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[54] **SELF-PROPELLED VEHICLE SYSTEM FOR USE IN TRANSFER OF MATERIALS**

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[63] Continuation-in-part of Ser. No. 727,906, May 9, 1968, abandoned.

[30] **Foreign Application Priority Data**

May 29, 1967 Canada.....991714

[52] **U.S. Cl.** **104/114,** 214/13, 254/172

[51] **Int. Cl.** **B61b 7/06**

[58] **Field of Search**.....104/113–115, 117; 212/19, 72, 76, 77, 94, 96, 132; 214/12, 13, 14; 254/172; 105/151, 150, 153, 148

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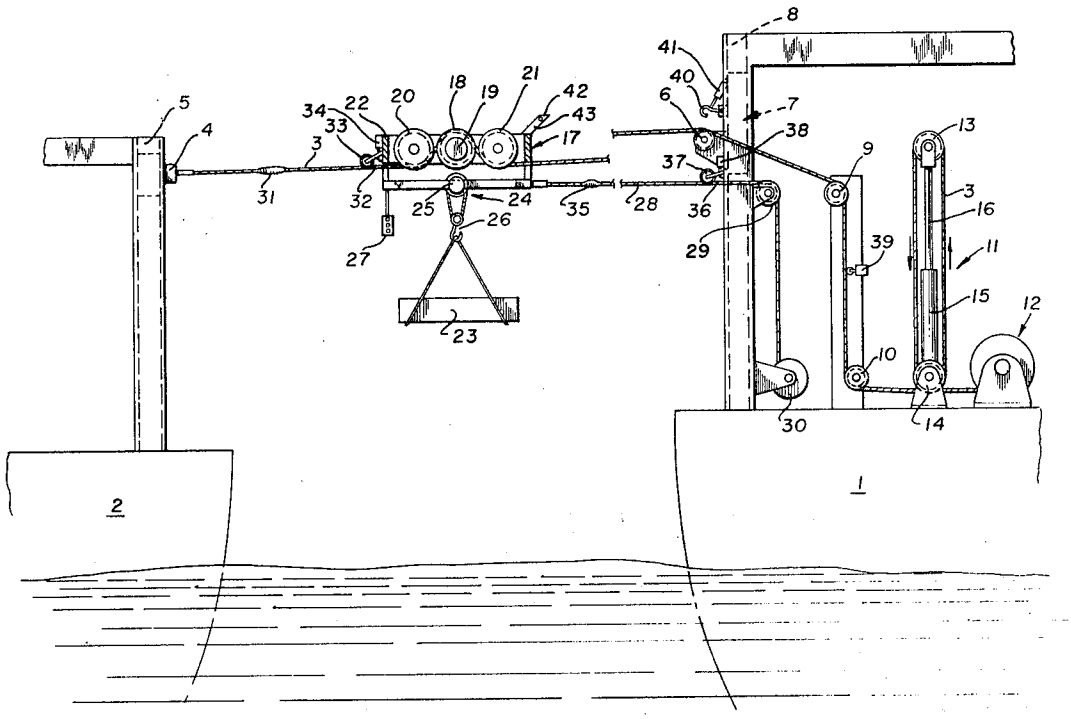
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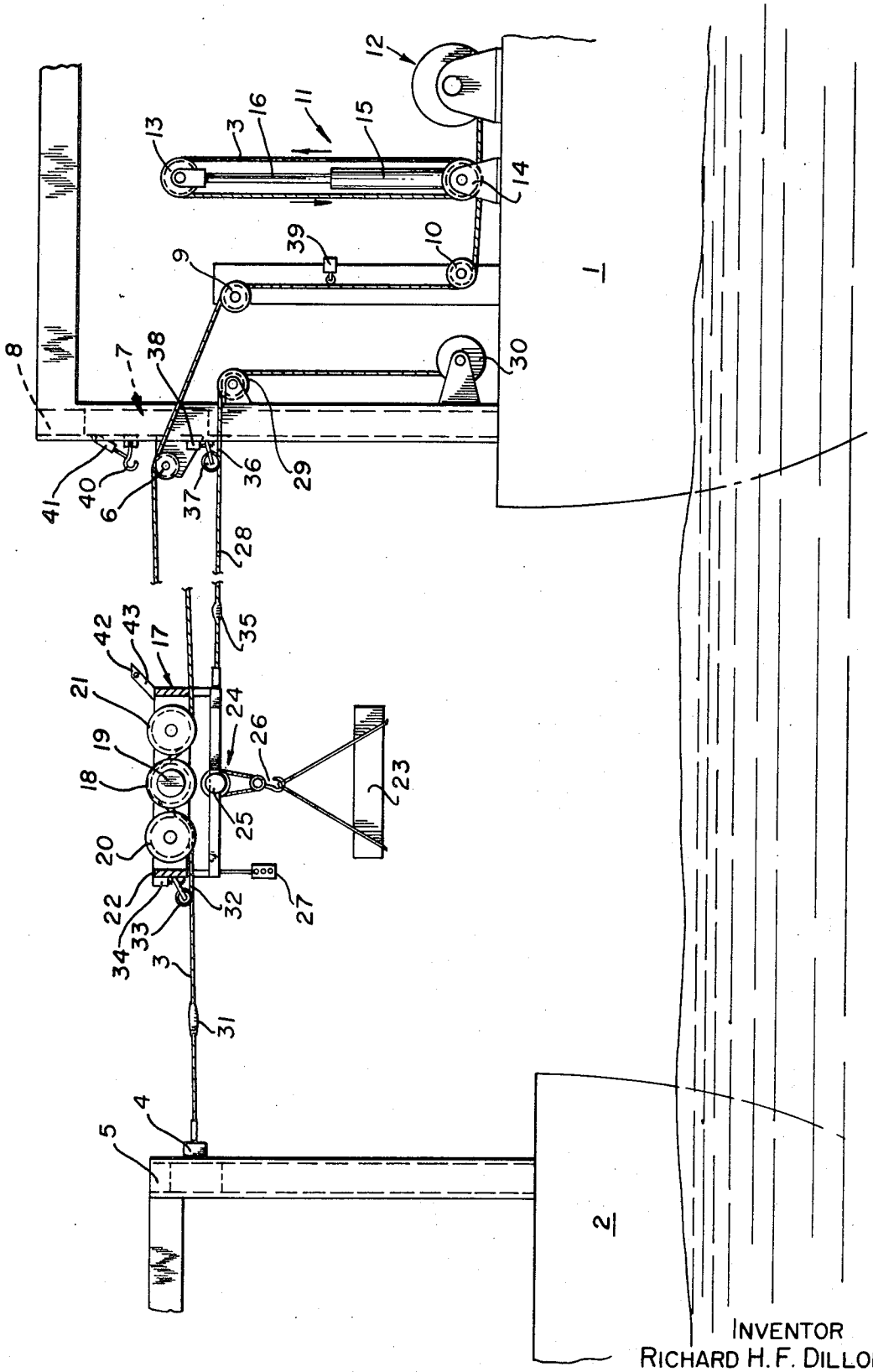
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[57] **ABSTRACT**

