

[54] **AERIAL LOGGING SYSTEM**

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[51] Int. Cl. **B66c 19/00**

[58] Field of Search **212/71; 104/22**

[56] **References Cited**

UNITED STATES PATENTS

3,346,127	10/1967	Pelton et al.	212/71
3,221,897	12/1965	Matheson	212/71
3,268,210	8/1966	Wilson	254/185 AB
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3,249,237	5/1966	Stewart	212/71 X

3,300,188 1/1967 Thompson254/185 AB

Primary Examiner—Harvey C. Hornsby

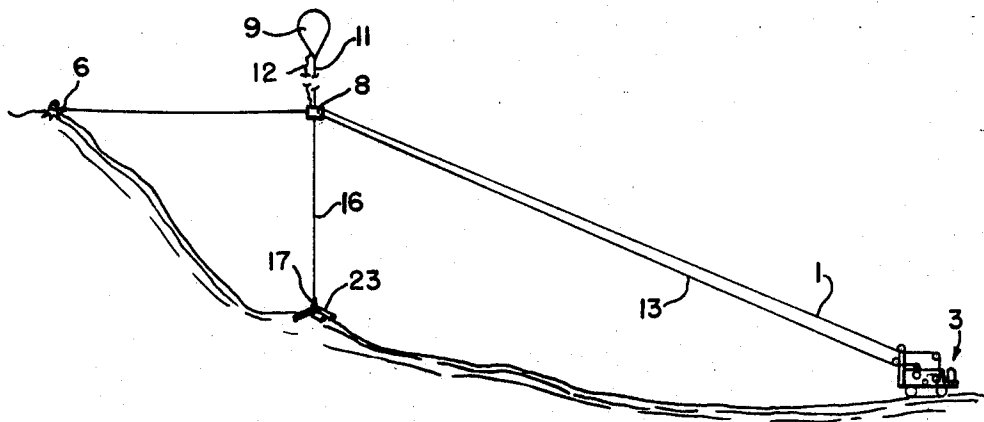
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[57] **ABSTRACT**

An aerial logging system for logging inclined terrain wherein a static lift balloon is anchored to a carriage engaged on a skyline which may be extended from an uphill point to a yarder drum at the landing. The skyline thus becomes inverted, having an apex at the point where the lift of the balloon is applied. A main line is used to haul the carriage downhill and the lifting force of the balloon moves the carriage uphill as the carriage seeks a natural apex along the skyline, a braking force being applied to the main line to control the speed of the carriage as it returns uphill. The lifting line and chokers are depended from the carriage.

