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(54) DEVICE FOR KEEPING CONSTANT THE TENSILE STRESS IN A CABLE

(71) We, N.V. INDUSTRIEELE HANDELSCOMBINATIE HOLLAND, a Dutch Company, of Marconistraat 2, Rotterdam, the Netherlands, do hereby declare the invention, for

which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a device for keeping constant the tensile stress in a cable, comprising two guide pulleys for the cable disposed in one plane at a distance from each other, and at least one intermediate pulley disposed between the two said guide pulleys and in the same plane, said intermediate pulley being secured to a piston-cylinder unit in such a manner that an essentially constant force is exerted upon the pulley owing to the interior of the cylinder communicating with an hydraulic system for the purpose of maintaining an essentially constant pressure within the cylinder, the intermediate pulley in its operative position guiding the cable from the one guide pulley to the other while forming a loop. Such device is known from the U.S. Patent 3,311,351.

In this known device, the guide pulleys and the piston-cylinder unit form a rigidly mounted assembly with the intermediate pulley so that all pulleys of the device are constantly into engagement with the cable.

The known device has the disadvantage that it cannot be disengaged when required, so that a balancing force is constantly exerted upon the cable, it being somewhat laborious to guide the cable over the pulleys when it must be run out. For that reason, the known device is not suitable for being applied e.g. in a tug-boat to keep constant the tensile stress in the towing cable.

The object of the invention is to provide a device of the type as mentioned, devoid of the said disadvantage.

According to the invention, there is provided a device for keeping constant the tensile stress in a cable or the like, comprising two guide pulleys for the cable disposed one on either side of the cable and in one plane at a distance from each other and at least one intermediate pulley disposed between the two said guide pulleys and in the same plane, said at least one intermediate pulley being secured to a piston-cylinder unit in such a manner that an essentially constant force is exerted upon the pulley owing to the interior of the cylinder being in communication with an hydraulic system for the purpose of maintaining an essentially constant hydraulic pressure within the cylinder, the said at least one intermediate pulley in the operative position guiding the cable from the one guide pulley to the other while forming a loop, characterized in that means are provided to move the guide pulleys and the cable towards and away from each other and that the piston-cylinder unit is constructed in such a manner that the said at least one intermediate pulley can be moved away from the cable out of engagement therewith.

Preferably, the guide pulleys are mounted on a frame mounted for a movement perpendicularly to the plane of the pulleys, the piston-cylinder unit with the intermediate pulley being likewise mounted on said frame.

The guide pulleys may be disposed on either side of the cable, two intermediate pulleys, each connected with a piston-cylinder unit, then being present and situated on either side of the cable in the reverse order of succession.

The guide pulleys may then be adjustable in the direction towards and away from the cable.

Preferably, the hydraulic system comprises an accumulator communicating with the interior of the cylinder, each cylinder then being movably mounted according to the invention and the corresponding intermediate pulley being secured to one side of the cylinder while a cylindrical piston protrudes from the cylinder near the other side and is firmly secured at its free end, the cylinder being connected with a spring means tending to drive the cylinder towards the piston and the interior of the cylinder has two connecting conduits with a reservoir, a pump and a non-return valve being incor-

porated in one conduit and a stop valve in the other conduit. The spring means may be formed by an hydraulic cylinder communicating with the accumulator.

The invention will now be described by way of example only with particular reference to the accompanying drawings wherein:

Figure 1 shows diagrammatically a side view of a device of the invention in the non-operative position,

Figure 2 shows said device in the operative position,

Figure 3 shows a plan view of the various positions of the pulleys of the device when it is put into operation and

Figure 4 shows a diagram of the hydraulic system.

As shown in Figures 2, 3 and 4, the device of the invention is mounted on a frame 1 which can be moved up and down by means of the hydraulic cylinders 2 with respect to, say, the deck 3 of a tug-boat. Also, a winch 4 and an aft roller 5 are mounted on said tug-boat for the purpose of hauling in and guiding a towing cable 6.

On the frame 1, two guide rollers 7 and 8 are mounted and, between said rollers, the guide pulleys 9 and 10 and the intermediate pulleys 11 and 12. The guide pulleys 9 and 10 can be moved towards and away from the cable 6 by means of the hydraulic cylinders 13 and 14. The intermediate pulleys 11 and 12 are connected with the piston-cylinder units 15 and 16 respectively, the cylinders being connected with said pulleys and movably mounted as will be further explained while referring to Figure 4.

As shown in Figure 1, the device is out of operation when the frame 1 is retracted so that the cable 6 can be hauled in by means of the winch 4. The frame 1 is then raised until the rollers 7 and 8 engage the cable 6. Thereupon, the guide pulleys 9 and 10 are moved towards the cable 6 as shown in Figure 3b, and finally, the piston-cylinder units 15 and 16 with the intermediate pulleys 11 and 12 secured to them are moved towards the cable 6 until the situation as shown in Figure 3c is obtained, in which the device is in its operative position.

As shown in Figure 4 for the intermediate pulley 11 and the corresponding piston-cylinder unit, the pulley 11 is secured to the cylinder 17 which, as shown diagrammatically by the rollers 18, is reciprocatingly mounted. In the cylinder 17, the piston 19 is situated which is firmly secured at 20 whereas the cylinder 17 is connected with the piston rod 21 of an hydraulic cylinder 22 which is firmly secured at 23. Via the conduit 24, the interior of the cylinder 17 is in communication with the accumulator 25 while the hydraulic cylinder 22 is in communication with the accumulator 25 via the conduit 26. A stop valve 27 is incorporated in the connecting conduit 24. Furthermore, the interior of the cylinder 17 is in communication with the reservoir 33 via the conduit 28 having the valve 29 incorporated therein and via the conduit 30 having the non-return valve 31 and the pump 32 incorporated therein. The reservoir 33 is fitted with a level switch 34.

