Feb. 26, 1963 E. O. NAUD 3,079,008

HOISTING AND CONVEYING APPARATUS

Filed Aug. 15, 1960

4 Sheets-Sheet 1

Fig. 1.

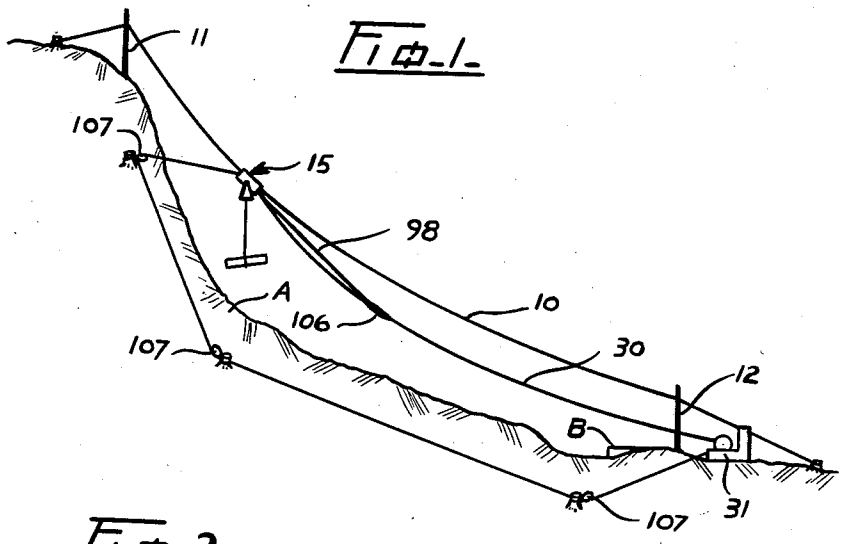
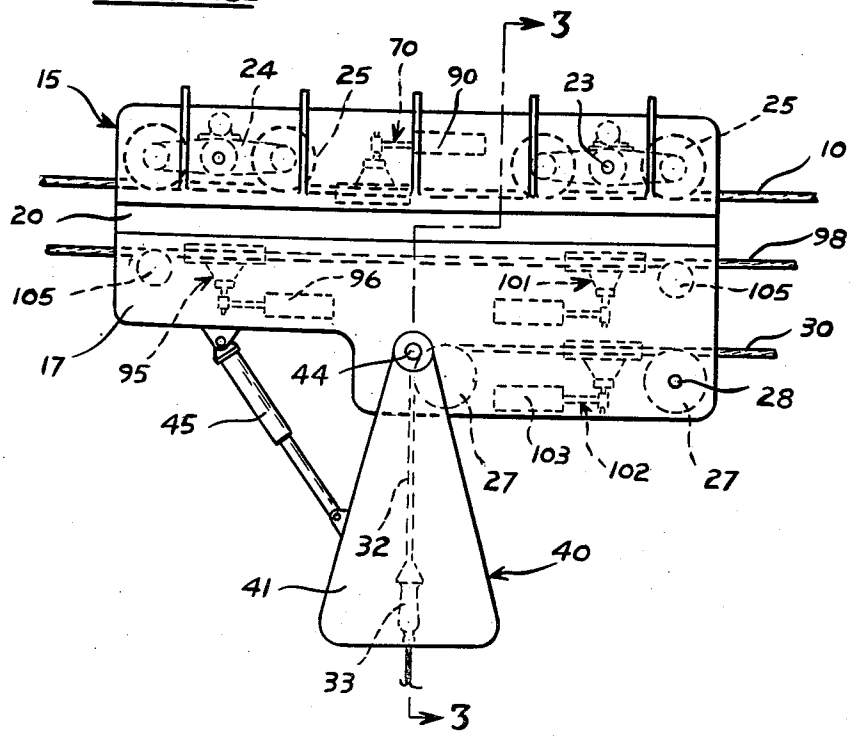


Fig. 2.