A ship-to-ship or ship-to-shore material conveying system comprises a load line extending between a supply station and a receiving station and means for keeping the load line under substantially constant tension. A self-propelled load carrying vehicle is arranged to travel along the load line and has means for reducing impact between the vehicle and one of the stations which may move with respect to the other.

14 Claims, 3 Drawing Figures





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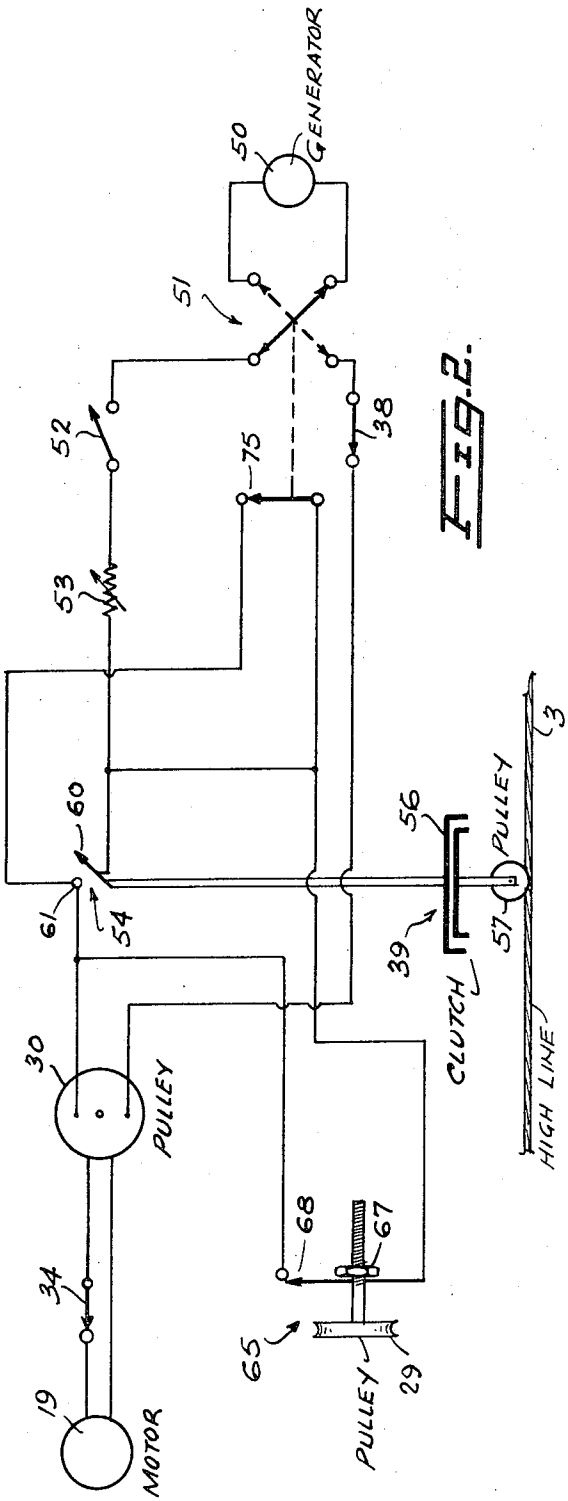

