No. 854,052. PATENTED MAY 21, 1907.

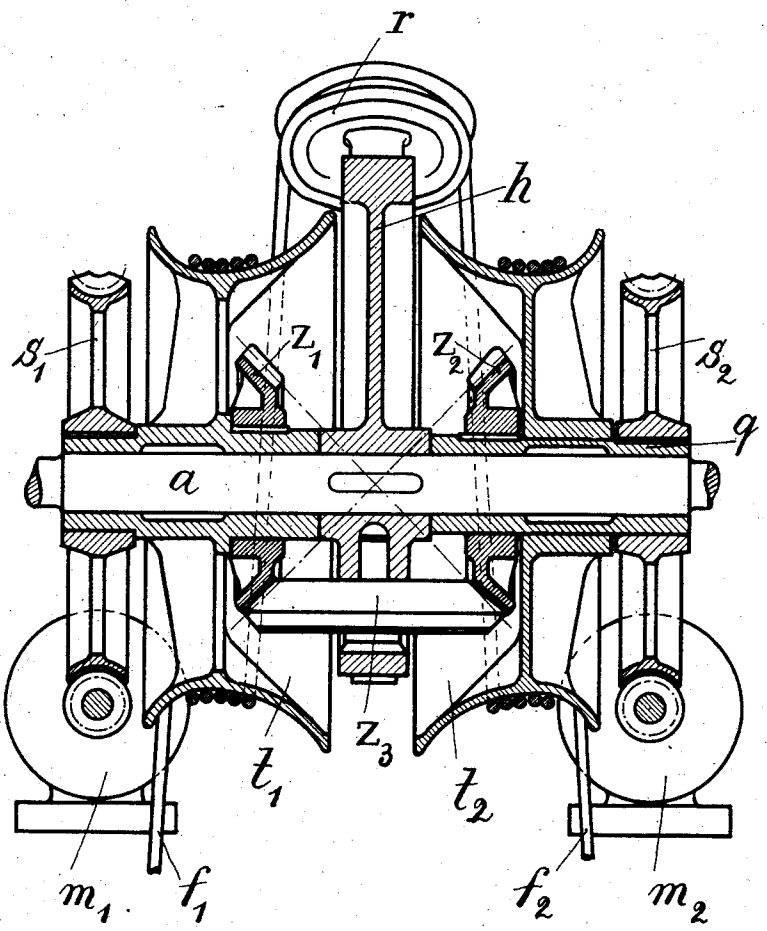
W. MOLLIER.

APPARATUS FOR CONVEYING LOADS BETWEEN POINTS OF VARYING DISTANCE.

APPLICATION FILED JAN. 29, 1906.

2 SHEETS—SHEET 1.

Fig. 1



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2 SHEETS—SHEET 2.

Fig. 2

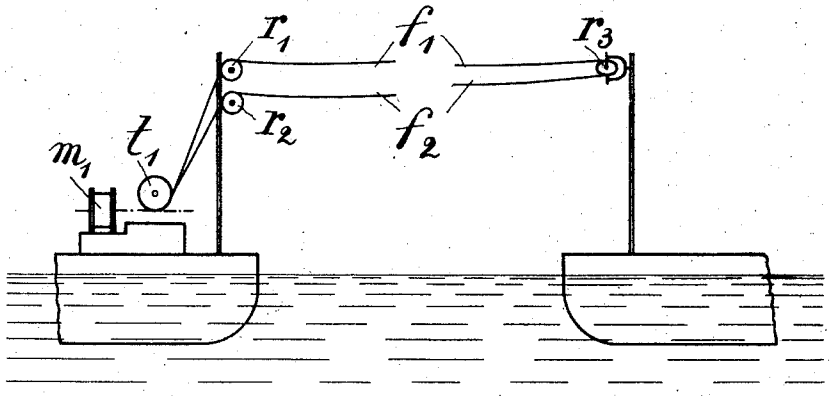
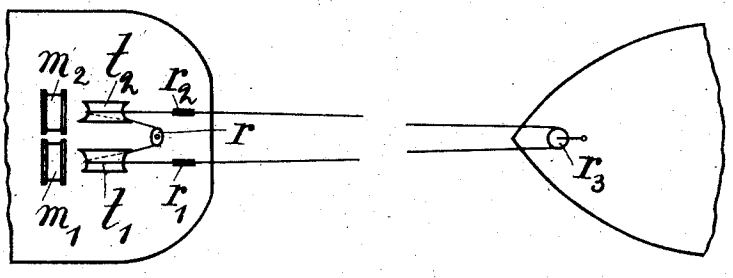


Fig. 3



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APPARATUS FOR CONVEYING LOADS BETWEEN POINTS OF VARYING DISTANCE.

