of a lift truck having the usual truck frame 12 and front wheel assemblies, such as assembly 14, supporting the forward end of the frame for movement over the ground.

Mounted on the front of frame 12 is a vertically disposed, telescopic mast structure or assembly 16. The mast structure comprises an outer stationary mast section including laterally spaced upright members 16a, and an inner mast section which is shiftable vertically relative to the outer mast section including laterally spaced upright members 16b nested within members 16a. The upper ends of members 16b are joined together through bar 18 which extends between the members. Although the outer mast section is referred to herein as a stationary section, to bring out the fact that it does not shift vertically, it should be understood that the section may be and ordinarily is mounted on the frame through the usual pivot means enabling limited forward and rearward tilting of the section.

A carriage 22 is shown disposed forwardly of the mast assembly which is mounted for vertical movement on members 16b of the inner mast section. In the usual industrial application, power-operated equipment, exemplified by a pair of hydraulically actuated clamping arms, might be mounted on the carriage for clamping onto loads transported by the lift truck. Since the particular type of equipment utilized forms no part of the invention, and to obtain clarity in the drawings, the power-operated equipment has been omitted from the drawings.

The carriage is shifted up and down on the inner mast section and the inner mast section is moved up and down on the outer mast section by operation of a hydraulic hoist ram 20. The cylinder end 20a of the ram is suitably mounted adjacent the base of the mast structure, and the rod end 20b is shown connected to a crosshead 21. Suitable sprocket and chain structure, portions of which are shown at 24, interconnects the carriage, inner mast and crosshead, whereby on extension of the hoist ram, the carriage moves up on the inner mast section, and the inner mast section moves up on the outer mast section.

Hydraulic fluid for operating the power-operated equipment on the carriage is supplied and exhausted through hoses partially shown at 26 and 28, which are suitably connected to the usual hydraulic system on the truck. Interconnecting these hoses and jumper hoses or lines 30, 32 on the carriage (which are the hoses actually used to connect with the power-operated equipment on the carriage), is line-handling apparatus shown generally at 34 comprising a hose or line takeup unit 36 mounted adjacent the top of the outer mast section, a pair of hoses or lines 38, 40 extending from the takeup unit to the carriage and a line coupling assembly 42 mounted on the carriage operatively connecting hoses 38, 40 with hoses 30, 32.

In the embodiment of the invention illustrated, takeup unit 36 includes a reel 44 occupying a substantially vertical plane (indicated at 45) and rotatable about a horizontal axis extending transversely of the mast assembly. The reel is located laterally outwardly on the truck from member 16a of the outer mast section (such member forming one side of the outer mast section). This positioning of the reel enables part of the reel to project forwardly from the back of the mast assembly, with hoses 38, 40 emanating from the reel extending downwardly to the forwardly located carriage in courses which are vertical when viewing the lift truck from the front, as in FIG. 2. In back of member 16a of the outer mast section, and laterally inwardly on the truck from the reel, is a spring assembly 46. The spring assembly and reel are supported on a journal member 48 which extends axially through the reel and through the spring assembly, and has an inner end 48a anchored on member 16a of the outer mast section. Anchoring such end in the drawing is fastener means 50 securing end 48a to a block 52 which is joined to the back of member 16a. Fastener means 50 extends through accommodating bores in end 48a, shown at 51 in FIG. 6.

With reference now also to FIGS. 4 and 5, reel 44 comprises an inner or first shroud section 54 and an outer or second shroud section 56 which, as will become more fully apparent, are separable from each other. A feature of this invention is that these two shroud sections may have essentially the same construction, whereby they are matching counterparts. Each includes a circular shroud, such as that shown at 56a, and formed integrally with the shroud a substantially cylindrical hub section or portion, such as that shown at 56b. Such hub portion has a smooth outer surface and extends continuously about the axis of the reel for the major part of a full circular arc. As seen in FIG. 4, axially extending margins 58 of a hub portion define an opening into the hollow interior of the hub portion. Formed integrally with the hub portion, on the inside thereof, and thus inwardly of the outer surface of the hub portion, are axially extending bosses 60, each provided with an axially extending bore 62. The shroud in a shroud section includes a central circular opening such as that shown at 64 (see FIG. 5).

