Oct. 26, 1948. F. GAYE 2,452,297

WINCH AND THE LIKE

Filed March 21, 1945 3 Sheets-Sheet 1

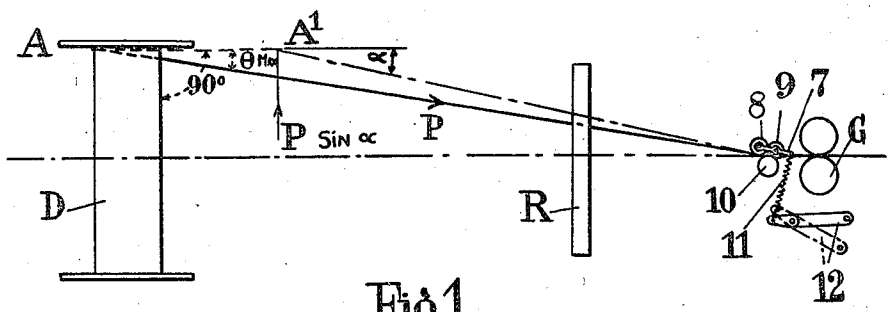


Fig. 1.

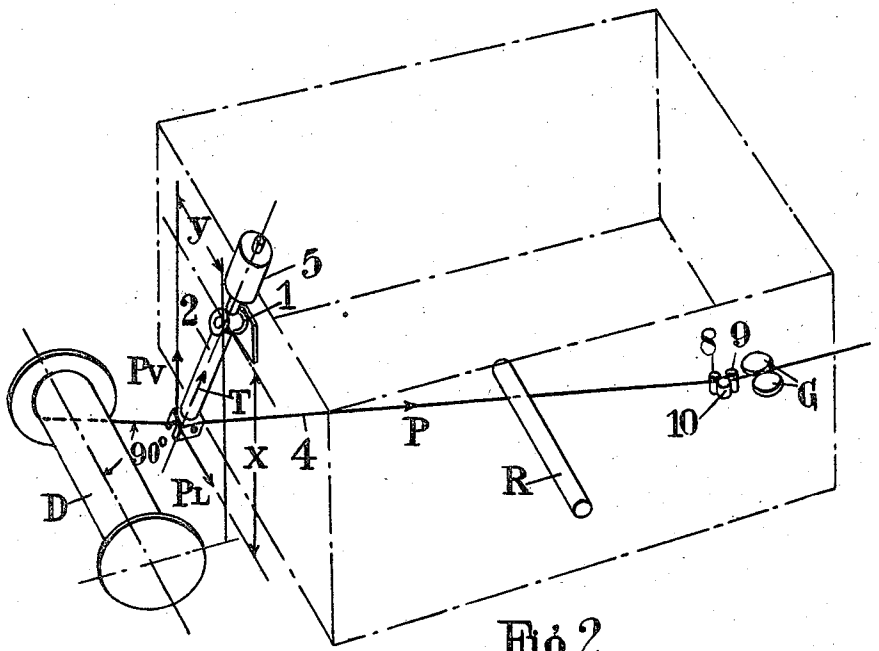


Fig. 2.

Inventor
F. Gaye
By Glascock Downing & Seebold
Attys.

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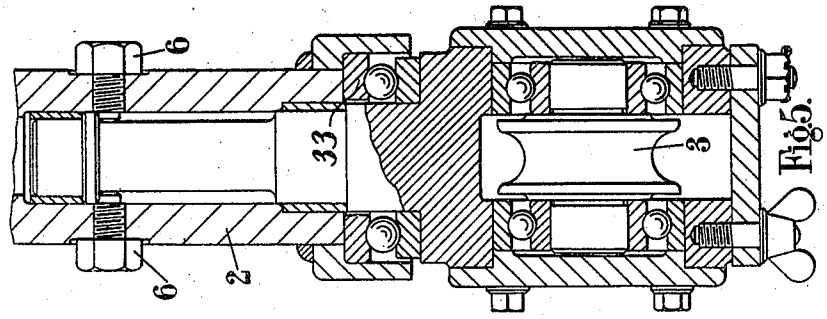


Fig.5.