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HOISTING AND CONVEYING APPARATUS

Filed Aug. 15, 1960 4 Sheets-Sheet 2

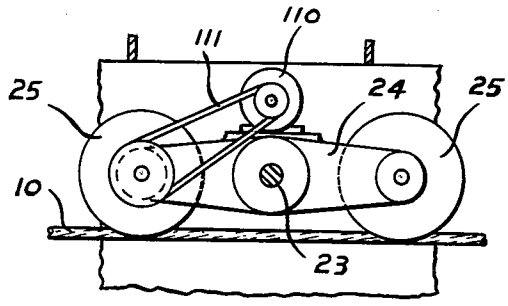


FIG. 4

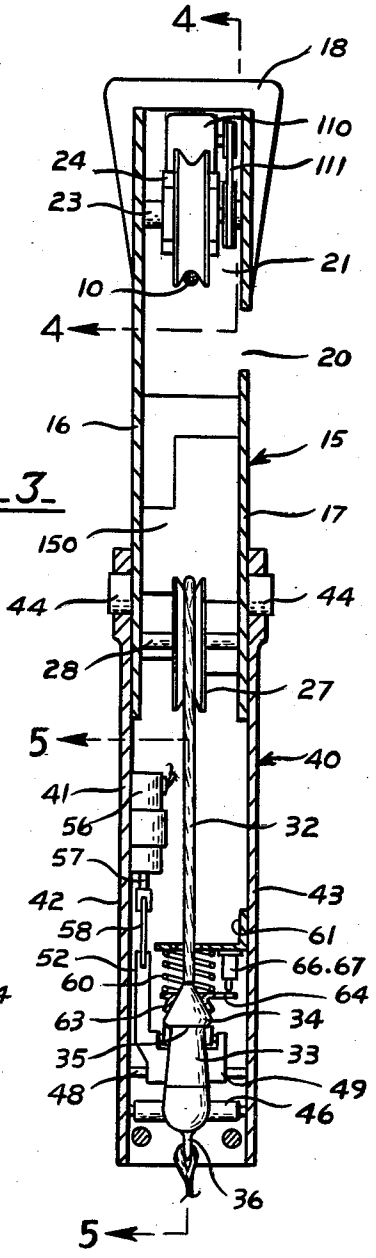
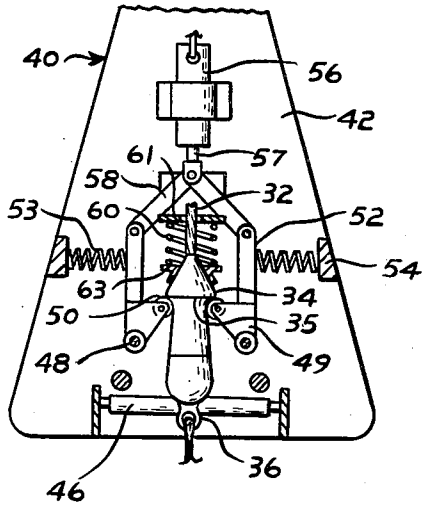


FIG. 3

FIG. 5



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HOISTING AND CONVEYING APPARATUS