50
GENERATOR
51
52
75
38
53
60
61
54
56
PULLEY
3
39
57
CLUTCH
HIGH LINE
30
PULLEY
68
67
34
65
PULLEY
29
19
MOTOR

Fig. 2.

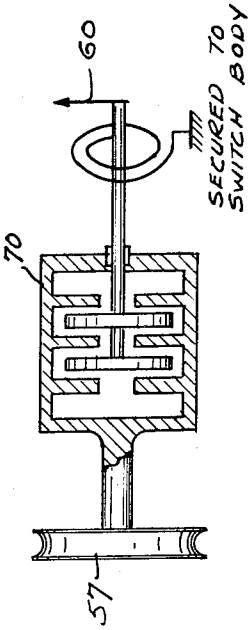

60
SECURED TO SWITCH BODY
70
57

Fig. 3.

SELF-PROPELLED VEHICLE SYSTEM FOR USE IN TRANSFER OF MATERIALS

BACKGROUND OF THE INVENTION

This is a continuation-in-part of abandoned application Ser. No. 727,906, filed May 9, 1968.

The present invention relates to an apparatus for conveying material from a supply station to a receiving station which stations are laterally spaced apart by a distance which is subject to random variation and is particularly directed to such an apparatus for conveying material from a supply ship to a receiving ship at sea.

The known systems for conveying material from a supply ship to a receiving ship at sea employ what is known as a "highline" or constant tension cable which extends from the supply ship to the receiving ship one end thereof being fixedly attached to the receiving ship while the other end is connected to a highline winch located on the supply ship. A tensioning device, in particular a ram tensioner, is usually mounted on the supply ship so as to maintain in combination with the winch a constant tension in the highline as the supply and receiving ships move towards and away from each other due to the motion of the sea, the ram tensioner immediately taking up or releasing line to maintain the tension in the highline and the winch being continually operated manually to maintain operation of the ram tensioner within certain limits and thereby avoid the ram tensioner from bottoming. Thus, the winch is operated to supply or retrieve line from the ram tensioner as the ram tensioner supplies or retrieves line due to the movement of the ships.

A material carrying trolley is arranged to travel along the highline and is pulled along it in either direction by means of inhaul and outhaul cables attached to the trolley, the inhaul cable having a direct connection between the trolley and an inhaul winch located on the supply ship and the outhaul cable passing from the trolley around an idler pulley on the receiving ship and thence to an outhaul winch also located on the supply ship. Thus when the outhaul cable is reeled in by its winch the inhaul cable is paid out and the trolley moves along the highline from the supply ship to the receiving ship and vice versa.

