R. R. DUNLOP.

GATHERING LOCOMOTIVE.

APPLICATION FILED OCT. 6, 1909.

1,049,826.

Patented Jan. 7, 1913.

2 SHEETS—SHEET 1.

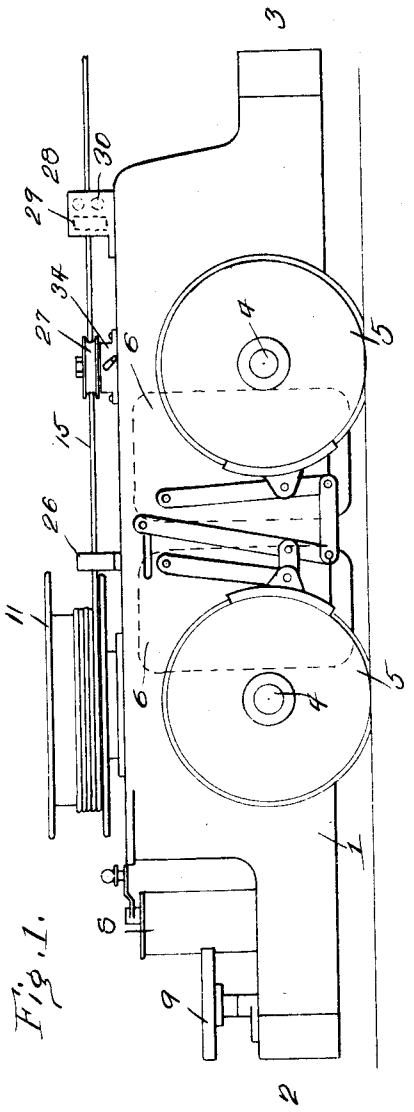

Fig. 1.

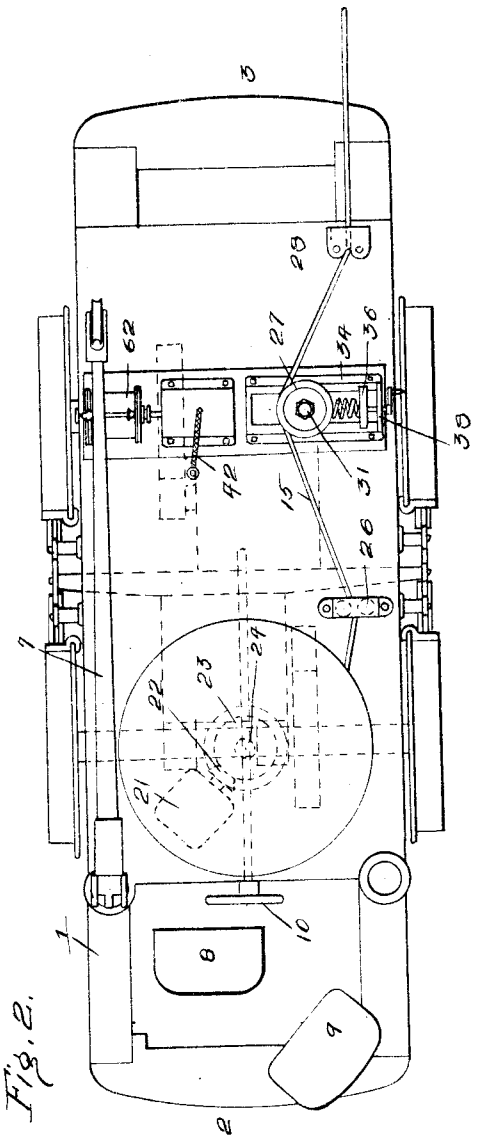

Fig. 2.

Witnesses

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2 SHEETS—SHEET 2.

Fig. 3.