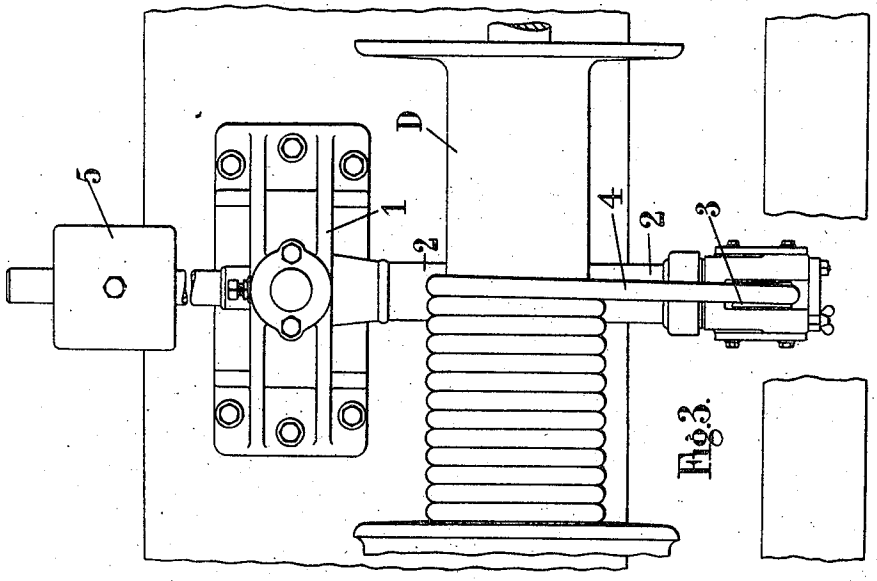


Fig.3.

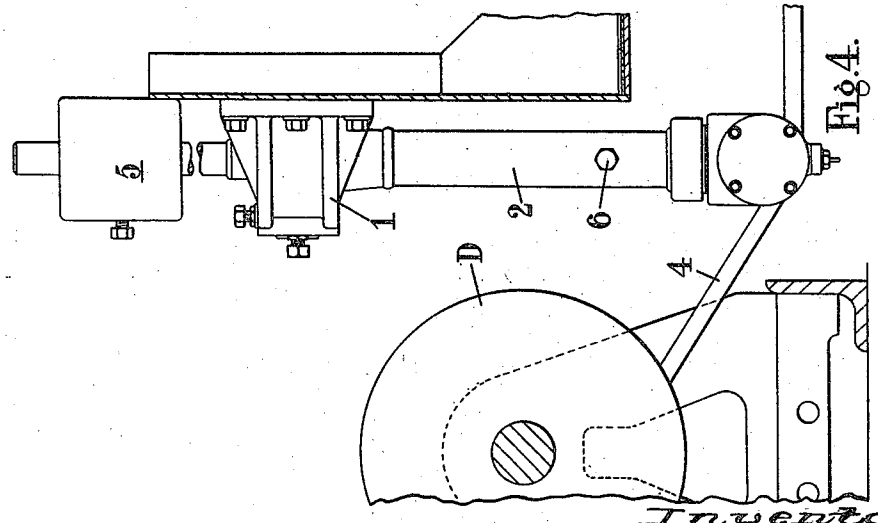


Fig.4.

Inventor
F. Gaye
By Glascock Downing & Seibold Attys.

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Fig. 5.

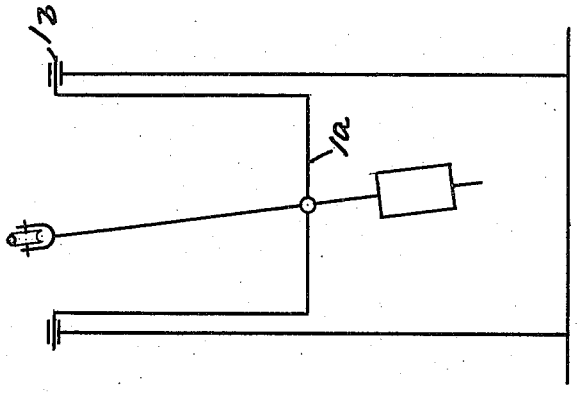


Fig. 6.