While the constant tension highline system has proven to be highly reliable in all sea conditions under which material transfer would be attempted, the inhaul-outhaul system for pulling the trolley along the highline has many disadvantages and is subject to severe difficulties of operation in rough seas. As will be readily obvious it is desirable that the trolley should move along the highline in operation at a constant velocity independent of the movement of the ships, i.e., the roughness of the sea. However it is found that when the ships are subject to rolling conditions the movement of the trolley is somewhat erratic and the trolley is found to be accelerated and decelerated due to the action of the inhaul and outhaul cables on the trolley as the distance between the supply ship and the receiving ship varies. Thus it has been found that the designed transfer velocity of the trolley during rough sea conditions may be exceeded by several times and these accelerations and decelerations of the trolley are found to be particularly undesirable when the trolley is carrying fragile material and explosives. The constant speed of the trolley is especially desirable when it approaches the receiving vessel as a sudden change in velocity of the trolley can cause its load to strike the receiving vessel which may cause extensive damage to the load and occasionally even to the vessel itself.

In order to compensate for these difficulties it has been attempted to provide the inhaul and outhaul winches with automatic conventional devices incorporating elaborate control systems which act to reduce the sudden velocity changes encountered by the trolley and its load during rough sea conditions. However such attempts while necessitating extremely expensive and complicated systems have not proven completely effective.

One object of the present invention is to provide an apparatus for transferring material from one ship to another which is extremely simple and effective and at the same time permits a load to be transmitted from a supply ship to a receiving ship while reducing the danger of impact between the load and the terminal stations. Other objects will be apparent from the description herein.

SUMMARY OF THE INVENTION

The applicant has found that it is possible to dispense with the complicated inhaul and outhaul cables and winches and substitute therefor a self-propelled vehicle which travels along the highline at a velocity which may be readily controlled.

According to one aspect of the present invention there is provided in a station-to-station supply system, the combination of: first and second stations at least one of which is unstable and subject to random movement during operation of the system to vary the distance between the stations, load line means extending between the stations, load line adjustment means at one station operable to maintain generally constant tension in said load line, a load carrying vehicle supported on said load line means and including a vehicle drive wheel in driving engagement with said load line means and a drive motor operatively connectable to the drive wheel, and control means for the vehicle, said control means including means for detecting movement of said line towards said one station, said detecting means being operatively connected to said motor to reduce the speed of approach of the vehicle to the station when said line is moving towards said station and said line adjustment means is retrieving cable.

In a preferred embodiment of the present invention the line means is secured at said one end to the receiving station thus providing the conventional highline known heretofore. Since the highline is directly secured to the receiving vessel changes in distance between the receiving station and the supply station, which of course will cause changes in the length of the highline therebetween, are taken up by the line adjustment means on the supply station and therefore no lengthwise movement of the highline with respect to the receiving station can take place. Since the vehicle moves with a predetermined velocity with respect to the highline it also moves with a predetermined velocity with respect to the receiving ship which cannot be exceeded and thus possibility of damage to the load by striking the receiving station at an uncertain velocity is avoided. The line adjustment means as with the con-

ventional highline system suitably includes a winch means for continually retrieving or releasing cable dependent upon the demands of the highline due to the movement of the stations which winch means acts in conjunction with a ram tensioner.

While the present invention is applicable for use with any receiving station and supply station between which the distance is subject to random variation such as between a fixed receiving station and a randomly moving supply station as would occur on the transfer of material from a ship at sea to shore, it has particular application to supply stations and receiving stations both of which are subject to movement and in particular to the transfer of material from supply ships to receiving ships at sea. With the transfer of material from a supply ship to a receiving ship it will be readily realized that the highline may extend between posts, e.g. kingposts, on each of the ships and the self-propelled vehicle can be lowered to the deck of either ship from an upper load transfer position for unloading or loading by means of slidable blocks in the posts to which the highline is attached. Thus for loading and unloading the vehicle may be lowered to deck level and then for transfer of the load the blocks may be slid up the posts so as to raise the load substantially above deck level. However, when transferring from ship to shore usually there are no facilities for lowering the highline on the shore as it is normal to attach the highline to a strong point or mast therefore the vehicle is desirably provided with a hoist which is adapted to lower the load carried by the vehicle to the loading platform while the vehicle is maintained in its load transfer position.

In order to avoid the vehicle, travelling along the highline, from striking either of the terminal stations the apparatus suitably includes limit switches adapted to stop the vehicle at the end of its travel. Further, it will be readily realized that, when the vehicle is approaching the ship, if the distance between the supply station and receiving station suddenly decreases (so that the winch and ram tensioner system retrieves line) then even with the presence of a limit switch, the vehicle might strike that station at a speed higher than permissible. In order to avoid such a situation, the apparatus also includes a line direction sensing means, such as a transducer, which is adapted to automatically reduce or cancel the drive means on said vehicle if, when said vehicle is approaching said supply station the distance between the two stations shortens and line is being retrieved by the winch or ram tensioner, and only allow the vehicle to approach the receiving station when the line is stationary or running in the opposite direction. Further, as there is constant movement of the line at the end of the path adjacent the supply ship, it is desirable to have a releasable latch means so as to hold the vehicle stationary with respect to the supply station so as to facilitate loading.