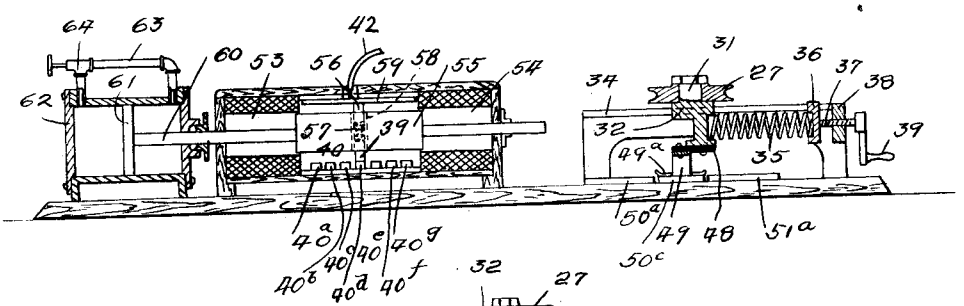


Fig. 4.

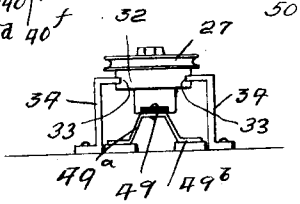


Fig 5

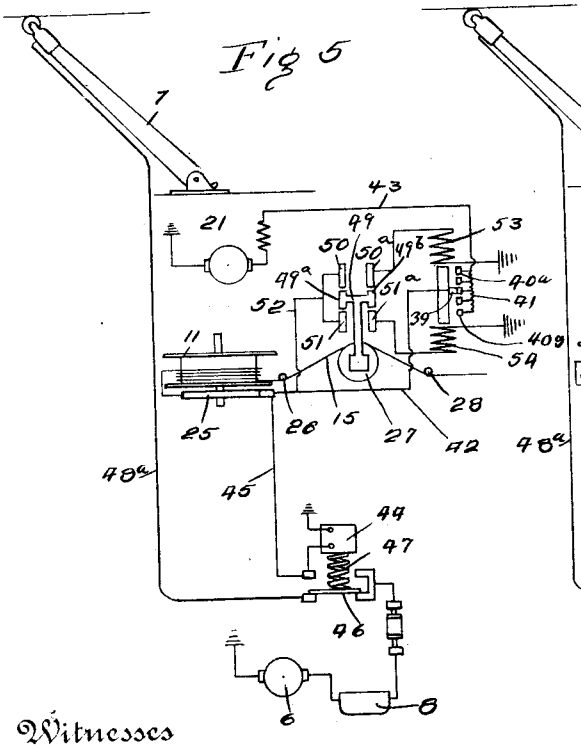
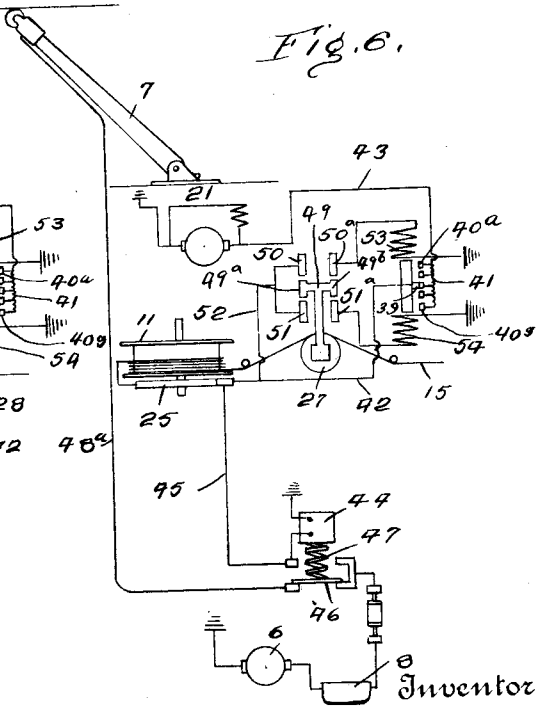


Fig. 6.



Witnesses

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UNITED STATES PATENT OFFICE.

ROBERT ROWSE DUNLOP, OF COLUMBUS, OHIO, ASSIGNOR TO THE JEFFREY MANUFACTURING COMPANY, A CORPORATION OF OHIO.