In the takeup unit the two shroud sections are mounted with their hub portions abutting and in matching relation, and with the bosses in one section aligned with the bosses in the other. Detachably joining the reel sections are fasteners such as the carriage bolt and nut assembly shown at 66. The bolts extend through the bosses and the nuts screwed onto the bolts comprise unfastenable parts for detaching the fastener means disposed on the outer side of the outer or second shroud section. This disassembly may be performed without disrupting the mounting of spring assembly 46 which is supported on the inner face of the inner or first shroud section. With the two shroud sections secured together, the two hub portions of the sections define an internal chamber which is used in the connection of the ends of hoses 38, 40 to the takeup unit. Margins 58 of the hub portions in the two shroud sections, together with inner faces of the shrouds in the sections (where such extend between the margins 58), collectively bound a relatively large opening through which such hoses extend to their connections with the takeup unit.

With the organization described, it will be noted that on removal of the outer shroud section, part of the structure which defines this opening, including the inner face of the shroud which bounds a side of this opening, is displaced, whereby the opening which receives these hoses is opened up on one side to permit placement of line through this open side into a position extending through this opening. There is no need to thread line, therefore, through an opening bounded on all sides. With the outer shroud section removed, that part of the hub which is integral with the inner shroud section extends only half as far in an axial direction as does the hub in the reel when assembled. This means that the space bounded by that portion of the hub which remains is more readily accessible.

Spring assembly 46 which is inwardly of the reel but directly adjacent it, includes a housing or casing 68 which houses a helical spring 70 lodged within the casing. The casing, in addition to an end wall 73 and a cylindrical wall 72 which circles the spring, includes a radially outwardly projecting annular flange 74 which abuts the outer face of the shroud in the inner shroud section in the completed takeup unit. The casing and reel are fastened together by nut and bolt assemblies 76 joining this flange to the inner reel section. The outer end of spring 70 is securely anchored to the casing as by fastener 78.

Journal member 48 which rotatably supports the reel and spring casing is best illustrated in FIGS. 4, 5, and 6. As can be seen with reference to these FIGS. the member includes, in addition to end 48a, an elongated substantially cylindrical portion 48b extending through the spring assembly and axially through the reel. Encircling cylindrical portion 48b is a sleeve portion 81 of a so-called line connector means or member 83, to be described in greater detail below. The shroud sections seat on sleeve portion 81, and a snap ring 80 disposed against the outer end of sleeve portion 81 functions to hold the reel and spring casing in place, with end wall 73 of the casing abutting a bearing 82 mounted on the shoulder defined where portion 48b joins with end 48a.

Cylindrical portion 48b is recessed at 84 to receive the inner looped end 70a of spring 70 (see FIG. 6). A pin 86 projecting through this recessed part and through looped end 70a serves to anchor detachably the inner end of the spring to the journal member. The pin shown has a threaded end 86a, permitting the pin to be screwed into place, with an axially extending bore 88 in the journal member providing the necessary access to the end of the pin. With such a construction, and with the reel and casing turned to tighten the spring, the spring is effective to bias the reel and casing through urging rotation in the opposite direction.

Describing in more detail line connector member 83, this member, in addition to bearing sleeve portion 81, includes an integrally formed mounting portion 90, which projects radially out to one side of the bearing sleeve portion. Portion 90 terminates at its outer extremity, as best seen in FIGS. 4 and 5, in an integrally formed lug 92. The outer extremity of this lug has a greater radial spacing from the axis of the reel than the inner extremities of bosses 60, and as a consequence, when the connector member is turned in a clockwise direction in FIG. 4, such causes the lug to strike a boss 60 to produce turning in the same direction of the reel. Such turning produces tightening of the spring within casing 68 and thus is yieldably resisted by the spring. In the organization the lug and boss constitute means inhibiting relative rotation between the line connector and reel.