No. 854,052. Specification of Letters Patent. Patented May 21, 1907.

Application filed January 29, 1906. Serial No. 298,567.

To all whom it may concern:

Be it known that I, WALTHER MOLLIER, a subject of the German Emperor, residing at Hamburg, Alte Rabenstrasse 34, Germany, have invented new and useful Improvements in Apparatus for Conveying Loads Between Points of Varying Distance, and in order that those skilled in the art may understand, make, and use my invention I give the following specification.

My invention relates to rope ways for conveying loads by means of endless ropes, between two points whose distance from one another constantly varies, such as rope ways between ships at sea, or between the shore and a ship anchored in the neighborhood, or lines for distributing and shooting goods over a large area. In such cases the varying distance of the ends of the line from each other will cause the rope to be slackened and tightened alternately so that a special means of regulating the tension in the rope is necessary. According to this invention the winding machine is so constructed that a uniform tension is maintained in the rope even when the load is being handled.

Figure 1 shows the construction of such a winding machine, and Figs. 2 and 3 the general arrangement of the transporting gear.

The endless rope f_1 and f_2 (Figs. 2 and 3) is carried over the pulleys r_1, r_2, r_3 on the two loading stations and over the drums t_1 and t_2 of the winding machine. The motor m_1 (Fig. 1) drives the capstan drum t_1 by means of a worm and worm wheel s_1: The capstan drum t_1 is mounted loose on the shaft a and carries on the inside the gear wheel z_1 of a differential gear. The other capstan drum t_2 runs loose on the hollow shaft q which in its turn is free to rotate about the shaft a. The worm wheel s_2, which is driven by the motor m_2 is fixed on this hollow shaft as is also the gear wheel z_2. The intermediate bevel gear wheel z_3 engages with the outside bevel wheels z_1 and z_2, and is mounted on the lever h which lever can rotate about the axle a, these three wheels forming thus a differential gear. This lever carries at its other end the pulley r round which the hauling rope runs.

Assuming now that the distance between the loading stations remains constant, that the motors for driving the winding machine are of the same type and size, and that the hauling rope is not tightened and worked at the same time, then the method of working is as follows:—To tighten the rope between the pulleys r_1, r_2 and r_3 the motors are so connected as to rotate in the same direction. The lever h with the pulley r will then rotate about the shaft a due to both the gear wheels z_1 and z_2 turning in same direction; the pulley r and wheel z_3 will not rotate relatively to their own axes. The rope f_1 and f_2 will be wound round the drums t_1 and t_2 by this process.

When it is required to use the rope for hauling then the motors are so connected that they run at equal speeds but in opposite directions. As the gear wheels now rotate in opposite directions the wheel z_3 will revolve about its own axis. The rope will be driven by the drum t_1 and run over the pulley r which also revolves about its own axis, round the drum t_2 to the other end of the line and so back again to t_1. If the tension in the rope remains normal during haulage, then both the motors run at the same speed as do also the gear wheels z_1 and z_2. As a consequence the gear wheel z_3 only turns about its own axis and the lever arm h remains stationary. The motors then serve solely to haul the rope. In order now to obtain automatically an equal tension in the rope with a constantly varying distance between the loading stations and while loads are being handled, the invention allows of the following method:—The drum t_1 and gear wheel z^1 are driven by a motor m_1 whose speed decreases as the load increases and increases as the load decreases; while gear wheel z_2 is driven by a motor m_2 whose speed is either not influenced by the load, or increases with increased load.

If electric motors are employed then motor m_1 can for instance be wound as a series motor and motor m_2 as a shunt or compound motor.

If the distance between the loading stations decreases then the rope will become slack and both motors have less load on them. The speed of motor m_2 will remain approximately constant or decrease either owing to its regulating device or to its electrical characteristics, whereas that of motor m_1 will increase due to the reduced load.

The unequal speeds of the gear wheels z_1 and z_2 will cause the lever h to turn about the shaft a by means of the wheel z_3, so as to wind the rope round the drums, as already described. The rope will continue to be wound up until the tension in it has reached its normal value, the motors will then run at their normal speed and the lever h will remain stationary.

If the distance between the loading stations increases then the series of operations described above will be reversed.

The result of the increased tension in the rope will be that motor m_1 runs slower than motor m_2 so that the lever h revolves in a direction opposite to that in which it turns when tightening the rope. This operation continues until the normal state of affairs is again reached.