GATHERING-LOCOMOTIVE.

1,049,826. Specification of Letters Patent. Patented Jan. 7, 1913.

Application filed October 6, 1909. Serial No. 521,374.

To all whom it may concern:

Be it known that I, ROBERT R. DUNLOP, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Gathering-Locomotives, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to mine gathering locomotives and has as its object to provide a locomotive with a flexible cable for collecting current and conducting it to the locomotive, and with an automatically controlled winding mechanism for the cable which is regulated by the tension in the cable.

Gathering locomotives provided with electric conductor cables are used in mine rooms and side entries which are not equipped with trolley wires or other fixed electric conductors. The free end of the cable is electrically connected to the trolley wire in the nearest main entry, and the locomotive is propelled along the tracks in the side entries and rooms by means of current conducted by the cable to the locomotive motors. The cable is wound upon a reel carried by the locomotive from which it is paid out as the locomotive is moving away from the trolley wire and upon which it is wound when the locomotive is moving toward the trolley wire. Thus equipped, the locomotive is able to gather the coal or ore cars from the rooms in which the mine product is being cut, and haul them to the main entry where they can be collected in trains for haulage to points outside the mine. Great difficulty has been experienced in properly controlling the unwinding and winding movements of the reel. When the reel is unwinding, it is desirable to maintain a constant tension in the cable which shall be sufficient to prevent the cable from being laid in undulations along the track, and which at the same time will not be sufficient to break or damage the cable or to remove it from its terminal fastening at its free end. When the cable is being wound it is necessary to operate the reel at a speed proportional to the speed of the locomotive, and at the same time to cause the power mechanism which operates the reel to tend to wind the reel at all times faster than the movement of the locomotive will permit so that a uniform tension may also be maintained during the movement of the locomotive toward the trolley wire. The failure of the winding mechanism to so operate will result in the locomotive running ahead of the cable and in the wheels of the locomotive passing over and damaging or completely severing the cable. Many devices have been suggested and many ideas followed out in an attempt to provide a winding mechanism for the reel and a brake for controlling its unwinding movements which will bring about the desired result.

It is the purpose of this invention to provide a combined brake and power winder which shall maintain an absolutely constant tension in the cable at all times, whether the locomotive be moving toward or away from the trolley wire or be standing still upon the track.

Figure 1 of the drawings is a side elevation of a locomotive embodying the improvements of my invention. Fig. 2 is a plan view of the same. Figs. 3 and 4 show the automatic voltage controlling mechanism in detail. Figs. 5 and 6 show circuits of two electrical apparatus embodying my invention.

The locomotive is constructed with the usual side frames 1, 1 and end frames 2, 3 bolted thereto. This framework is mounted on the axles 4, 4 and wheels 5, 5. The locomotive is propelled by means of the electric motors, 6, 6, each of which is geared to its corresponding axle 4. The trolley poles 7, 7 serve to conduct current from the trolley wire to the motors when the locomotive is operating in those parts of the mine which are equipped with trolley wires. At the rear end of the locomotive a controller 8 for the locomotive motors, a motorman's seat 9, a brake wheel 10, and the other controlling mechanism are placed.

A cable reel 11 is mounted on a vertical axis on top of the locomotive, and upon it is wound the cable 15 which is provided at its free end with a hook adapted to engage the trolley wire and receive current therefrom. An electric motor 21 is suitably mounted on the frame of the locomotive adjacent to and below the reel, and is geared to the reel by means of the armature pinion 22 and the beveled gear 23, which is keyed upon the reel shaft 24. Appropriate sliding contact devices 25 are provided for conducting the current from the inner end of the reel to the locomotive motors and to the reel

motor 21. The cable 15 as it leaves the reel passes first between the vertically mounted guide rollers 26, then around the sheave 27 and lastly, as it leaves the locomotive, through the guide mechanism 28. This guide mechanism 28 comprises the pair of vertically arranged rollers 29 and the horizontally arranged rollers 30.