Filed Aug. 15, 1960 4 Sheets-Sheet 3

Fig. 7

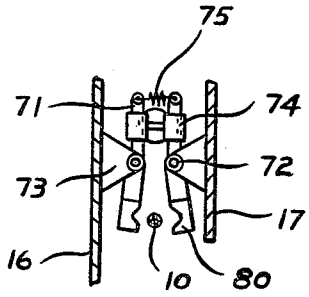


Fig. 6

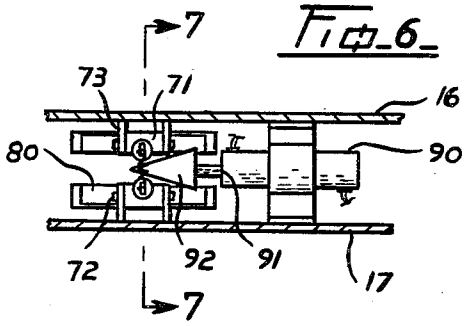


Fig. 8

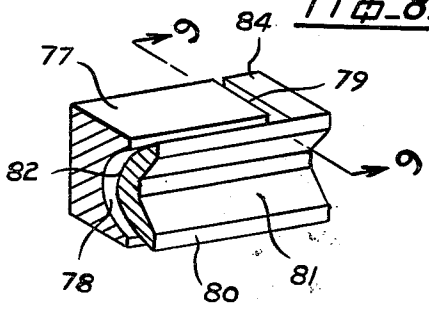


Fig. 9

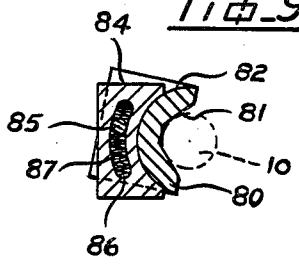
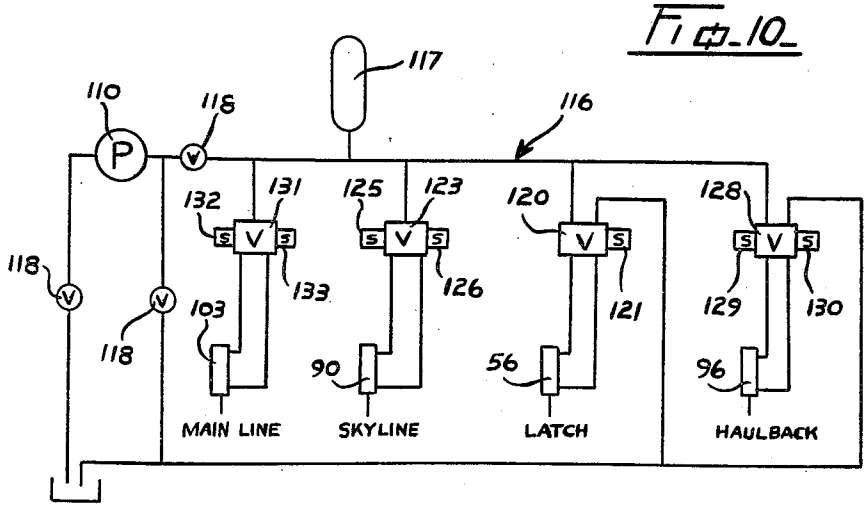


Fig. 10

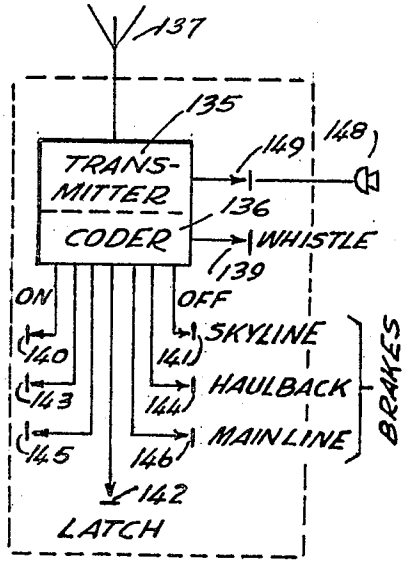


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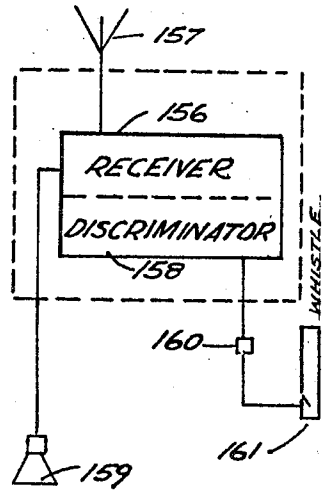
HOISTING AND CONVEYING APPARATUS

