Aug. 12, 1930. N. D. LEVIN 1,773,087

HAULAGE SYSTEM FOR MINES

Filed May 12, 1925

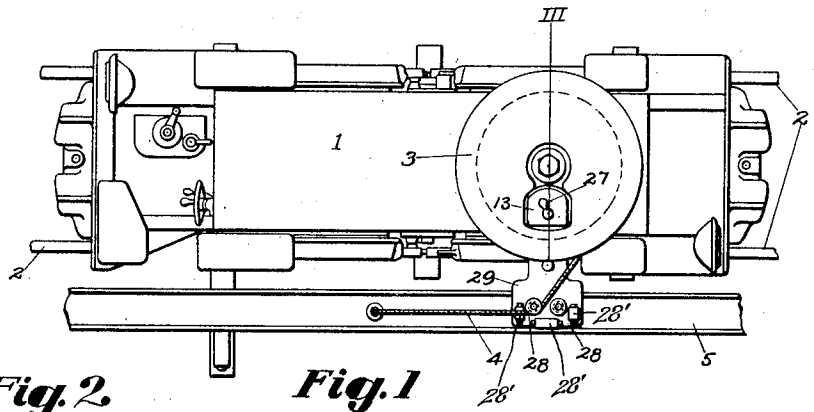
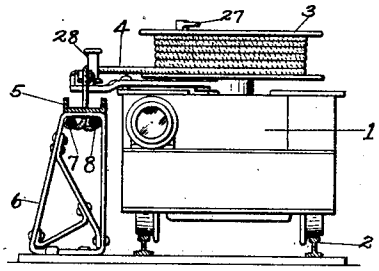


Fig. 1

Fig. 2.



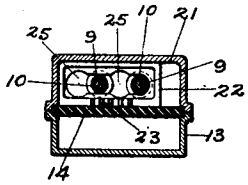


Fig. 6

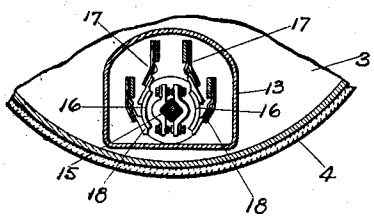


Fig. 5

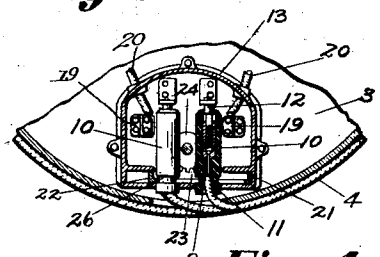


Fig 4

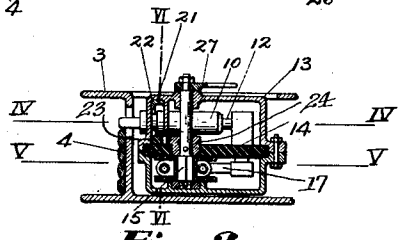


Fig. 3

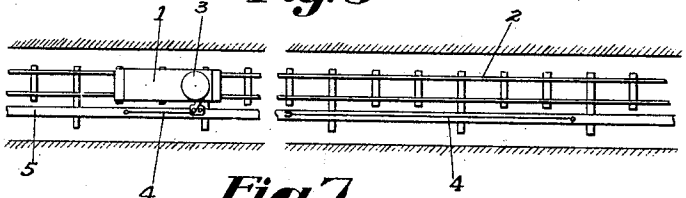


Fig. 7

Witnesses!
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UNITED STATES PATENT OFFICE

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HAULAGE SYSTEM FOR MINES

Application filed May 12, 1925. Serial No. 29,832.

The present invention relates to certain new and useful improvements in haulage systems for mines, and particularly for systems adapted to use in coal mines for hauling the broken down coal from the mine, and comprising locomotives having propelling motors supplied with energy from a stationary source of supply through suitably disposed conductors connectible with said motors while they travel along the passages of the mine.

Heretofore the locomotives available for use in coal mines, and similar installations, have been propelled by electric motors deriving their actuating current through the well known trolley wire and cooperating traveling contacts.

In some coal mines the mining operation occasionally release pockets of gas confined in the body of the coal vein, and the prevalence of such gas pockets presents a constant danger of explosion. Electrical devices adapted to use in such mines are, therefore, enclosed in gas tight casings designed to prevent the ignition of the gas charged atmosphere of the mine by electric arcs occurring within said devices. Usually the currents of air flowing through the entries of a mine effectively prevent the accumulation therein of gas in sufficient quantities to render the atmosphere explosive, and naked trolley wheels cooperating with bare trolley wires of the usual type can be safely used to supply current for the locomotive by which coal is hauled along these entries.