The sheave 27 is mounted on a vertical axis on the stub shaft 31, which is formed integral with the block 32. This block is grooved at 33, 33 along its vertical edges to slidably engage the guides 34. These guides are bolted to the top parts of the locomotive in a transverse position with respect to the locomotives. The spring 35, which lies longitudinally between the guides 34, abuts at one end the sliding block 32 and at the other end the fixed block 36 and serves to hold the sheave 27 in a position farthest from the straight line joining the rollers 26 and 29. It is resisted in its action by the cable which compresses the spring to an extent varying in accordance with the amount of the tension in the cable. The position of the fixed abutment block 36 is variable by means of the screw rod 37, which has threaded engagement with the stationary end wall 38 connecting the two guides 34 and which can be manually rotated by means of the crank 39.

To the under face of the block 32 is fastened an insulating plate 48, to which in turn is secured the conductor yoke 49. This yoke has sliding contact with the terminals 50 and 51 by means of the shoe or brush 49^a and with the terminals 50^a and 51^a by means of the brush 49^b. When the tension in the cable is normal in amount the shoes 49^a and 49^b will not be in engagement with any of these terminals, but will be supported on a block 50^c which is without electrical connection with other parts.

53 and 54 are two solenoids mounted in alinement with each other preferably with their axes extending transversely of the locomotive.

55 is a core rigidly mounted on a rod 60 for longitudinal movement between the two solenoids and into one or the other of them. The solenoid 53 is electrically connected with the contact 50^a and the solenoid 54 is electrically connected with the contact 51^a.

When the tension in the cable 15 becomes too small the spring 35 will move the yoke 49 to a position where it will connect terminals 50 and 50^a and complete the circuit of the solenoid 53, conducting current to it from the sliding contact devices 25 of the cable reel by means of conductor 52. When, on the other hand, the tension in the cable increases above normal the yoke will be pulled back against the action of the spring 35 into position to similarly energize the solenoid 54 through the contact 51^a. As shown in Fig. 3, when the solenoid 53 is energized, the iron core 55 will be moved to the left, and when solenoid 54 is energized the core will be moved to the right, and as it moves it will carry with it the contact blocks 56 and 39, which are slidably mounted in the insulating bushing 57 seated in the hole 58 drilled through the core. One of these contact blocks 56 slidably engages the terminal 59 of the conductor wire 42 and the other contact block 39 slidably engages the contact buttons 40, which are the terminals of the wire 43 leading to the motor 21. Resistance 41 is interposed between these buttons, so that when the contact block 39 is in engagement with the right hand button 40^g all of this resistance is interposed in series in the circuit of the motor. As the contact block moves successively into engagement with the contact buttons 40^f, 40^e, etc., the resistance is decreased by steps until the contact button 40^a is reached, when the voltage applied to the motor becomes a maximum. To steady the action of the solenoid 55, so that control of the cable tension may not be jerky, the rod 60 has secured at its outer end the piston 61 which operates in the oil cylinder 62. The oil passes from the chamber in front of the piston to the chamber to the rear of the piston by means of the by-pass 63, and its freedom of flow is regulated by means of a valve 64. In this manner the automatic tension controlling mechanism, which is in effect a tension governor, is prevented from overrunning. In other words, the oil cylinder or retarding device prevents the controlling mechanism from responding so quickly and violently to the change of tension, as to more than counteract the change.

The motor 21 may either be a series motor, as shown in Fig. 5, or a shunt motor, as shown in Fig. 6. From the motor the current is led back to the generator in any suitable path, the drawings indicating that the return terminal of the motor is grounded. Mechanism is provided whereby, when the cable is connected to the trolley wire, the trolley pole and its connections are cut out of circuit and the cable is placed in series with the locomotive motors. The same mechanism also automatically cuts the cable and the reel motor out of circuit as soon as the cable hook is separated from the trolley wire. This mechanism comprises the electro-magnet 44, which is energized by means of the conductor wire 45 as soon as the cable hook is electrically connected to the trolley wire. When thus energized, the electromagnet draws the switch 46 toward itself against the action of the spring 47 connecting the wire 45 with the controller 8 and the car motors 6. When the locomotive is operated from the trolley wire the electromagnet is deënergized and the spring 47 moves the switch 46 into position to connect the wire 48^a, which leads to the trolley wheel