The self-propelled vehicle suitably includes a drive wheel, adapted to be driven from an electric motor, if desired, through suitable clutch and gear means, so as to move along the highline. To provide for good traction between the drive wheel and the highline a pair of idler wheels is arranged, one on either side of the drive wheel so that the highline passes round the drive wheel in embracing contact with it. The self-propelled vehicle is also suitably provided with a brake system, the brakes preferably being energized when the motor is not driving for safety reasons so that, in the event of power failure the brakes would be energized and the vehicle would not move along the highline in an uncontrolled manner. The highline hangs in a catenary perforce, and therefore slopes downwards away from each point of support. The self-propelled vehicle is suitably controlled from the supply station via a cable carrying electric leads extending from the vehicle to a cable reel on the supply ship which cable reel is adapted to supply and reel in cable as the vehicle travels along the highline. The motor may be controlled manually from the supply ship as well as by the limit switches by the line direction sensing means, which suitably deactivate the motor and apply the brakes. The sensing means switches off the motor when the line is being retrieved, but allows it to be energized at other times.

According to a particularly preferred embodiment of the present invention there is provided an apparatus for conveying material from a supply ship to a receiving ship at sea, which ships are laterally spaced apart by a distance which due to the motion of the sea is subject to random variation, which comprises a cable extending between said ships, one end of said cable being fixedly secured to said receiving ship and the other end of said cable passing through sheave means and being connected to a winch through a ram tensioner mounted on said supply ship, which winch and ram tensioner are adapted to continually release or retrieve cable in accordance with a variation of said distance and thereby maintain a substantially constant tension in said cable, a self-propelled vehicle, including motor means and brake means, arranged to travel along said cable between said ships, said vehicle further including a drive wheel in driving engagement with said cable, means for actuating said motor means and brake means from said supply ship whereby to control the speed and direction of said vehicle along said cable, sensing means adapted to automatically stop said motor means and apply said brake means when said vehicle reaches each ship, a line direction sensing means adapted to automatically reduce the speed of said motor on said vehicle approaching said supply ship during periods in which said winch and ram tensioner is retrieving cable and releasable latch means on the supply ship adapted to retain said vehicle for the loading thereof.

In order to avoid any possibility of the supply station receiving any substantial shock from the self-propelled vehicle as the vehicle approaches the supply station, the supply station may suitably be provided with buffers to absorb any shock which occurs as the vehicle arrives at the end of the path at the supply station. When the vehicle reaches the supply station along the highline, the motor is de-clutched with the brakes in the off position to allow the highline to run back and forth through the wheels of the vehicle as the line is retrieved or released.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be further illustrated by way of the accompanying drawings in which:

FIG. 1 is a schematic representation of the apparatus according to one embodiment of the present invention;

FIG. 2 is a schematic circuit diagram of the motor drive and associated switching; and,

FIG. 3 is a drive mechanism for one of the switches of FIG. 2, partly in section.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1 of the drawings a heavy cable 3 is fixedly attached at one end thereof to a block 4 vertically slidable in a kingpost 5 on a receiving ship 2. The cable 3 extends from said block 4 to a supply ship 1 where it passes over a pulley 6 mounted for rotation on a block 7 vertically slidable in a kingpost 8 on said supply ship 1 and from the pulley 6 passes over idler pulleys 9 and 10 around a ram tensioner 11 to a winch 12.

The ram tensioner 11 is relatively fast-acting, is adapted to release or retrieve cable as the distance between the ships randomly varies due to the motion of the sea, and comprises a pair of pulleys 13 and 14 around which the cable 3 loops. The pulleys 13 and 14 are mounted in spaced relationship respectively on a piston rod 16 and cylinder 15. The winch 12 is manually or automatically operated also to retrieve and release cable to the ram tensioner 11 as required to maintain operation of the tensioner within selected limits and thus to prevent the tensioner bottoming. The arrangement described above comprises a conventional highline system.