Filed Aug. 15, 1960 4 Sheets-Sheet 4



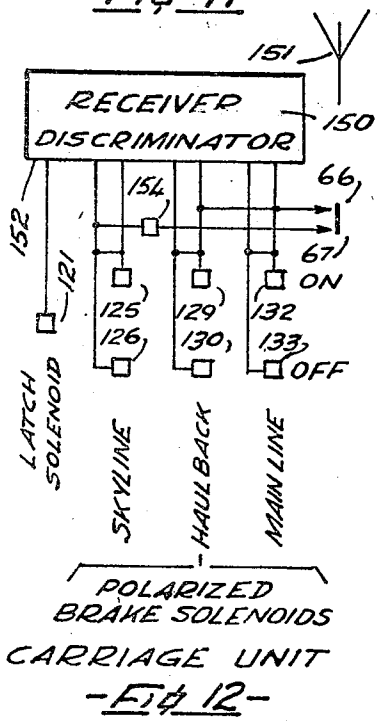
CONTROL UNIT

-Fig 11-



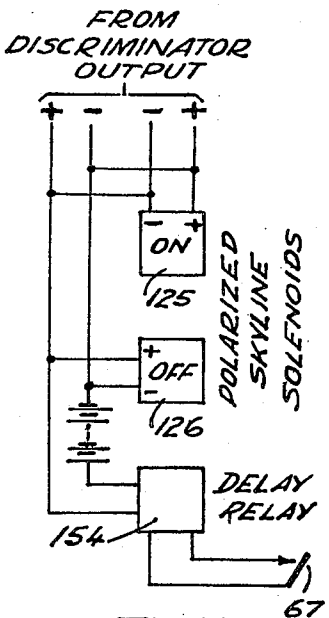
WINCH UNIT

-Fig 13-



CARRIAGE UNIT

-Fig 12-



-Fig 14-

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United States Patent Office 3,079,008
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3,079,008
HOISTING AND CONVEYING APPARATUS

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Filed Aug. 15, 1960, Ser. No. 49,496
9 Claims. (Cl. 212—94)

My invention relates to apparatus for lifting a load clear of ground obstructions, transporting the same by means of a carriage adapted to travel along a cable called a skyline, which cable is suitably supported throughout its length, and for lowering the load at a desired position.

Such apparatus has particular application to logging operations.

Previously the load movements have been effected by means of additional cables operated by a power winch suitably located near one end of the skyline, and difficulty arises in connection with pulling the slack in the operating cables before the load is hoisted to the carriage.

As well, with some such devices it is difficult to pass the necessary signals to the winch operator, these difficulties with increase in danger of damage to the equipment, and danger of loss of life and limb, are enhanced when the load is to be transported for considerable distances. Thus there have been numerous improvements, such as automatic and semi-automatic control of certain phases of the operation, devised to reduce the difficulty and danger.

The objects of my invention are to simplify the operation, to increase the safety factor to the extent that men may be transported thereby from one part of the site to another, and to provide remote control means for the various functions.

In my invention these objects are attained by employing a simplified cable system resulting from joining the two operating cables, the main line cable and the haulback cable, and effecting that the former may accomplish the load lifting function. Automatic operational and safety features are provided, with overall control of certain functions by portable radio transmitter to which a suitable receiver and decoder, on the carriage, is responsive.

The attainment of these and other objects of the invention will be understood from a consideration of the specification with reference to the drawings in which:

Referring to the drawings,

FIGURE 1 is a diagram showing schematically the carriage employed on a typical logging operation.

FIGURE 2 is an elevation of the carriage.

FIGURE 3 is a section taken on line 3—3 of FIGURE 2.

FIGURE 4 is a section taken on line 4—4 of FIGURE 3.

FIGURE 5 is a section taken on line 5—5 of FIGURE 3.

FIGURE 6 is a plan view, part in section, of the skyline brake.

FIGURE 7 is a transverse section taken on line 7—7 of FIGURE 6.

FIGURE 8 is a perspective view of an end portion of the brake.

FIGURE 9 is a section taken on line 9—9 of FIGURE 8.

FIGURE 10 shows the hydraulic circuits schematically.

FIGURE 11 is a block diagram of the radio control unit.

FIGURE 12 shows the carriage receiver unit.

FIGURE 13 shows the winch receiver unit.

FIGURE 14 shows a typical circuit of the polarized solenoids.

Like characters of reference refer to corresponding parts in each figure.