with the controller 8 and the car motors 6. Since the reel motor is always in series with the cable, it is automatically energized whenever the cable hook is connected to the trolley wire and current. This current is cut off whenever the cable is disconnected from the trolley wire by the action of the spring 47. When the locomotive is to be operated by means of the cable the cable hook is fastened to the trolley wire and the locomotive proceeds away from the trolley wire with either the motorman's end in advance or with the other end in advance, as may be most convenient. When the end opposite the motorman's position is in advance, the cable is conducted back from the guide mechanism 28 and kept from chafing against the locomotive parts by any suitable anti-friction devices. Irrespective of whether one end or the other is in advance, as soon as the cable is connected to the trolley wire, the motor will be energized and the armature will be compelled to turn against the magnetic torque of the field, as the cable is unwound from the reel under the action of the moving locomotive. Tension will be created in the cable because the motor armature is thus resisted in its rotation by the energized field. If this tension exceeds a predetermined amount the spring 35 will be compressed more than its normal amount and resistance will be put in series with the reel motor. Thus, the voltage applied to the motor will be diminished, the winding torque will be correspondingly diminished and the tension in the cable will be lowered to the desired normal. If the locomotive should be suddenly retarded in its motion along the track and the cable should become too slack, the spring 35 will automatically cut out resistance from the circuit of the reel motor, the voltage across the motor terminals will be increased and the winding torque will be correspondingly increased, with the result that the tension in the cable is again brought back to normal. When the locomotive is moving toward the fixed end of the cable the motor armature will be rotated by electrical energy, and the voltage applied to the motor terminals will be regulated and increased or diminished as the conditions of operation vary, so as to maintain the tension in the cable constant in quantity. The motor is so designed that it will thus operate either as an electro-magnetic brake or to furnish power to wind the reel, according as the locomotive is moving in the direction to unwind the cable or in the direction to wind the cable respectively. The electric energy required to rotate the reel to wind the cable is greater than that required to cause the motor to act as a brake when the reel is unwinding—other conditions being equal—if constant tension under both sets of conditions is the desideratum. By using the automatic controlling mechanism which has been described, the same motor can be used for both purposes and the tension be kept at a normal value under all circumstances. This automatic action is the same whichever end of the locomotive be in advance, as it recedes from the fixed end of the conductor. The reel motor is automatically put in circuit, and from the time that the cable is placed in operation until the time when the cable is again disconnected, no attention of the motorman is required however suddenly the conditions of operation may vary.

The automatic controlling mechanism is operated by the tension of the cable and not by the speed of the locomotive, the speed of the reel motor, or any variation in the speed of the locomotive or of the reel motor. It operates effectively whether the slack in the cable on the one hand, or the excessive tension in the cable on the other hand, be caused by variation in the line voltage, by mechanical obstruction of the rotative movement of the reel, by friction between the cable and the locomotive parts or by variations in the speed of the locomotive. It will also operate whether a series motor or a shunt motor be used to drive the reel. For some reasons a shunt motor is preferable to a series motor for the purpose of driving the reel, the shunt motor being capable of being so designed that its speed will not vary excessively under varying load conditions. When a shunt motor is used the slackening of the cable is not automatically taken care of by an increase in the speed of the motor, such as is to some extent the case with a series motor which thus responds to a lightening of the load; and when using a shunt motor, the automatic device, which is the subject matter of this invention, becomes then a necessity for increasing the speed of the motor.

What I claim is—

1. The combination in a locomotive, of an electric motor for propelling it, a cable reel mounted on the locomotive, a conductor cable wound on the reel at one end and adapted to be secured to a fixed conductor at the other end, and electrically connected with the said motor, a power device, transmitting mechanism between the power device and the reel, and mechanism for varying the power supplied the power device, said mechanism being controlled by the tension in the cable.