In the takeup unit the journal member and connector member are employed to permit an operative connection to be established between lines or hoses 26, 28 and lines or hoses 38, 40 which emanate from the reel, while permitting relative movement of the ends of hoses 38, 40, such as must occur on rotation of the reel. Thus, and referring to FIG. 5, it will be noted that a pair of bores or passages 96, 98 are provided extending generally in an axial direction along the journal member. Hose 26 is mounted through fitting 100 on the inner end 48a of the journal member, with the interior of this hose communicating with passage 96, and similarly, hose 28 is mounted on the journal member through fitting 102 with the interior of this hose communicating with passage 98. A channel 104 in mounting portion 90 communicates through cooperating annular grooves 106, 108 with passage 96, and a similar channel 110 communicates through cooperating annular grooves 112, 114 with passage 98. The usual seals 116, 118, and 120 are included to provide a fluid-tight seal between the journal member and bearing sleeve portion 81 on either side of cooperating grooves 106, 108, and 112, 114.

Mounting hose 38 on connector means 83, with its interior communicating with channel 104, is a fitting assembly including nut 126, and mounting hose 40 on connector means 83 with its interior communicating with channel 110 is a fitting

assembly including nut 128. In the assembled takeup unit, the connector and hose ends are within the chamber defined by the hub portions in the two shroud sections, and the hoses extend out from this chamber through the opening defined by margins 58 in the shroud sections. The hoses thence are wrapped around the smooth outer surfaces of the hub portions in the space between the shrouds of the shroud sections, and thence extend to a connection with the carriage through line coupling assembly 42.

Describing the line coupling assembly in more detail, such includes a junction block 130 mounted on the back side of the carriage and disposed laterally outwardly on the truck from the side of the outer mast section. Journaled in the junction block is a swivel part 132, journaled for rotation about an axis substantially paralleling the rotation axis of the reel. The swivel part projects inwardly from the block into the vertical plane of reel 44. As best seen in FIG. 2 the line paid out and taken in by the reel is connected to the swivel part, and with the organization contemplated, such line extends downwardly to the line coupling assembly in vertical courses viewing a front elevation of the lift truck.

The swivel part has fittings, shown generally at 134, 136, for connecting the ends of the lines, more specifically hoses 38, 40, to suitable ports in the swivel part. These ports communicate through passages in the swivel part with ports in the junction block connected by fittings 138, 140 to jumper hoses 30, 32.

Describing generally how the apparatus operates, and some of the advantages thereof, with the construction described hoses 26, 28 communicate through hoses 38, 40 with hoses 30, 32 on the carriage. Hoses 38, 40 are connected to the reel in the takeup unit in such a manner that a bias is always exerted by the helical spring tending to urge the reel to rotate in a direction causing the hoses to be wound up on the reel. With elevation of the carriage as the same approaches the takeup unit, the length of hose extending from the reel to the line coupling assembly decreases, and the remainder of the hose is taken up as windings about the hub in the reel. With the hose extending in vertical courses viewing a front elevation of the truck, the hose is never bent around the shrouds on extending to the line coupling assembly, even with the carriage directly opposite the takeup unit. On the carriage being moved upwardly beyond the takeup unit the hose is let out with such being unwound from the reel.

The spring assembly is located inwardly on the truck from the reel and behind the outer mast section in the mast assembly. In this way the spring assembly is protected from damage. Replacement of hose on the reel is easily made without disassembly of the spring assembly, and with plenty of access given to make the necessary connections with the fittings of the line connector member. Further explaining, if it should be necessary to replace a hose or hoses, such may easily be done by removing the outer shroud section through unscrewing the nuts on the carriage bolts. The outer shroud section is then removable, to leave the inner shroud sections still in place and to fully expose connector member 83. This produces easy access to the connector member, and more specifically, fitting assemblies 126, 128 utilized in connecting hose to the connector member.