The numeral 10 indicates an overhead cable, or skyline, which is shown in FIGURE 1 as being suspended between the spar trees 11 and 12 of a sidehill logging operation. The skyline forms an overhead track for a carriage 15, which, see FIGURE 3, consists of spaced side plates 16 and 17 connected by transverse members 18. A longitudinal slot 20 is formed in the side plate 17 and said slot communicates with a channel 21 provided in the upper portion of the carriage 15. Adjacent each end of the carriage a shaft 23 extends across the channel 21 and rockingly mounted on said shaft is an arm 24. A pair of tandem sheaves 25 is fitted to each arm so as to ride upon the skyline 10.

At the bottom of the carriage 15, two sheaves 27 are journalled on shafts 28 and trained over said sheaves is the main line 30. The main line 30 extends to a winding drum on a power driven winch or donkey 31, which suitably is located in the vicinity of the spar tree 12, and the free end of said main line depends vertically from the carriage 15 to provide a portion 32 which is fitted with a weighted member 33. The member 33 has, on its upper end, a cone 34 which defines an annular stop 35 and fitted to the lower end of said member 33 is a clevis 36 to which the log load is adapted to be attached.

Said clevis 36 is supported within the member 33 upon, suitably, the inner race of a tapered roller thrust bearing the outer race of which seats within 33, thus said clevis is free to rotate with respect to 33, which obvious arrangement is not shown in the figure.

In the raised position the member 33 is secured to the carriage 15 by means of a latch 40 which has a triangular frame 41 made up of connected side members 42 and 43. The side members are rockingly mounted on laterally projecting trunnions 44 carried by the carriage and said members are preferably connected to the carriage side plates by hydraulic dampers 45. At the bottom of the frame 41 four rollers 46 are mounted to provide a fairlead through which the main line 30 extends. The members 42 and 43 are connected by longitudinally spaced shafts 48 which rockingly support latch blocks 49 and mounted on said blocks are opposing rollers 50. Adjacent the side member 42 each block is fitted with an upwardly extending arm 52 and a spring 53 is interposed between said arm and a part 54 of the frame 41. A hydraulic cylinder 56 is secured to the member 42 and its piston rod 57 is hingedly connected to the upper ends of the arms 52 by a pair of diverging links 58.

As the weighted member is drawn upwardly into the frame 41 by the main line 30 the cone 34 abuts the rollers 50 and forces apart the spring-pressed blocks 49. When the annular stop 35 is subsequently engaged by the roller, the member is latched against withdrawal from the frame and can only be released by the cylinder 56, the operation of which will be later described.

In order to limit the upward movement of the weighted member, a coil spring 60 is secured beneath a bracket 61 which projects inwardly from the side member 43.

The spring 60 is fitted on its lower edge with a conical socket 63 which receives the cone 34 and the socket is fitted with a laterally projecting finger 64. Depending from the underside of the bracket 61 is a dual limit switch comprising two elements 66 and 67. As the spring 60 is compressed by the upwardly moving cone 34, the position of the finger 64 is such that said dual switch is closed by said finger. The functions of the limit switches, and their operating circuits, will be described later.

With the channel 21 the carriage is provided with a brake adapted to grip the skyline 10 and generally indicated by the numeral 70. As best shown in FIGURE 7, said

brake is formed by a pair of opposing arms 71 which are rockingly mounted on pins 72 carried by bearings 73 rigidly attached to the side plates 16, 17. The arms 71 are fitted with tubular rollers 74 and above said rollers the arms are connected by a spring 75. The lower ends of the brake arms are fitted with horizontal bars 77 having arcuate inner faces 78 and end faces 79. Each bar 77 is fitted with a brake shoe 80 having a V-shaped cable engaging face 81 and an arcuate outer face 82. The ends 84 of the brake shoes overlap the end faces 79 of the bars and said ends are fitted with removable pins 85 which project into arcuate slots 86 formed in the end faces of the supporting bars. Springs 87 are mounted in the slots 86 above and below the pins 85. By securing the brake shoes to the bars in this manner the shoes will move relative to the bars should the carriage swing transversely of the skyline when the brake is applied.