2. The combination in a locomotive, of an electric motor for propelling it, a cable reel mounted on the locomotive, a conductor cable wound on the reel at one end and adapted to be secured to a fixed conductor at the other end, and electrically connected with the said motor, a power device, transmitting mechanism between the power de-

vice and the reel, and mechanism for varying the speed of the power device, said mechanism being controlled by the tension in the cable.

3. The combination in a locomotive, of an electric motor for propelling it, a cable reel mounted on the locomotive, a conductor cable wound on the reel at one end and adapted to be secured to a fixed conductor at the other end, and electrically connected with said motor, means for applying a winding torque in opposition to the unwinding rotation of the reel, and an automatic controlling mechanism for the said torque applying means operable by the cable tension.

4. The combination in a locomotive, of an electric motor for propelling it, a cable reel mounted on the locomotive, a conductor cable wound on the reel at one end and adapted to be secured to a fixed conductor at the other end, and electrically connected with the said motor, means for rotating the reel, said means being independent of the locomotive motor and propelling mechanism and being energized independently of the movement of the locomotive, and automatic controlling mechanism for the said reel rotating means operable by the cable tension.

5. The combination in a locomotive, of an electric motor for propelling it, a cable reel mounted on the locomotive, a conductor cable wound on the reel at one end and adapted to be secured to a fixed conductor at the other end, and electrically connected with the said motor, a second electric motor for operating the reel, and automatically acting controlling mechanism for the second motor operable by the cable tension.

6. The combination in a locomotive, of an electric motor for propelling it, a cable reel mounted on the locomotive, a conductor cable wound on the reel at one end and adapted to be secured to a fixed conductor at the other end, and electrically connected with the said motor, a second electric motor for operating the reel, and automatically acting mechanism operable by the cable tension for varying the voltage applied to the second motor.

7. The combination in a locomotive, of an electric motor for propelling it, a cable reel mounted on the locomotive, a conductor cable wound on the reel at one end and adapted to be secured to a fixed conductor at the other end, and electrically connected with the said motor, a single device adapted to serve as a combined power brake and power winder for the reel, operating as a brake when the reel is unwinding and as a winder when the reel is winding, a single train of connections between the said device and the said reel, and a governor for the said device controlled by the cable tension.

8. The combination in a locomotive, of an electric motor for propelling it, a cable reel mounted on the locomotive, a conductor cable wound on the reel at one end and adapted to be secured to a fixed conductor at the other end, and electrically connected with the said motor, means for applying an electro-magnetic torque to resist the unwinding rotation of the reel, and an automatic controller for the said means operable by the cable tension.

9. The combination in a locomotive, of an electric motor for propelling it, a cable reel mounted on the locomotive, a conductor cable wound on the reel at one end and adapted to be secured to a fixed conductor at the other end, and electrically connected with the said motor, a second electric motor geared to the cable reel and adapted to wind the cable when the locomotive is moving toward the fixed conductor and to electro-magnetically resist the unwinding of the cable reel when the locomotive is moving away from the fixed conductor, and an automatic controller for the second motor operated by the cable tension.

10. The combination in a locomotive, of an electric motor for propelling it, a cable reel mounted on the locomotive, a conductor cable wound on the reel at one end and adapted to be secured to a fixed conductor at the other end, and electrically connected with the said motor, a second electric motor permanently geared to the cable reel, and automatic mechanism operated by the cable tension to vary the voltage applied to the reel.

11. The combination in a locomotive, of an electric motor for propelling it, a cable reel mounted on the locomotive, a conductor cable wound on the reel at one end and adapted to be secured to a fixed conductor at the other end, and electrically connected with the said motor, a second electric motor for the cable reel, and mechanism operable by the cable when the tension therein exceeds or is less than normal to decrease or increase respectively the voltage applied to the reel motor.