A self-propelled vehicle 17 is arranged to run on the cable 3 by means of a drive wheel 18 driven by an electric motor 19 through a clutch (not shown) and a pair of idler wheels 20 and 21 on either side of the drive wheel, the cable 3 passing under the idler wheels 20 and 21 and over the drive wheel 18. The positioning of the idler wheels 20 and 21 with respect to the drive wheel 18 is such as to provide sufficient wrap of the cable 3 about the wheel 18 that the drive wheel 18 may obtain the desired traction on the cable 3 having regard to the load carried and the angle of the highline to the horizontal at the ends of its span. The drive wheel 18 and idler wheels 20 and 21 are mounted in a frame 22 from which is suspended a load 23 by means of a hoist 24 comprising an electric motor 25 and a load carrying hook 26. The motor 25 can lower and raise the load 23 from deck level on the supply or receiving ship 1 and 2 for loading and unloading to the level shown in the drawing at which it is transferred along the highline. Operation of the motor 25 may be effected from a switch 27 suspended from the frame 22. The use of the hoist 24 has particular application where either of the blocks 4 and 7 might not be vertically slidable.

Operation of the motor 19 is effected from the supply ship 1 from a console (not shown) via an electric cable 28 which passes from the vehicle 17 over a pulley 29 on the kingpost 8 to a cable reel 30 also mounted on the kingpost 8 and biased so as to automatically reel in cable and thus maintain a constant tension in the cable 28.

In order to avoid the self-propelled vehicle 17 striking the kingpost 5 or kingpost 8 upon the receiving ship 2 or supply ship 1 respectively under power from the motor 19 there are provided limit switches at each end of the cable 3. The limit switch adjacent the receiving ship 2 suitably is operated by a slight bulge 31 in the cable 3 arranged to trip a finger 32 carrying a pulley 33 in contact with the cable 3 so as to actuate a switch 34 which automatically switches off the motor 19 and applies brakes (not shown) to the vehicle 17. Similarly the limit switch 38 on the kingpost 8 adjacent the supply ship 1 is actuated by a slight bulge 35 in the cable 28 arranged to trip a finger 36 carrying a pulley 37 in contact with the cable 28, to switch off the motor 19 and apply the brakes on the self-propelled vehicle 17.

In order to avoid the self-propelled vehicle 17 striking the kingpost 8 with increased speed due to the winch 12 and ram tensioner 11 taking in cable when the ships 1 and 2 are approaching each other, a line-direction sensing transducer 39 is provided which is in contact with the cable 3 and is adapted via the console and the cable 28 (see FIG. 2) to prevent the motor 19 on the self-propelled vehicle 17 from operating when that vehicle is approaching the kingpost 8 and the cable 3 is being taken in, but to allow the motor 19 to restart when the cable 3 is being released by the winch 12 and/or the ram tensioner 11.

To retain the self-propelled vehicle 17 adjacent the supply ship 1 for loading and unloading and at the same time allow for the motion of the cable 3 with respect to the vehicle 17, a latch mechanism is provided comprising a latch 40 located on the sliding block 7 in the kingpost 8 and adapted to be raised and lowered by means of a ram 41 which thus retains or releases according to the position of the latch 40, a bar 42 located in uprights 43 on the self-propelled vehicle 17. The vehicle is maintained with its brakes in the released position and motor de-clutched when in the latch, by suitable control from the console (not shown).

In operation the self-propelled vehicle 17 lying adjacent the supply ship 1 and in the latch is loaded at deck level with the load 23 and the load 23 then raised, by the hoist 24 or the block 7 in the kingpost 8 to the level shown for transfer. The loaded vehicle 17 is then released from the latch by actuation of the ram 41 and the motor 19 started from the console via the cable 28. The vehicle 17 then proceeds along the cable 3 towards the supply ship 1 until the finger 32 and its associated pulley meets the bulge 31 whence the limit switch 34 cancels the motor 19 and applies the brakes so that the vehicle 17 coasts slowly in to lie adjacent the kingpost 5 on the receiving ship 2.

For unloading the vehicle the hoist mechanism 24 is operated or the sliding block 4 is moved downwards to lower the load 23. After removal of the load the block 4 is raised or the hoist mechanism 24 is again operated to lift the hook 26 to the transfer position. The motor 19 is then actuated once more from the console and the vehicle 17 travels back towards the supply ship 1 and provided that cable 3 is not being taken in by the winch 12 or the ram tensioner 11 the vehicle 17 continues to approach the supply ship 1 until the bulge 35 on the cable 28 actuates the limit switch 38. This switches off the motor 19 and the vehicle 17 coasts in to lie adjacent the kingpost 8 on the supply ship 1 to be held there by means of the hook 40 accommodating the bar 42 in the latch. On the other hand, if, on approach, as the vehicle approaches the supply ship 1, the highline 3 is being taken in by the winch 12 or ram tensioner 11, the line senser 39 through the cable 28 will switch off the motor 19. Only when line 3 ceases to be taken in 3 will the motor 19 automatically be restarted to allow the vehi-

cle 17 to continue its approach to the supply ship 1. When the vehicle 17 is in the latch adjacent the supply ship 1 the brakes of the vehicle are placed in the off to allow the cable 3 to run freely between the idler wheels 20 and 21 and the drive wheel 18 of the vehicle and the loading of the vehicle 17 is effected in a similar manner as the unloading in the receiving ship 2.