11 Claims, 5 Drawing Figures



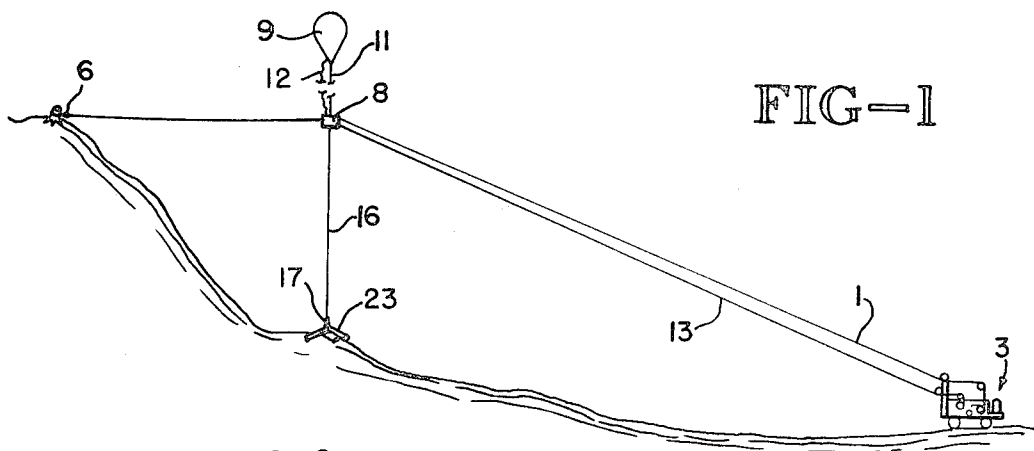


FIG-1

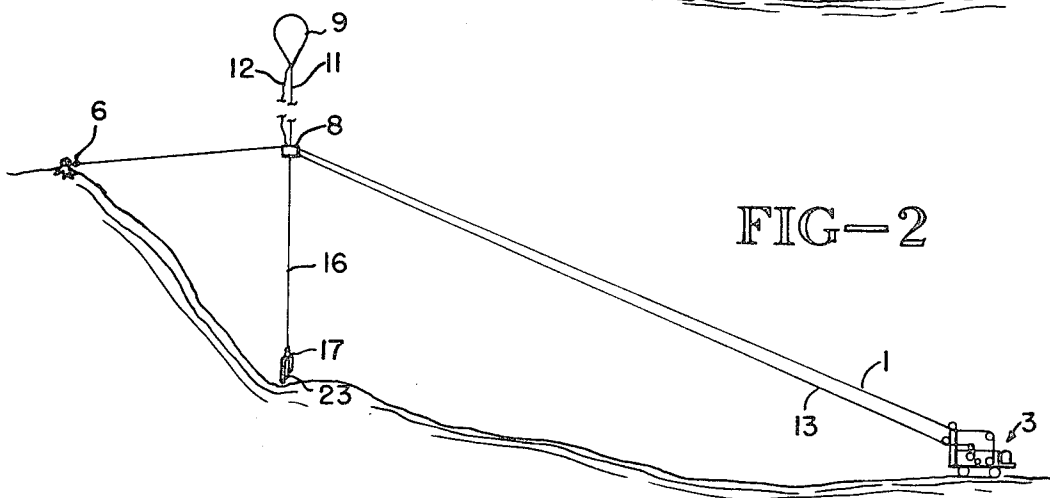


FIG-2

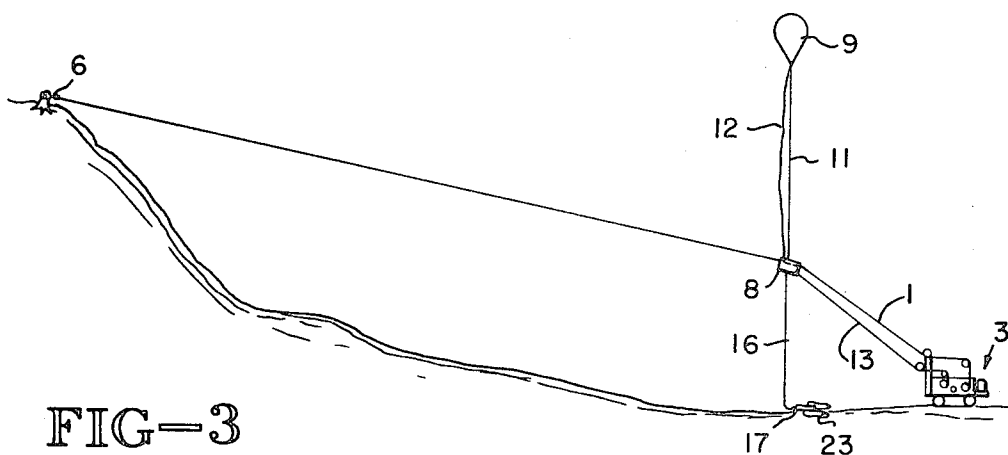


FIG-3

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FIG-4

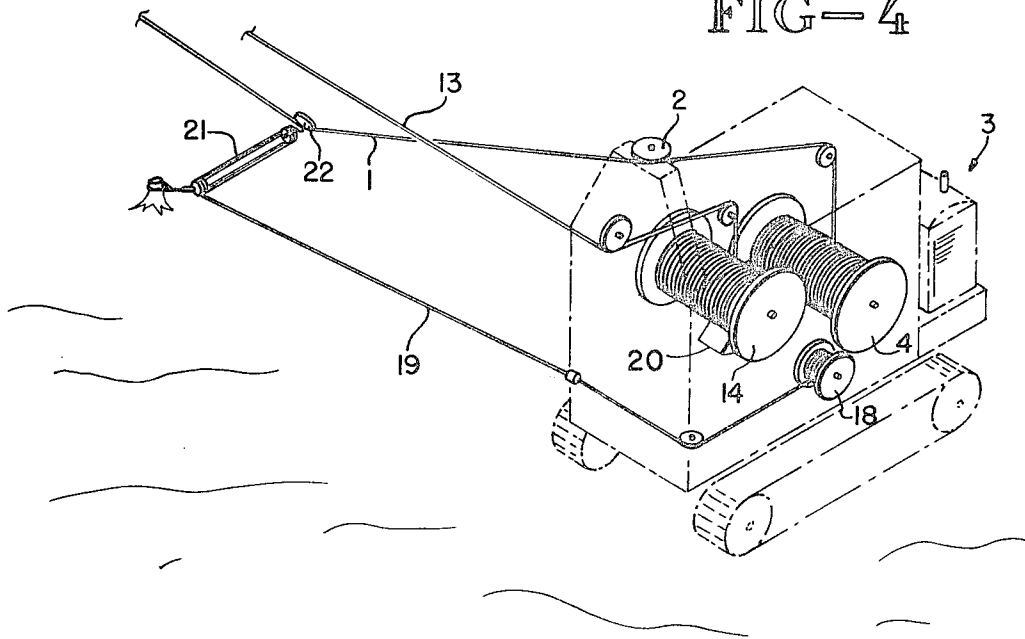
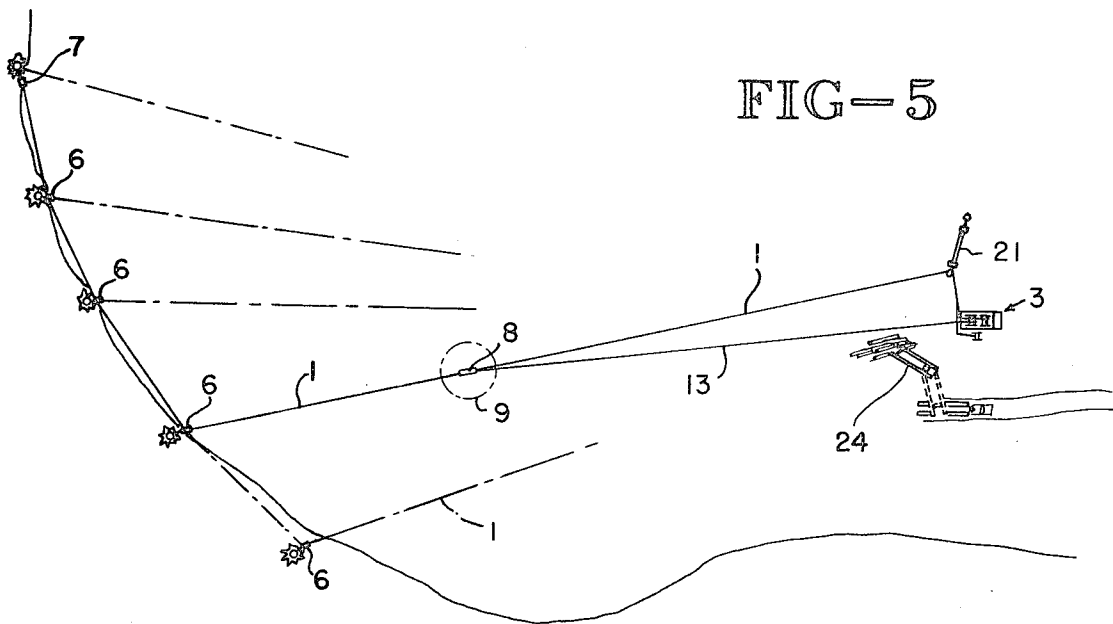


FIG-5



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AERIAL LOGGING SYSTEM

BACKGROUND OF THE INVENTION

The present invention pertains to an aerial logging system and more particularly to such a system adapted for logging inclined terrain wherein a static lift balloon is used to both provide a lifting force for elevating the logs to be moved and for returning the carriage on an inverted skyline to an uphill position after the logs have been landed. This order may be reversed, of course, for uphill logging operations.

Many attempts have been made in the past to devise practical and workable aerial logging systems utilizing both static and dynamic lift devices. Swedish Pat. No. 165,262, issued to State Research Institute, Stockholm, published Nov. 11, 1958 is a good example of such an effort wherein the concept of a skidder system, utilizing conventional main and haulback lines, is used, the static lift balloon being towed in one direction or the other by the main or the haulback line. U.S. Pat. Nos. 3,270,895 and 3,359,919, issued to Faye H. Stewart are further examples of such aerial systems wherein the aerodynamic lift or "kiting" effect is utilized as opposed to the static lift of the balloon.