12. The combination in a locomotive, of an electric motor for propelling it, a cable reel mounted on the locomotive, a conductor cable wound on the reel at one end and adapted to be secured to a fixed conductor at the other end, and electrically connected with the said motor, a second electric motor for the cable reel and means for regulating the voltage applied to the reel motor operable by the cable tension to maintain said tension constant under varying conditions.

13. The combination in a locomotive, of an electric motor for propelling it, a cable reel mounted on the locomotive, a conductor cable wound on the reel at one end and adapted to be secured to a fixed conductor at the other end, and electrically connected

with the said motor, a combined power brake and power winder for the reel, operating as a brake when the reel is unwinding and as a winder when the reel is winding, and a governor for the said brake and winder controlled by the cable tension, and adapted to regulate the power applied thereto to maintain the cable tension constant under varying conditions and irrespective of the direction of movement of the locomotive.

14. The combination in a locomotive, of an electric motor for propelling it, a cable reel mounted on the locomotive, a conductor cable wound on the reel at one end and adapted to be secured to a fixed conductor at the other end, and electrically connected with the said motor, a second electric motor geared to the cable reel and adapted to wind the cable when the locomotive is moving toward the fixed conductor and to electro-magnetically resist the unwinding of the cable reel when the locomotive is moving away from the fixed conductor, and an automatic controller for the second motor operated by the cable tension and adapted to maintain the cable tension constant under varying conditions and irrespective of the direction of movement of the locomotive.

15. The combination in a locomotive, of an electric motor for propelling it, a cable reel mounted on the locomotive, a conductor cable wound on the reel at one end and adapted to be secured to a fixed conductor at the other end, and electrically connected with the said motor, means for operating the reel to wind the cable, means for regulating the unwinding movement of the reel, and means for controlling the winding and the regulating means operable by the cable to maintain the cable tension constant irrespective of the direction of movement of the locomotive.

16. The combination in a locomotive, of an electric motor for propelling it, a cable reel mounted on the locomotive, a conductor cable wound on the reel at one end and adapted to be secured to a fixed conductor at the other end, and electrically connected with the said motor, a second electric motor geared to the cable reel and adapted to wind the cable when the locomotive is moving toward the fixed conductor and to electro-magnetically resist the unwinding of the cable reel when the locomotive is moving away from the fixed conductor, and automatic means for applying more power to said motor when the locomotive is moving toward the fixed conductor than when it is moving away therefrom.

17. The combination in a locomotive, of an electric motor for propelling it, a cable reel mounted on the locomotive, a conductor cable wound on the reel at one end and adapted to be secured to a fixed conductor at the other end, and electrically connected with the said motor, a second electric motor geared to the cable reel and adapted to wind the cable when the locomotive is moving toward the fixed conductor and to electro-magnetically resist the unwinding of the cable reel when the locomotive is moving away from the fixed conductor, and automatic means operable by the cable tension for increasing the voltage applied to the reel when it is moving toward the fixed conductor to a value greater than that when the locomotive is moving away from the fixed conductor.

18. The combination in a locomotive, of an electric motor for propelling it, a cable reel mounted on the locomotive, a conductor cable wound on the reel at one end and adapted to be secured to a fixed conductor at the other end, and electrically connected with the said motor, a second electric motor for the reel, a variable resistance in series with the motor, and a controller operable by the cable whenever the tension therein exceeds or is less than a predetermined amount to give the resistance a new value adapted to bring the cable tension back to normal.

19. The combination in a locomotive, of an electric motor for propelling it, a cable reel mounted on the locomotive, a conductor cable wound on the reel at one end and adapted to be secured to a fixed conductor at the other end, and electrically connected with the said motor, a second electric motor for the reel, a variable resistance in series therewith, a switch to vary the resistance, a movably mounted pulley for the cable, a spring acting on the pulley and resisting the tension in the cable, and means operatively connecting the pulley and switch.

In testimony whereof I affix my signature, in presence of two witnesses.

ROBERT ROWSE DUNLOP.

Witnesses:
W. R. YOUMANS,
ARTHUR G. SKEELS.