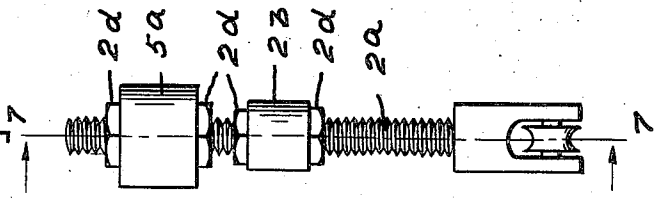
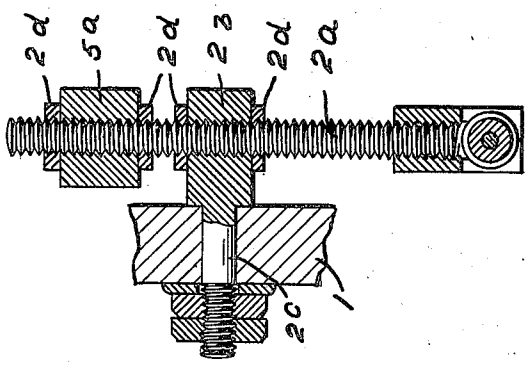


Fig. 7.



Inventor
FELIX GAYE

By Glascock Downing Seibold
Attys.

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UNITED STATES PATENT OFFICE

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WINCH AND THE LIKE

Felix Gaye, Broadmoor, near Dorking, England

Application March 21, 1945, Serial No. 583,891
In Great Britain June 10, 1944

5 Claims. (Cl. 242—158)

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This invention relates to winches, winding drums and other apparatus in which a cable, wire, thread, or like flexible member (herein generically referred to as "cable") is to be wound under tension on to a drum, former, or other winding member.

With the arrangements hitherto adopted it is impossible to achieve a correct paying-on of more than one layer of the cable (that is, paying-on with adjacent turns closely and evenly arranged) without the use of complicated mechanically driven pay-on gears. Such faulty paying-on is due to a sideways component of force on the cable which, with a central pull, is a maximum at each end of the drum and a minimum at the centre and which causes gaps to occur between successive coils.

The object of the present invention is to achieve correct (or practically correct) paying-on without the necessity for the use of mechanically driven paying-on gears.

According to my invention I provide between the winch drum or other member on which the cable is to be wound and the load or tensioner, a rotatable lever or strut, mounted on a pivot, and one end of which acts as a guide for the cable throughout the winding operation. The axis of the pivot is in, or near to and parallel with, the imaginary plane passing through the centre of the drum at right angles to its axis. The exact position of the pivot, and the length of lever, and the imaginary plane through the arc of its swing, are determined by the size of the drum and the geometrical considerations of design governing correct paying-on, and will vary according to whether the winding mechanism has a horizontal or vertical spindle, or a spindle otherwise disposed to all of which the invention is applicable.

The invention also consists in paying-on gear according to the preceding paragraph in which one end of the strut or lever is counterweighted to counterbalance the weight of the fairlead or other cable engaging device at the other end of the lever.

The invention also consists in a paying-on gear according to either of the preceding paragraphs in which provision is made for alteration of the length of the lever and in the position of the counterweight.

Further features of the invention will be apparent from the description given hereafter.

The accompanying drawings illustrate one mode of carrying out the invention.

Figure 1 is a diagram illustrating the principle on which the invention operates.

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Figure 2 is a diagram showing the application of the invention to a winch on a vehicle.

Figure 3 is a front elevation showing in detail one form of paying-on gear in accordance with the invention.

Figure 4 is a side elevation of Figure 3, and Figure 5 is a section on a larger scale of the lower part of the swinging arm shown in Figures 3 and 4.

Figure 6 is a side elevation of an adjustable lever.

Figure 7 is a vertical section on the line 7—7 of Figure 6, in the direction of the arrows.

Figure 8 is a diagram showing a pivoted frame for supporting the lever.

A brief explanation of the principles underlying the invention may first be given by reference to Figures 1 and 2 of the drawings showing the invention applied to a vehicle.