A logical control by means of which the hydraulic system can be operated is marked with 35. When the logical control 35 is switched on, the stop valve 29 is closed, the pump 32 is put into operation and the stop valve 27 is slowly opened, as a result of which the cylinder 17 will move to the left in the figure until the surface of the liquid in the reservoir 33 will have attained the level determined by the level switch 34. The cylinder 17 with the pulley 11 will then be in its operative position as shown in Figure 3c, while a constant pressure is exerted inside the cylinder 17 by means of the accumulator 25. When the tensile stress in the cable 6 exceeds a predetermined value, the intermediate pulley 11 with the cylinder 17 will again move to the right in Figure 4 until the tensile stress in the cable will have attained the predetermined value.

In the switched-off position of the logical control 35, the stop valve 27 is slowly closed and the stop valve 29 is opened, as a result of which the cylinder 17 with the pulley 11 secured to it is entirely drawn to the right in Figure 4 by the hydraulic cylinder 22 until the pulley 11 has become entirely disengaged from the cable 6, as shown in Figure 3a. Therefore, in this manner, it will be possible to entirely retract the pulley 11 or 12 without discharging the accumulator 25.

WHAT WE CLAIM IS:

1. A device for keeping constant the tensile stress in a cable or the like, comprising two guide pulleys for the cable disposed one on either side of the cable and in one plane at a distance from each other and at least one intermediate pulley disposed between the two said guide pulleys and in the same plane, said at least one intermediate pulley being secured to a piston-cylinder unit in such a manner that an essentially constant force is exerted upon the pulley owing to the interior of the cylinder being in communication with an hydraulic system for the purpose of maintaining an essentially constant hydraulic pressure within the cylinder, said at least one intermediate pulley in the operative position guiding the cable from the one guide pulley to the other while forming a loop, characterized in that means are provided to move the guide pulleys and the cable towards and away from each other and that the piston-cylinder unit is con-

structed in such a manner that the said at least one intermediate pulley can be moved away from the cable out of engagement therewith.

2. A device as claimed in Claim 1, characterized in that the guide pulleys are mounted on a frame mounted for a movement perpendicularly to the plane of the pulleys and that the piston-cylinder unit with the at least one intermediate pulley is likewise mounted on said frame.

3. A device as claimed in Claim 2, characterized in that two intermediate pulleys, each connected with a piston-cylinder unit, are present and are disposed on either side of the cable in the reverse order of succession to the guide pulleys.

4. A device as claimed in claim 2 or 3, characterized in that the guide pulleys are adjustable in the direction towards and away from the cable.

5. A device as claimed in Claims 1 to 4, in which the hydraulic system comprises an accumulator communicating with the interior of the cylinder, characterized in that each cylinder is movably mounted and that the corresponding intermediate pulley is secured to the one side of the cylinder while a cylindrical piston protrudes from the cylinder at its other side and is firmly secured at its free end, that the cylinder is connected with a spring means tending to drive the cylinder towards the piston and that the interior of the cylinder has two connecting conduits with a reservoir, a pump and a non-return valve being incorporated in the one conduit and a stop valve in the other conduit.

6. A device as claimed in Claim 5, characterized in that, the spring means are formed by an hydraulic cylinder communicating with the accumulator.

7. A device for maintaining constant tensile stress in a cable or the like and substantially as hereinbefore described and as shown in the accompanying drawings.

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2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

fig-1

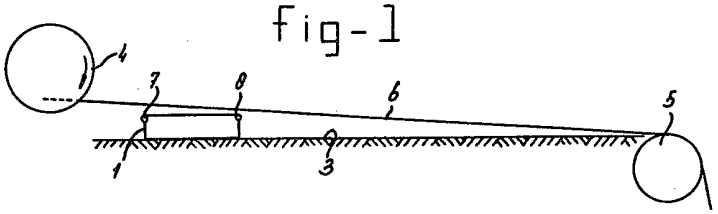


fig-2

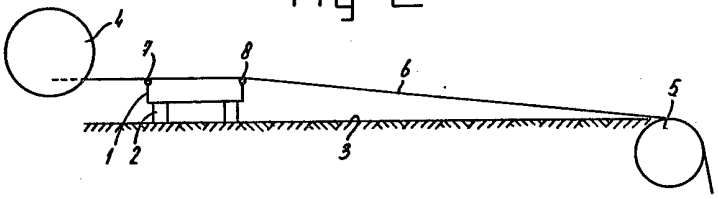
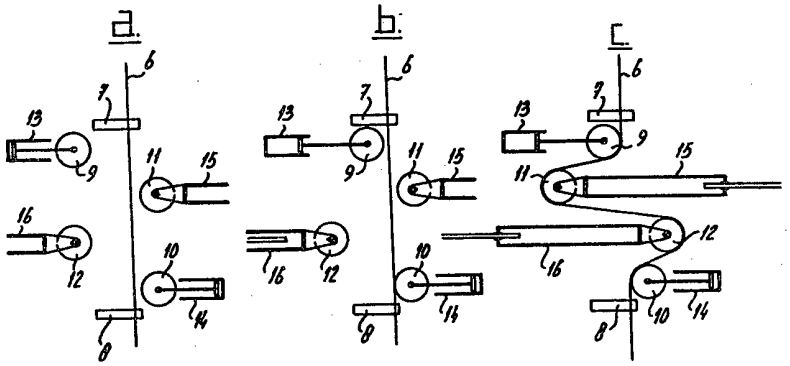


fig-3



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2 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 2

Fig-4