FIG. 2 shows an example of suitable circuitry for driving the motor 19. The cable wound up on the take up winch 30 is supplied from a DC generator 50 through a reversing switch 51, an on-off switch 52 and a variable resistance 53. In series are limit switches 34 and 38, and an on-off switch 54 driven by a shaft 55 in which is interposed friction clutch means 56 driven from a pulley 57 running on the highline 38. Details of friction clutch 56 are described later but its essential purpose is to swing the moving contact 60 of switch 54 away from fixed contact 61 when the line 38 moves in a direction towards the station 1 but to allow contact 54 to engage contact 61 when the cable 38 moves past sensor 39 in the opposite direction or when the cable is substantially stationary. If motor 19 is a DC motor, the direction of movement of the vehicle 17 will be determined by the positioning of reversing switch 51, it will be actuated on closing of switch 52, which may usefully form part of the variable resistance 53 as a speed control having an off position at the end of its travel.

Since it is undesirable that the vehicle should be stopped while when away from station 1 merely because of movements of station 1 in a direction towards station 2, switch 54 is shunted by a further switch 65 operated from pulley 29 which drives, through suitable gearing, a threaded member 66 having a nut runner 67 thereon which in turn engages and lifts the movable contact 68 of switch 65 at that end of its travel which corresponds with the proximity of vehicle 17 to the station 1. At all other positions of the vehicle 17, the switch 65 shunts the switch 54 rendering the vehicle under the control only of the remaining circuitry. A second shunting switch 75 is operated by reversing switch 51 to prevent cut-off of the motor drive when the reversing switch is so oriented that the vehicle is travelling away from station 1.

FIG. 3 shows in some more detail a suitable arrangement for switch 54 in its drive. The movable contact 60 is spring biassed normally into connection with fixed contact 61 and the moving contact shaft is coupled through a viscous fluid clutch 70 to wheel 57. Depending upon the viscosity of the fluid, rotation of wheel 57 in one direction will move the contact 60 away from contact 61 against the action of the biassing spring but when the pulley comes to rest or moves in the opposite direction, the contact 54 will be brought either by its spring or by the pulley movement, respectively, into connection with contact 61.

As an alternative, those skilled in the art will appreciate that switch 54 might be replaced by a polarized relay operated either directly or with interposed circuitry from a DC generator driven by wheel 57. By using a polarized relay, and if necessary, with bias current in the relay, the relay can be chosen to close when the movement of cable 38 past wheel 57 is in one direction or stationary, or up to a chosen speed in the opposite direction and made to open when this speed in the opposite direction exceeds the chosen value. Other arrangements may employ electronic circuitry for instance in which the generator is replaced by a potentiometer followed by a differentiating circuit. When the rate of change of voltage developed by the potentiometer exceeds a certain value in a given direction, a relay operated switch interposed in place of switch 54 could be made to open. If desired the signal produced by the generator or potentiometer may be passed through an integrator circuit so that minor small movements of the highline towards station 1 (occassioned when the ram tensioner is taking up cable) will not deactivate the motor 19 but large movements such as when the winch 12 takes up cable will cause deactivation. These and other directional or polarity sensitive devices are within the knowledge of those skilled in the art. Similarly in some instances it may be satisfactory merely to reduce rather than cut off the drive to the motor when the line is being retrieved. A suitable known type of controllable variable conductance means might then replace the switch 54 or relays described above. In other cases the output of source 50 might be reduced or be switched off.

Although limit switches 34 and 38 have been shown to be operated by enlargements 31 and 35 in the respective cables 3 and 28, it will be apparent too that in instances where the cable may be required to fit tightly around small pulleys or winches when not in use, it will be desirable to employ some other form of switch operating means. A coil spring around the cables 3 and 28, abutting against kingposts 5 and 7 respectively, which will engage actuating arms for switches 34 and 38 would suffice. Use of springs in such instance, could also be part of any additional buffing gear arranged between the vehicle 17 and the kingposts to prevent any untoward collision due to very excessive movement of the station 1 and 2 towards one another or unexpectedly violent sea conditions.