Mounted in the upper portion of the carriage 15 is a double acting hydraulic cylinder 90 having a horizontally disposed piston rod 91 which is fitted with a wedge 92. As shown in FIGURE 6 the tip of the wedge is disposed between the rollers 74 so that when the cylinder is pressurized to project its rod 91, the wedge engages the rollers and swings the arms 71 about their pivots to apply the brake to the skyline. Release is effected by pressurizing the opposite side of the double acting cylinder 90, so causing the piston rod 91 to move in the opposite direction.

A similar brake 95, see FIGURE 9, is mounted in an inverted position in a lower part of the carriage 15. This brake is applied by means of a hydraulic cylinder 96 and is adapted to grip the haulback line 98.

Said brake 95 is duplicated and suitably is placed at 101 also to operate on the haulback 98, both said brakes acting simultaneously.

As well, within the lower part of the carriage 15, also in inverted position, spaced between the sheaves 27 is a main line brake 102 of the same construction as the brakes 70 and 95 aforesaid, which brake 102 is operated by a cylinder 103. Means of controlling these three brake systems are described later.

The haulback line 98 is trained over sheaves 105, carried within the carriage, and one end of the line is spliced as at 106 to the main line, as shown in FIGURE 1 only. From the carriage, the haulback line extends around suitably located blocks 107 thence back to a second winding drum on the donkey 31.

The several above mentioned cylinders are supplied with fluid pressured by a pump 110 which is mounted on one of the arms 24, see FIGURE 4. The pump is belt and pulley connected as at 111 to the shaft supporting one of the sheaves 25. Thus, as the sheaves roll over the skyline, the pump is driven thereby.

A hydraulic circuit 116, is provided for the pump which circuit includes various elements which are shown in FIGURE 10 only. These elements include a pressure accumulator 117 and the necessary valves 118 for maintaining fluid pressure in the accumulator at a predetermined level.

The latch cylinder 56 is provided with a valve 120 operated by a solenoid 121 and said valve is returned to normal position by a spring. Valve 123 admits fluid to either side of the cylinder 90 of the skyline brake 70. Solenoid 125 operates upon valve 123 to admit fluid to urge the piston rod 91 (FIGURE 6) outwards to engage the skyline brake. Solenoid 126 is energized to act upon the valve 123 to admit fluid to the cylinder 90 to cause the piston rod 91 to withdraw so releasing the brake. A similar valve 128 having solenoids 129 and 130 is connected to the cylinder 96, so engaging and releasing the haulback brake 95. The cylinder of the duplicate haulback brake 102 is similarly operated by a valve and solenoids in parallel with 129 and 130, which duplicate valve and solenoids are not shown. In the same manner valve 131 is operated by the solenoids 132 and 133 to set and release the mainline brake cylinder 103.

The skyline carriage brakes and latch hydraulic operating means are controllable by radio means such as shown by the block diagrams of FIGURES 11, 12, 13 and 14. Suitably all electronic units are transistorized.

The control unit FIGURE 11, of which more than one normally are required, comprises a portable radio transmitter 135 adapted to transmit tone function signals and voice, and provided with a coder 136 and antenna 137. Control push button switches 139 through 146 supply information to the coder 136, and voice may be transmitted via a microphone 148 upon closing a microphone switch 149. The unit is inoperative unless a master switch (not shown) is closed so that no signal can be transmitted by closing a single push button switch. All push button switches aforesaid are of normal off type, and the limit switches 66, 67 also are normal off type.

Mounted within the skyline carriage 15 is the receiver 150, FIGURE 12 having an aerial 151 and the discriminator 152, output circuits of which are such as to supply 12 volts D.C. to actuate the various previously mentioned solenoids.

Power to operate this unit, as well as the associated circuits, is from a 12 volt storage battery chargeable from the output of a suitable generator not shown, attached and driven in the same manner as illustrated in FIGURE 4 with respect to the hydraulic pump 110, said generator being mounted upon the tandem sleeve assembly which does not carry the pump.

Also shown in FIGURE 12 are the dual limit switches (NO) 66—67 which are mechanically operated by the upper cone 34, as has been explained with reference to FIGURE 3.