Imperfect paying-on of the winch rope is due to a sideways component force in the plane of the base of the winch-drum D—where the rope pays on—and the fixed central roller R. For a given load hauled this force is dependent on the angle between the position of the rope on the drum and the rear fairleads G of the vehicle. It is clearly greatest at either extremity of the drum, and progressively decreases towards the centre of the drum where it is instantaneously zero.

Suppose now the rope is set at one extremity A of the drum (Figure 1) and pulled taut by a load P through the rear fairleads G, it will take up an angle θ max. determined by the width of the drum. If the drum is now rotated and the rope moving towards the centre, gaps between the successive coils will be caused.

To avoid these gaps it is essential that the rope should approach the bottom of the drum at right angles to the drum's axis of rotation, but to achieve this end the rope has to be pressed sideways and outwards to some arbitrary point A' with a force P sin α equivalent to the component set up by the change in position, as shown by the dotted lines in Figure 1. Referring now to Figure 2, the pendulum swings in a vertical plane, the centre line of the pivot in plan passing through the centre of the winch drum.

The lower extremity of the pendulum, to which a fairlead is fitted, applies the lateral force necessary to press the rope outwards until it is at right angles to the drum.

Since the pivot of the pendulum is raised above the rope level, then when the lever is pressed outwards to displace the rope, there will be a restor-

ing couple P_1x about the pivot centre tending to bring the extremity back into the position of equilibrium of the rope. In Figure 2 this couple is counter-clockwise as viewed from the front of the vehicle.

It is clear that, for a given position, this couple can be balanced by a clockwise couple, $P_v y$, by using the mechanism to depress the rope downwards, as well as outwards, for in that case a vertical component P_v is induced, with a leverage y about the pivot. It will be noted that the rod of the pendulum then becomes a strut to accept the radial thrust T up the rod on the pivot. Also that the fact that the rope is depressed downwards—while altering its tangential approach to the drum—does not invalidate its ability to pay-on at right angles to the drum's axis of rotation, which is the pre-condition for correct paying-on for any of the various positions of coils on the drum.

It is easy to see that, by due attention to the geometry of the system, the equilibrium of the pendulum at right angles to the drum with the rope at one or other extremity can be established. Now the pendulum has no effect on the rope when it reaches the centre of the drum, as there is then no lateral force attempting to straighten the rope, and although the vertical force is greatest it has no moment about the pendulum pivot.

In carrying my invention into practical effect in one convenient manner as, for example, in its application to a vehicle provided with a hauling winch D, the cable to which passes through fairleads G arranged in line with the centre of the winch drum and under a roller R disposed between the fairleads and the winch drum, I mount on a bracket 1, secured to any convenient part of the vehicle a pendulous lever 2, adapted to swing in a vertical plane and the lower end of which is provided with a roller fairlead 3, or other device adapted to engage the rope or cable 4. The upper end of the pendulous lever above the pivot is provided with a counterweight 5 to counterbalance the weight of the fairlead at the lower end of the lever and any suitable provision may be made for adjusting the length of the pendulum and also the position of the counterweight; for example (Figs. 6 and 7), the pendulous lever may be in the form of a threaded rod 2—*a* threaded in a nut 2—*b* formed in the pivot 2—*c* and the counterweight 5—*a* may also be threaded on to the upper end of the pendulum rod 2—*a*, suitable lock nuts 2—*d* being provided for holding the pendulum rod 2—*a* and counterweight 5—*a* in any position to which they may be adjusted. It will, however, be understood that this is merely one example and is not given by way of limitation since I may employ a telescopic or other arrangement for the purpose. For example, as shown in Figure 5 of the drawing, the lower part of the pendulum may be replaceable, being held in position by the retaining screws 6. Also the position of the pivot in the vertical centre line may be made adjustable, it being understood that in this particular case the centre line of the pivot in plan passes through the centre of the winch drum. By arranging the pendulous lever so that as it swings outwards towards either end of the drum it presses the cable both outwards and downwards it will be seen from the foregoing explanation that by suitable choice of pivot position and length of pendulum the latter will be in equilibrium at each end of its swing when the cable is at right angles to the winch drum, and it will clearly also be in equilibrium at the centre of its swing when the pendulum will have no effect upon the rope since there is no lateral force attempting to straighten the rope and although the vertical force at this point due to depression of the rope is at its maximum such force has no moment about the pendulum pivot.