The takeup unit may be constructed to handle hoses of a wide variety of sizes. Alternatively, the takeup unit may be employed with other types of line such as flexible conductor line in installations where a connection with electrically operated equipment on the carriage is desired. Where the takeup unit is utilized with electrical conductor lines, slip rings and brushes are provided in the reel, between the reel and journal member, and electrical conductors are provided making a suitable electrical connection between any conductor lines taken in and paid out by the reel unit and conductor lines extending from the truck to the journal member.

The takeup unit is easily modified to provide for the double tracking of lines or hoses in the reel, i.e., the winding of the two hoses in separate regions within the reel. Thus, and referring to the modification of the invention illustrated in FIG. 7, a divider section may be included which is mounted in the reel

between the inner and outer shroud sections. This divider section, shown at 150, includes a substantially cylindrical portion or section 152 having a circular outline which matches the outline of the hub portions 56b of the shroud sections. This hub section lies between the hub sections of the shroud sections. Formed integral with the hub section 152 and distributed circumferentially around its interior are integral bosses 154 which are aligned with the bosses in the shroud sections with the takeup unit assembled. Integral with the hub section of the divider section and projecting radially outwardly from the hub section is an annular vane 156, which serves to divide the space between the shroud sections into two regions. With the inclusion of the divider section between the two shroud sections, the distance between the shroud sections is somewhat increased, as can be seen by comparing FIGS. 5 and 7. This necessitates the use of somewhat longer carriage bolts in attaching the parts of the reel together.

With a reel including the divider section, a pair of hoses, for instance, may be connected to the line connector in the reel with one hose then being wrapped in the reel in the region between the divider vane and the outer shroud section and the other wrapped between the divider vane and the inner shroud section. With such separation of hose windings, what is referred to as double tracking is obtained.

It should be apparent from the above that a highly versatile line takeup unit is contemplated which is adaptable to handle many different types and sizes of lines, be they electrical or hose-type lines. With the takeup unit installed on a lift truck, the same is highly resistant to damage, particularly because of the protected position of the spring assembly. The reel sections may be substantially identical, simplifying manufacture of the components. If desired, a plastic material may be used for the reel sections, giving them some flexibility and resistance to becoming permanently bent. The reel sections also are easily separated to facilitate the change of hose handled by the takeup unit.

While several modifications of the invention have been described herein, other variations and changes are, of course, possible, and it is desired to cover all embodiments of the invention as would be apparent to one skilled in the art, and that come within the scope of the appended claims.

I claim:

1. A takeup unit for flexible line comprising a reel including a first and a second shroud disposed opposite and axially spaced from each other, and a hub having a chamber within it extending between the shrouds about which such line is collected in windings; a helical spring assembly concentric with the reel mounted against the axially outer side of said first shroud for urging rotation of the reel; a journal member having passage means therein, said journal member extending axially through the reel and the spring assembly mounting the reel with the reel relatively rotatable with respect to said journal member; said shrouds being separable sections in the reel and the reel further including detachable fastener means joining the shrouds and hub together and constructed to permit removal of the second shroud without disrupting the spring assembly; said hub having an opening in the side thereof enabling line to be extended from the outside of the hub into said chamber; and a line connector disposed within said chamber and journaled on said journal member; said line connector having passage means therein connecting with said passage means in the journal member; said second shroud including a portion that bounds a side of said opening in the hub which portion upon removal of the second shroud is displaced relative to other boundaries of said opening whereby the opening has an open side permitting placement of a line for the purpose of connecting it to said line connector by shifting of such line laterally through said open side to a position extending through the opening.

2. The takeup unit of claim 1, wherein the fastener means has a removable part for detaching the fastener means exposed on the axially outer side of said second shroud.

3. The takeup unit of claim 1, wherein means is provided within the hub inhibiting relative rotation between the line connector member and said reel.