Switch 66 is connected to solenoids 129 and 132 to operate the same and engage the haulback brake and main line brake independently of the electronic control. Switch 67 is connected to a delay relay 154 the output of which is connected to solenoid 126 actuating the skyline brake release independently of the electronic control. The delay introduced by relay 154 is some two or three seconds, thus the limit switches aforesaid operate to apply the haulback brakes and the main line brake some seconds before release of the skyline brake.

FIGURE 14 shows details of the circuitry associated with the skyline solenoids and the carriage limit switch 67. Skyline solenoids 125, 126 are polarized, that is to say, suitably each may comprise a polarized relay part actuating a solenoid part. When limit switch 67 is closed by mechanical action as previously explained, the polarized solenoid 126 is energized placing skyline control valve 123 (FIGURE 10) in the brake off position, and said valve remains in the off position so long as limit switch 67 is closed, or until other action, which will now be described, occurs.

When the skyline on solenoid 125 is energized by radio means previously described, limit switch 67 still being closed, the discriminator output to 125, also feeds 126, but, as shown, at opposite polarity. Hence the voltage now applied to 126 is zero and it, accordingly, is de-energized.

When 125 is energized by radio means, 67 being open, then the discriminator voltage on 126 is of opposite polarity to that required to energize the same.

Haulback solenoids 129, 130, and main line solenoids 132, 133 also are polarized. Circuits similar to FIGURE 14 are employed, arranged so that these brakes may be released by radio control notwithstanding limit switch 66 is closed, in manner analogous to that described above.

A second radio receiver 156 having an antenna 157 and a discriminator 158 is mounted in the power driven winch 31. The circuits of this receiver include a loudspeaker 159, and a solenoid 160 actuating an air or steam whistle 161.

Radio controlled functions, by tone command from one

or more transmitters, effected by the carriage receiver 150 electronics are seen to be:

Pushbutton 140, skyline brake on;
Button 141, skyline brake off;
Button 142, latch release to cause load or line to descend;
Button 143, haulback brake on;
Button 144, haulback brake off;
Button 145, main line brake on;
Button 146, main line brake off;

Commands to the winch operator may be given by whistle, operated by pressing button 139, or by voice by pressing button 149.

The winch operator, in response, may move the main line 30, or the haulback line 98. The following action is automatic: As the load, or line, having left the ground rises to the carriage 15, the haulback brakes and the main line brake are automatically applied and, some seconds thereafter, the skyline brake is automatically released.

The operation of the skyline carriage is as follows, assuming the device is being used to haul logs from the area marked "A" in FIGURE 1 to a point marked "B." In this case the man in charge of loading and the man in charge of unloading are each equipped with a transmitter control unit 135, FIGURE 11. The push buttons 139 et seq. of the transmitter, when closed, actuate the coder 136 to transmit a tone signal corresponding to a specific function which the carriage is required to perform. This signal is picked up by the carriage receiver 150 the discriminator 152 of which decodes the signal and energizes the appropriate solenoid.

The winch operator runs the carriage out to area "A," the loader presses button 139 to sound the whistle 161 and signal stop, then presses button 140 to apply the skyline brake 70. At this time the splice 106 will be say, 500 feet from the carriage and downhill therefrom. The loader presses button 144 to release the haulback brake 95, then button 142 to release the latch 40, then whistle button 139 to signal the winch operator to pay out the main line. Since the haulback 98 is secured by splice 106 to the main line 30, this lowers the member 33 to ground level to permit the log load to be attached, the weight 33 being such as will accomplish this. Whistle button 139 is actuated to signal when the load is to be raised, whereupon the winch operator hauls the main line drawing 33 up to the carriage. Upon member 33 reaching the carriage, it is automatically latched as has been explained. Compression of the spring 60 closes switch 66 to apply the haulback and main line brakes simultaneously, and at the same time closes switch 67. Approximately two seconds later, solenoid 126 energizes and causes release of the skyline brake 70. The carriage may now be moved to point "B" where the unloader takes over and, by similar use of his transmitter, controls the carriage to apply the skyline brake, release the main line and haulback brakes, release the latch, and thus permit the load to descend.