In order to relieve the pivoted member 2 of all torsional stress throughout its swing and particularly at the extremities of the swing, the guide member 3 may be mounted in a thrust bearing 33 (Figure 4) so that it is permitted to oscillate about the axis of the member 2.

It is not deemed necessary to go in detail into the mathematical and theoretical considerations involved but theoretically if the apparatus is set for correct paying-on for one layer it will not be absolutely correct for other layers of the rope and the further the layers are from that designed to pay-on correctly the greater the error of the system. In practice, however, if the apparatus is designed so that the rope is paid on correctly on an intermediate layer, then according to the width and size of drum, and diameter of the flexible member, several layers can be paid on to all intents and purposes correctly, and in the case referred to, i. e. a vehicle winch, at least five or six layers can be accommodated without error.

As indicated above the pendulum arm may be counterbalanced so that its weight on the winch rope has no directive effect towards the centre of the drum, and in fact for very light loads, such as is provided, for example, by a tensioner device (for paying-on under no load conditions) it is perhaps desirable that a slight out-of-balance bias be given to the pendulum by raising the counterweight so that there is a very small tendency for the lever fairleads to press the rope outwards towards the extremity of the drum. In this connection it is important that the rope or cable be associated with a tensioner device for paying the rope on under no load conditions since the gear will not operate unless the winch rope is stretched.

In Figure 1 there is shown a tensioner device consisting of a carriage 7 having two rollers 8, 9 thereon, the carriage being connected by a tension spring 11, to a lever 12, which may be set in either of two positions in which the tensioner will be operative or inoperative respectively, according to whether the cable is pressed against a third roller 10 or not.

In some cases (Fig. 8) the pendulum device may be pivoted in a frame 1—*a* which itself is pivoted about an axis 1—*b* at right angles to the pendulum axis so that the inclination of the latter to the vertical may be varied as may be necessary, particularly when winding thread or like material.

It will be understood that the foregoing details are given purely by way of example to indicate the nature of the invention, and one of its applications, but the invention is applicable generally to the winding of cables or like flexible members on to drums or other winding members, and the details of construction may be variously modified depending upon the type or construction of apparatus to which the paying-on gear is to be applied or any practical requirements which may have to be fulfilled.

I claim:

1. Paying-on gear for winding apparatus of the kind referred to comprising a horizontally

disposed winding member, a tensioner for the cable, a member between said winding member and said tensioner pivoted at a point above the winding member so as to be freely swingable in the manner of a pendulum in a plane substantially parallel to the axis of said winding member, and means on the lower end of said pivoted pendulum member and situated at a point lower than the winding member to engage the cable throughout the winding operation.

2. Paying-on gear according to claim 1 in which the cable engaging means at the lower end of the pivoted member is vertically adjustable relative to the pivot point of the member and is also mounted for oscillation about the axis of said member, an extended portion on the member above the pivot point, and a counterweight adjustably mounted on the extended portion to counterbalance the weight of the cable engaging means.

3. Paying-on gear according to claim 1 in which the pivotal axis of the pivoted member lies in a plane substantially coincident with the imaginary plane passing through the center of the winding member at right angles to its axis, and means for adjusting the length of the lower portion of the pivoted member.

4. Paying-on gear for winding apparatus of the kind referred to comprising a winding member, a tensioner for the cable, a member between said winding member and said tensioner pivoted so as to be freely swingable in a plane substantially parallel to the axis of said winding member, means on said pivoted member to engage the cable throughout the winding operation, a frame in which said pivoted member is pivoted, and said frame being movable angularly about a pivot whose axis is at right angles to the pivotal axis of said pivoted member.

5. Paying-on gear for winding apparatus according to claim 1 in which the cable-engaging means on the pivoted member is mounted for oscillation about the axis of said member.

FELIX GAYE.

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