Having thus described the nature of my said invention, what I claim as new therein and desire to secure by Letters Patent is:

1. In an apparatus for conveying loads between points of varying distance, the combination of a plurality of drums independently journaled, an endless rope wound on said drums, means for operating one of said drums controlled by the tension of said rope to keep same under a predetermined tension.

2. In an apparatus for conveying loads between points of varying distance, the combination of two drums suitably independently journaled, an endless rope wound on said drums, a motor operating one of said drums, a motor adapted to coöperate with said drum operating motor when the rope has its normal tension, and means between said motors and actuated by said motors under an abnormal rope tension adapted to restore the normal tension of said rope.

3. In an apparatus for conveying loads between points of varying distance, the combination of two drums suitably independently journaled, an endless rope wound on said drums, a motor operating one of said drums having its revolution number varying inversely with the load, a motor adapted to cooperate with the drum operating motor when the rope has its normal tension keeping its revolution number practically constant under all loads, and means between said motors and actuated by said motors under an abnormal rope tension adapted to restore the normal tension of said rope.

4. In an apparatus for conveying loads between points of varying distance, the combination of two drums suitably independently journaled, an endless rope wound on said drums, an electro-motor operating one of said drums having its revolution number varying inversely with the load, an electro-motor adapted to coöperate with said drum operating motor when the rope has its normal tension keeping its revolution number practically constant under all loads, and means between said electro-motors and actuated by said motors under an abnormal rope tension adapted to restore the normal tension of said rope.

5. In an apparatus for conveying loads between points of varying distance, the combination of two drums, suitably independently journaled, an endless rope wound on said drums, a differential gear having one of its outside members connected to one of said drums operating the rope, a motor operating said drum and having its revolution number varying inversely with the load, a motor connected to the other outside member of said differential gear and keeping its revolution number practically constant under all loads, a lever arm suitably pivoted between said drums operatively connected to the intermediate member of said differential gear and having on its free end a pulley adapted to guide said rope between said drums, said lever being inoperative under normal tension of the rope and coiling and uncoiling said rope on the drums respectively under abnormal tension until normal tension is restored.

6. In an apparatus for conveying loads between points of varying distance, the combination of two drums suitably independently journaled, an endless rope wound on said drums, a differential gear having one of its outside members connected to one of said drums operating the rope, an electro-motor operating said drum and having its revolution number varying inversely with the load, an electro-motor connected to the other outside member of said differential gear and keeping its revolution number practically constant under all loads, a lever arm suitably pivoted between said drums operatively connected to the intermediate member of said differential gear and having at its free end a pulley adapted to guide said rope between said drums, said lever being inoperative under normal tension of the rope and coiling and uncoiling said rope on the drums respectively under abnormal tension until normal tension is restored.

7. In an apparatus for conveying loads between points of varying distance, the combination of two drums coaxially independently journaled, an endless rope wound on said drums, a differential gear having one of its outside members coaxially connected to one of said drums operating the rope, a motor operating said drum and having its revolution number varying inversely with the load, a motor connected to the other outside member of said differential gear and keeping its revolution number practically constant under all loads, a lever arm coaxially independently pivoted between said drums operatively connected at one end to the intermediate member of said differential gear and having at its other end a pulley adapted to guide said rope between said drums, said lever be-

ing inoperative under normal tension of the rope and coiling and uncoiling said rope on said drums respectively under abnormal tension until normal tension is restored.

8. In an apparatus for conveying loads between points of varying distance, the combination of two drums coaxially independently journaled, an endless rope wound on said drums, a differential gear having one of its outside members coaxially connected to one of the drums operating the rope, an electro-motor operating said drum and having its revolution number varying inversely with the load, an electro-motor connected to the other outside member of said differential gear keeping its revolution number practically constant under all loads, a lever arm coaxially independently pivoted between said drums, operatively connected at one end to the intermediate member of said differential gear and having at its other end a pulley adapted to guide said rope between said drums, said lever being inoperative under normal tension of the rope and coiling and uncoiling said rope on said drums respectively under abnormal tension until normal tension is restored.

9. In an apparatus for conveying loads between points of varying distance, the combination of a shaft suitably journaled, a drum mounted on said shaft, a sleeve on said shaft, a drum mounted on said sleeve, means for rotating said drum, a lever mounted on said shaft and a pulley mounted on said lever.

10. In an apparatus for conveying loads between points of varying distance, the combination of a shaft suitably journaled, a drum mounted on said shaft, a sleeve on said shaft, a drum mounted on said sleeve, means for rotating said drum, a lever mounted on said shaft and provided with a pulley, and means for revolving said lever around said shaft.

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