The microphone switch 149 being closed, at any time either transmitter 135 may speak directly to the winch operator via the loudspeaker 159.

The apparatus is here shown being used to collect logs from a steep incline with the winch located at the foot of the incline. In this position the slack in the main line, which slack permits the weighted member to be lowered to ground level, is obtained by winding in the haulback line in the manner described above. However it is pointed out that the required slack can be obtained equally as well with the apparatus rigged so that the winch is disposed at the top of the incline, or alternately with the skyline extending across a slope in which deep valleys or other depressions are formed. Slack may be pulled in the main line over any type of terrain, this has hitherto been impractical with conventional apparatus.

It will be noted that the spring 60 serves to eject the member 33 from the frame 41 when the latch 40 is released. The thrust thus exerted by the spring starts the main line running over its sheaves, so that said line may be lowered to pick up a load without the need for the weighted member 33 to be extremely heavy.

The haulback line and the main line may lead from suitable separate drums of a winch, but the subject apparatus is operable from one drum only and in certain settings this mode of operation is preferable.

In some circumstances it may be desirable to have the main line and haulback brakes operate in unison, and in other instances it may be desirable that the latch release be actuated simultaneously with both brakes.

By ganging the concerned function switches of the control unit, any desired group of available actions may be effected by the pressing of a single button.

The invention is capable of a number of modifications and alternative constructions. There is shown in the drawings and described hereinabove in detail a preferred embodiment.

It is however to be understood that the subject invention is not limited thereto, but is intended to cover such modifications and alternative constructions as fall within the spirit and scope of the invention as expressed in the description, illustrated by the drawings, and as set forth in the appended claims.

What I claim as my invention is:

1. In a hoisting and conveying apparatus, the combination with a skyline, a carriage mounted on the skyline and a source of haulage, of a main line extending from the source of haulage to the carriage passing through the same and terminating in means adapted for attachment to a load, said main line being adapted to move the carriage along the main line in one direction, a haulback line extending from the source of haulage, thence through the carriage and terminating in a splice on the main line, a first brake system upon the carriage adapted to grip the skyline, a second brake system upon the carriage adapted to grip the haulback line whereby the carriage may be moved along the skyline in the opposite direction and remote controlled means for independently operating each brake system.

2. Structure as claimed in claim 1, wherein the carriage has a third brake system adapted to grip the main line.

3. Structure as claimed in claim 2, wherein each brake system includes cooperating electric circuits and hydraulic circuits, said hydraulic circuits having solenoid operated control valves, said electrical circuits having a normally open dual contact switch adapted to be actuated in response to the load attachment means engaging the carriage, one contact of the switch when closed energizing solenoids to operate valves and apply the main line and haulback brakes, the other contact when closed energizing a solenoid to operate a valve and release the skyline brake.

4. Structure as claimed in claim 3, wherein a relay is included in the electric circuits to delay the release of the skyline brake.

5. Structure as claimed in claim 1, wherein each brake system includes a pair of opposing arms, each of said arms being mounted on a pivot disposed intermediate the length of said arm, a brake shoe fitted to one end of each of said arms and having limited rocking movement in the plane of said arms, said brake shoes having V-shaped cable engaging faces and means for rocking the arms about their pivots to move the shoes into clamping engagement with the cable.

6. Structure as claimed in claim 5, and spring means urging the brake shoes away from the cable.

7. Structure as claimed in claim 5, wherein the arm rocking means is a hydraulic cylinder having a piston rod fitted with a wedge, the wedge being disposed between the ends of the arms remote from the brake shoes.

8. Structure as claimed in claim 1, and means on the carriage for latching the load to said carriage, means for

releasing the latching means and remote controlled means for actuating the latch releasing means.

9. Structure as claimed in claim 1, wherein the main line which terminates in the load attachment means is provided with a weighted member having a stop, a pair of pivotally mounted latch blocks adapted to engage the stop, hydraulically operated means for rocking the latch blocks about their pivots to disengage the stop and remote controlled means for actuating the hydraulically operated means.

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