It will be understood too that the limit switches might be replaced by circuitry adapted to detect the approach of the vehicle to the respective stations, for instance, operated by a sensor which determines the quantity of cable paid out or taken up by reel 30.

It is important to note that by wrapping the highline 3 around the driving and idler pulleys 19, 20 and 21, excellent grip between the drive and the highline is achieved even in conditions in which the vehicle 17 must mount at a steep angle to the receiving station such as when the highline 3 is long and the catenary is of considerable amplitude. In practice a wrap angle of 123° is an example which enables a design load of 5000 pounds to be transferred at a speed of 95 feet per minute against 2000 pound tractive force with a highline tension of 12,500 pounds. This still enables a tractive force of 2000 pounds to be obtained with a highline tension of only 6,500 pounds. In practice a highline tension of 10,000 is satisfactory.

While the circuit of FIG. 2 has been shown by way of example only, those skilled in the art will understand that motors 19 and 25 should have as high a power to weight ratio as possible since any saving in tare weight of the vehicle 17 can be passed on as load carrying capacity. Thus the motors usefully could be 3 phase 400 Hz and driven for instance by a variable frequency motor generator set as a speed control.

I claim:

1. In a station-to-station supply system, the combination of: first and second stations at least one of which is unstable and subject to random movement during operation of the system to vary the distance between the stations, load line means extending between the stations, load line adjustment means at one station operable to maintain generally constant tension in said load line, a load carrying vehicle supported on said load line means and including a vehicle drive wheel in driving engagement with said load line means and a drive motor operatively connectable to the drive wheel, and control means for the vehicle, said control means including means for detecting movement of said line towards said one station, said detecting means being operatively connected to said motor to reduce the speed of approach of the vehicle to the station when said line is moving towards said station and said line adjustment means is retrieving cable.

2. A system as defined in claim 1 said control means being operative to stop said motor upon movement of said line towards said one station.

3. A system as defined in claim 1 said detecting means including means running on said line for determining movement of said line with respect to said one station, current changing means in series with said motor and means operatively connecting said running means and said current changing means.

4. A system as defined in claim 3, said current changing means comprising circuit interrupting means.

5. A system as defined in claim 4 said circuit interrupting means comprising a switch.

6. A system as defined in claim 1 in which said self-propelled vehicle includes means for deflecting said line over said drive wheel for maintaining required traction grip on said cable for said drive wheel, and brake means for said drive wheel.

7. A system as defined in claim 1 in which the line means has one end thereof secured to said first station and said line adjustment means is at said second station and secured to the other end of the line means.

8. A system as defined in Claim 1 in which said line adjustment means comprises a winch and a ram tensioner for taking up and releasing line.

9. A system as defined in claim 1 in which said stations are a supply ship and a receiving ship.

10. A system as defined in claim 7 in which said line means comprises a cable fixedly attached at one end to said receiving ship and said line adjustment means is on said supply ship and further including means for automatically stopping said vehicle when it approaches adjacent each station.

11. A system as defined in claim 10 including releasable latch means on said supply ship for retaining said vehicle with respect to said supply ship.

12. An apparatus for conveying material from a supply ship to a receiving ship at sea, which ships are laterally spaced apart by a distance which due to the motion of the sea is subject to random variation, which comprises a cable extending between said ships, one end of said cable being fixedly secured to said receiving ship and the other end of said cable passing through sheave means and being connected to a winch through a ram tensioner mounted on said supply ship, which winch and ram tensioner are adapted to continually release or retrieve cable in accordance with a variation of said distance and thereby maintain a substantially constant tension in said cable, a self-propelled vehicle, including motor means and brake means, arranged to travel along said cable between said ships, said vehicle further including a drive wheel in driving engagement with said cable, means for actuating said motor means and brake means from said supply ship whereby to control the speed and direction of said vehicle along said cable, sensing means adapted to automatically stop said motor means and apply said brake means when said vehicle reaches each ship, a line direction sensing means adapted to automatically reduce the speed of said motor on said vehicle approaching said supply ship during periods in which said winch and ram tensioner is retrieving cable and releasable latch means on the supply ship adapted to retain said vehicle for the loading thereof.

13. An apparatus as defined in claim 12 in which the line direction sensing means is a transducer.

14. An apparatus as defined in claim 12 the line direction means being adapted to de-energize said motor.

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