U.S. Pat. No. 3,221,897 to C.R. Matheson is illustrative of further attempts to utilize the static lift of lighter than air vehicles or balloons to apply a vertical lifting force to the turn of logs. This patent also illustrates an attempt to utilize such a static lift both in skyline and in skidder logging systems. The skyline system of the Matheson patent, however, uses the known concept of moving the carriage along the skyline by means of main and haulback lines with multiple yarder drums or the concept of placing such drums in the actual carriage which depends from and is supported by the skyline. In no case is the lift of the balloon utilized to both lift the logs and to move the carriage to either the pick-up point or the landing point, reliance being placed on conventional main and haulback lines or their equivalents.

The present invention seeks to utilize a true skyline logging system concept wherein the static force of a balloon or lighter-than-air vehicle is applied directly to a carriage which moves freely along the skyline controlled only by a single line and its yarder drum. According to the present invention, the carriage is not actually supported by the skyline but is rather guided by the skyline. The skyline is used also as a means to control the height of the carriage above ground. In this manner, the static lifting force of the balloon is used to elevate the carriage and the load of logs and also to lift the skyline at the point of application of the lifting force so as to form an apex in the skyline. When applied to downhill logging, this arrangement permits an extremely simplified system of cables. The free running carriage is pulled downhill by a main line and, under the influence of the static lift of the balloon, will automatically return uphill requiring only braking control of the main line as it returns. Thus only one line, the main line, is necessary, in addition to the inverted skyline. Since the number of lines involved is substantially reduced, the system is very easily moved from one location to the other and the equipment needed to handle the lines involved is substantially reduced as will be presently described. Likewise problems of control of the balloon position and application of its lifting force are alleviated by the simplified system.

SUMMARY OF THE INVENTION

A primary object of the present invention is to provide a simplified aerial logging system wherein the static lift of a lighter-than-air vehicle is applied to a carriage which is guided by a true skyline for logging inclined terrain.

Another object of the invention is to provide an aerial logging system of the character described wherein the carriage is moved uphill by the tendency of the carriage, under the influence of the lifting force of the balloon, to seek a natural apex point in the skyline dependent upon the degree of incline and the amount of slack in the skyline.

Another object of the invention is to provide an aerial logging system of the character described wherein the carriage is moved uphill by the natural tendency of the carriage, under the influence of the lifting force of the balloon, to seek a natural apex point in the skyline uphill from the location of the yarder, such position being controlled by both the main line and the slack in the skyline.

Another object of the invention is to provide an aerial logging system of the character described necessitating only the main line in addition to the skyline for moving the carriage downhill with a load of logs and for restraining uphill return of the carriage.

Another object of the present invention is to provide an aerial logging system of the character described which may be easily relocated with a minimum of down-time.

Still another object of the present invention is to provide an aerial logging system utilizing a true "skyline" wherein a carriage is caused to move freely along the skyline with a vertical lift being applied to the carriage by a lighter-than-air vehicle.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1 to 3 illustrate the different positions of the carriage and the load line during the pick-up and landing of the turn of logs;

FIG. 4 illustrates one arrangement of yarder drums for handling the main line and skyline; and

FIG. 5 is a schematic illustration of the method of moving the skyline over an area to be logged.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings wherein like reference numerals indicate identical parts in the various views, FIGS. 1-3 illustrate the overall relationship between the various lines, the carriage, balloon and yarder vehicle in a downhill logging application. As illustrated in these Figures, the skyline 1 is passed around the sheave or block 2 of the top fairlead of the yarder vehicle indicated generally at 3 and wound onto the skyline drum 4. The preferred embodiment of the system illustrated is peculiarly adapted for downhill logging, hence the upper end of the skyline will be engaged with the tail-block 6 at the top of the hill to be logged. It will be understood, however, that the system could also be adapted for uphill logging so as to carry loads in the opposite direction if desired. As illustrated in FIG. 5, the selected area may be logged without moving the position of the yarder 3 by running the skyline through a series of corner blocks 6 at the top of the hill to be logged

and dead ending it at a tailblock 7. In this manner, the skyline may be swung across an arc in front of the mobile yarder, it being only necessary to release the series of corner blocks 6 in succession as the arc is traversed.