In the room of such a mine, however, where the principal mining operations are performed, greater precautions are required, and flexible insulated electric conductor cables, temporarily connected with the trolley wires in the entries, supply current to mining machines of approved construction operating in the mine rooms. Relatively small locomotives having protected electric motors and controlling devices, and provided with automatically acting winding reels upon which may be wound sufficient lengths of cable, usually from three to six hundred feet, are used to enter the mine rooms and gather cars of coal therefrom. In some mines, however, the danger of explosion is so great that trolley wires cannot be safely used even in the main haulage entries, and the use of electric locomotives in such mines has heretofore been prevented.

It is the especial object of this invention to provide a system of mine haulage adapted to be used in a gas charged atmosphere, comprising locomotives and explosion proof means available along the entries of the mine to deliver energy from a stationary source of supply to the locomotives as they move along said entries.

The means whereby I attain this object is fully set forth in the following specification, and illustrated in the accompanying drawing, of which—

Fig. 1 is a plan view of a locomotive associated with the devices of my invention.

Fig. 2 is an end elevation of the locomotive illustrated in Fig. 1.

Fig. 3 is a fragmentary sectional view taken along the lines III—III of Fig. 1.

Fig. 4 is a fragmentary sectional view taken along the line IV—IV of Fig. 3.

Fig. 5 is a fragmentary sectional view taken along the line V—V of Fig. 3.

Fig. 6 is a sectional view taken along the line VI—VI of Fig. 3.

Fig. 7 is a diagrammatic plan view of a mine entry showing the arrangement of tracks and conductor cables involved in the present invention.

Like numerals refer to similar parts in the several figures.

In the drawing I have shown the preferred embodiment of my invention wherein the numeral 1 refers to an electric locomotive adapted to travel along the rails 2 of a mine track. There is provided, preferably, and as here shown, an automatic take-up and pay-out cable reel 3 connected with suitable power devices by which the reel may be caused to rotate in either direction and adapted to wind an insulated electric conductor 4 through which current is received for the actuation of the motors by which the locomotive is propelled along the track. The automatic cable reel 3 may take the form of any one of many well-known types of reels for this purpose,

and this form of reel may be that of the type disclosed in the patent to Shaver, No. 853,522, May 14, 1907, Mayers, No. 1,100,139, June 16, 1914, or any other well known in this art. The cable reel 3 is provided with suitable connecting devices, hereinafter described, whereby the cable 4 is connected with the motors of the locomotive in a manner which is well understood in the art.

It has been proposed, in delivering power to a locomotive of this general type, to provide a trolley wheel adapted to engage a naked trolley wire disposed adjacent the path of travel of the locomotive. Furthermore, to make temporary power connections and permit operation of the locomotive on branch tracks not provided with trolley wires, there has been provided a cable reel with a flexible power conductor permanently secured thereto, the conductor having contact hooks to make connections with the trolley wire outside of the room. Such devices are shown in the patent to Sessions and Fisher, No. 1,132,740, May 23, 1915.

With these devices, however, both the trolley wheel and the temporary connecting hooks have a tendency to draw arcs, and, in a mine where gas is present, such devices cannot be safely used.

To overcome the difficulties above described, I have provided along the entries of the mine adjacent the mine track, as here shown, but in any event, preferably adjacent the path of travel of the locomotive or similar vehicle, a trough 5, composed of suitable insulating material, such as wood or the like, which is supported upon suitable brackets, such as the brackets 6. Upon the underside of the trough, I have supported suitable conductor cables 7 and 8 which are connected with a source of electric supply and constitute the feeders by which current is supplied to the devices hereinafter described. At suitable intervals along the cables 7 and 8 are connected branch conductor cables 4 adapted to lie in the insulating trough 5, and of a length substantially equal to half the distance between adjacent connecting points. At the free ends of each of these branch cables 4 is provided a pair of terminal plugs 9 having protecting insulating shields 10, of the type which is well understood in the art, adapted to prevent their accidental electrical connection with each other or with other electrical conductors.