A carriage 8 may be of any conventional design utilizing wheels or rollers which engage the skyline and allow the carriage to be moved therealong. This type of structure is well known in the logging arts and the details thereof form no part of the present invention. A balloon 9 is tethered by means of a cable 11 to the carriage 8. A simple connection such as a ring or the like may be utilized for this connection and, if desired, an additional safety line 12 may be connected between the balloon 9 and the carriage 8. In practice, a balloon capable of providing approximately 25 thousand pounds gross lifting capacity is recommended although the capacity needed will depend upon the weight of the lines involved and the size of loads desired to be transported. A tethering cable 11 approximately 150 feet in length will serve satisfactorily in most instances.

A main line 13 is secured to the carriage 8 and wound about a main line drum 14 carried on the yarder 3. As previously described, the function of the main line 13 is to pull the carriage 8 downhill along the skyline once the turn of logs has been lifted and to restrain the upward or uphill movement of the carriage as it returns. The yarder unit 3 may have any conventional braking means 20 for braking the various drums involved as will be understood by those skilled in the art.

A load line 16 provided with a number of choker lines 17 is connected to the carriage 8 and depends downwardly therefrom. In the preferred system, the mobile yarder unit 3 will have independent controls for the skyline and main line drums 4 and 14, respectively, such that these lines may be hauled in and payed out completely independent of one another as opposed to conventional interlock systems. This arrangement is desirable since, for adequate control of the skyline and main line, it may be necessary to haul in on both lines simultaneously so as to take up the slack in the skyline while hauling in on the main line. In practice, a load line of about 150 feet in length has proven satisfactory.

FIG. 4 shows an alternative arrangement which may be used in the event an innerlock yarder is utilized rendering it impossible to haul in on both lines simultaneously. In this case, a straw drum 18 and a straw line 19 may be operated through the multiple sheave and line arrangement 21 anchored to a stump or the like and connected to a rider block 22. With this arrangement, the skyline drum of an innerlock yarder can be braked and slack in the skyline taken up by means of hauling in on the straw line 19.

FIGS. 1-3 illustrate the various positions of the balloon and carriage during a typical logging operation. As shown in FIG. 1, the lifting force of the balloon 9 will form an apex in the inverted skyline 1, the position of which is determined by the degree of incline, the amount of slack in the skyline 1 and the length of the main line 13. Assuming that the main line is allowed to pay out and the balloon 9 has returned the carriage uphill to the approximate position of the turn of logs 23, the skyline will be tightened by means of its winding drum or, in the alternative, a straw line arrangement shown in FIG. 4. Normally, only a few revolutions of

the drum will be required to take up enough slack in the skyline so that the load line 16 is lowered to the vicinity of the turn of logs 23. In may, of course, be necessary to either haul in or pay out slightly on the main line in order to accurately position the carriage 8 simultaneously with adjusting the slack of a skyline. As soon as the choker lines 17 are set to secure the turn of logs 23, enough slack is provided in the skyline to allow the balloon 9 to raise the carriage, load line and turn of logs sufficiently far above the terrain to permit the logs to be transported to the landing. With the logs being thus raised, as shown in FIG. 2, the main line is hauled in so as to move the carriage 8 toward the landing. As the turn of logs approaches the landing, slack in the skyline may again be taken up by hauling in on the skyline drum or by use of the straw line arrangement to lower the carriage and land the logs as shown in FIG. 3. The logs may then be loaded or stacked by any conventional piece of equipment such as the heel boom loader 24 shown in FIG. 5.

Once the turn of logs is released the skyline is again payed out to provide slack and the main line allowed to pay out under braking action to allow the balloon to lift the carriage and load line and to control the uphill movement of the carriage under influence of the balloon. In practice, it has been necessary to carefully control the upward travel of the carriage to avoid damage to the skyline and the main line. With a balloon of the capacity mentioned, and depending upon the incline being logged, the carriage, if allowed to run freely, would accelerate to a speed of approximately 1,000 feet per second in 1 second rendering it impossible to stop without damage to the main line and/or the skyline. Braking capacity of the main line drum in the neighborhood of 1,300 horsepower has been found adequate to safely return the balloon of the capacity mentioned.

Excellent results have been obtained with the present system on inclined terrain having a slope of 35 percent or greater. As long as the terrain is sloped upwardly over the general course of the skyline, there is theoretically no limit to the reach which may be logged. As illustrated in FIG. 5, when the skyline is passed through a series of corner blocks 6 initially, a wide arc may be logged without the necessity of moving either the mobile yarder 3 or the loader 24. It is simply necessary to disengage each block 6 in succession as the arc is traversed.

As will be understood by those skilled in the art, the present aerial logging system and method provides distinct advantages over known systems of this character in terms of simplicity of rigging, minimal equipment requirements and economy and speed of operation.

While the preferred form of the invention has been shown and described, it should be understood that changes in the details will be readily apparent to those skilled in the art. Accordingly, the invention is not to be limited to the embodiment disclosed but is to be determined solely by the scope and proper interpretation of the claims appended hereto.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

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1. A logging system for logging on inclined terrain which is adapted to lift a load bearing carriage means and propel said carriage means solely by means of a lighter-than-air vehicle in the upwardly inclined direction along a guiding skyline extending over said terrain in the general direction of incline, comprising in combination, lighter-than-air vehicle means for providing a vertical lifting force, a skyline extending over said terrain in the general direction of incline and having the ends thereof at spaced, fixed locations, means connected to one of the ends of the skyline for selectively controlling the slack in said skyline, carriage means engaging said skyline and adapted for free movement therealong, tethering cable means connected between said vehicle means and said carriage means, the vertical lifting force of the vehicle means applied to the carriage means and the skyline by said tethering cable means forming an apex in the skyline at the position of the carriage means, load line means depending from said carriage means adapted for connecting a load to the carriage means, means for moving said carriage means along the skyline in a downhill direction in opposition to the lifting force of the vehicle means, and braking control means acting in opposition to the lifting force of the vehicle means for controlling the speed of the carriage means in an uphill direction, whereby the elevation of the carriage means and its position along said skyline may be selectively controlled for picking up and landing loads connected thereto.

2. The combination according to claim 1 wherein said skyline is anchored at one end and including; yarder drum means connected to the other end of said skyline, said means for controlling slack in the skyline comprising means for selectively controlling the rotation of said yarder drum to either haul in or pay out said skyline.

3. The logging system according to claim 1 wherein said means for moving the carriage in a downhill direction comprises;

cable means connected at one end to the downhill side of said carriage, yarder drum means connected to the other end of said cable means for selectively hauling in on said cable means, and

means for guiding said cable to apply a pulling force on the carriage in the downhill direction when said cable means is hauled in.

4. The logging system according to claim 3 wherein said braking control means is applied to said yarder drum to control the speed at which the cable means is paid out.

5. The logging system according to claim 2 wherein said means for moving the carriage in a downhill direction comprises;

cable means connected at one end to the said carriage for exerting a downhill pull thereon, second yarder drum means connected to the other

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end of said cable means for selectively hauling in on said cable means, and means for guiding said cable means to apply a pulling force on the carriage in the downhill direction when said cable means is hauled in.

6. The logging system according to claim 5 wherein said braking control means is applied to said second yarder drum to control the speed at which the cable means is paid out.

7. The logging system according to claim 1 adapted for downhill logging wherein;

said means for moving the carriage in a downhill direction comprises a main line connected to said carriage and yarder drum means for selectively hauling in and paying out the main line,

said braking control means being applied to control the paying out of the main line,

said yarder drum means being located on the downhill end of the skyline,

whereby logs may be picked up at an uphill location and transported downhill by hauling in on the main line and landed in an area adjacent said yarder drum means.

8. The logging system according to claim 6 adapted for downhill logging wherein;

said first and second yarder drum means are located on the downhill end of the skyline,

whereby logs may be picked up at an uphill location and transported downhill by hauling in on the main line and landed in an area adjacent said yarder drum means.

9. A method of logging inclined terrain comprising the steps of: applying the vertical lift of a lighter-than-air vehicle to a freely movable carriage mounted on a normally slack skyline to provide the sole means for propelling the carriage in the uphill direction, selectively applying a pulling force to the carriage to move it along the skyline in the downhill direction and a braking force to control the speed of the carriage in the uphill direction against the lifting force of the vehicle, and simultaneously controlling the slack in the skyline to control the elevation of the carriage, whereby a load may be connected to the carriage at one point along the skyline, lifted, transported and landed at a second point.

10. The method according to claim 9 including the step of initially anchoring said skyline at an uphill location and utilizing the movement of the carriage in the downhill direction to transport logs from an uphill point to a landing area at a lower elevation.

11. The method according to claim 10 including the step of passing said skyline through a plurality of releaseable corner blocks in an arc on the terrain above the landing area, whereby said corner blocks may be successively released to permit successive areas to be logged in an arc across the terrain above the landing point.

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