The plugs 9 are adapted to be inserted in apertures 11 of, and to engage the terminal connections 12 in the terminal box 13 which is mounted upon the cable reel 3. Preferably this terminal box will be installed as shown, within the reel, being accessible through an opening in the periphery thereof for attaching and detaching the terminal connections 9. It will be seen that as the conductor winds up on the reel, it will overlie the entrance to the terminal box 13, and as the reel pays out and the aperture in the wall of the reel is uncovered, the operator will observe that he is approaching the limit of conductor length, and will guard against driving his locomotive beyond the point which would cause undue strain on the connection.

The terminal box 13 is divided by a horizontal plate 14 of suitable insulating material, into two compartments, the lower of which is gas tight, and in this gas tight compartment is mounted a rotary switch member 15 to which are attached the contact segments 16. The segments 16 are adapted to connect the contact brushes 17 and 18 when the member 15 is in one position of angular adjustment. The brushes 17 are connected with the terminals 12 in the upper compartment of the box 13, and the brushes 18 are connected with suitable binding posts 19, and through them with the cables 20 of the locomotive wiring, in such manner that when the plugs 9 are in engagement with the terminals 12, and the rotary member 15 is in closed circuit position, the conductors of the cable 4 will be in circuit with the motor apparatus of the locomotive.

Circular apertures 11, of a diameter to fit closely around plugs 9, are formed in the front wall of the box 13 in alignment with the terminals 12, and through these apertures the plugs 9 may be thrust to engage the terminals 12. Slidably mounted in guideways 21 formed on the front wall of the box 13 is a shutter 22 provided with rack teeth 23 which engage the teeth of a segmental gear 24 attached to the rotary member 15 in such manner that when said rotary member is turned from one position of angular adjustment to the other, the shutter 22 will slide longitudinally of the guideways, and will be held in adjusted position. Formed in the shutter 22 are two keyhole shaped apertures 25 of such proportion and position that when the rotatable member 15 is in its open circuit position the expanded portions of the apertures 25 will be in alignment with the apertures 11 and 12 to permit the insertion of the plugs 9. Formed in the outer shell 10 of the plugs 9 are circumferential grooves 26 adapted to engage the contracted portion of the apertures 25 to lock the plugs 9 against removal when the rotary member 15 is in its closed circuit position. A suitable operating handle 27 is provided upon the outside of the casing in a position convenient to the hand of the operator for the manipulation of the rotary switch member 15 and the locking shutter 22.

By the arrangement of parts above described, the plugs 9 will be locked in position when the circuit is closed, thereby preventing their withdrawal while current is flowing through the conductors of the cable 4, and the release of the plugs 9 for removal from their engagement with the terminals 12 is preceded by the opening of the circuit, thereby

insuring against the formation of electric arcs when the plugs 9 are withdrawn from the box 13.

In the operation of my improved system of distribution the plugs 9 of one of the branch cables 4 will be inserted in the terminal box 13 and locked in place by closing the switch 15. This supplies current to the locomotive by which it may be propelled in a direction towards and past the point of attachment of said branch cable with the feeder cables 7 and 8. As the locomotive approaches said point of attachment of the branch with the feeders, the branch cable 4 is automatically paid out as the locomotive travels away from said connecting point. Guide sheaves 28, 28', mounted upon a bracket arm 29, preferably mounted on the locomotive, are arranged to lead the cable onto or off of the reel 3 and to lay said cable in the trough 5 where it is protected against accidental injury.

It will be observed that the trough 5 is substantially in line with the top of the locomotive, so that the conductor 4 may be readily laid off from the reel 3 into the trough without any undue amount of slack.

When the locomotive 1 arrives at the end of the branch cable 4, the switch 15 is opened to unlock the plugs 9. These plugs may then be removed from the terminal box 13, and the plugs upon the end of the next adjacent branch cable 4 may be inserted in their place, thus permitting the locomotive to travel along the next stage of its journey, each stage being double the length of the branch cable 4. Since the switch 15 must be opened before the removal of the plugs 9 is possible, and the construction of the plugs 9 prevents their accidental contact with each other or with other conductors, the formation of arcs outside of the explosion proof casings of the apparatus is effectively prevented, thereby insuring against the ignition of an explosive gaseous atmosphere in the room or entries along which the locomotive operates. By the use of the devices above described, locomotives adapted to the haulage of cars of coal from the mine, may be safely employed in mines having explosive atmosphere in which such apparatus has heretofore been impossible.

While I have shown and described the invention as applied to haulage systems, in which a locomotive or equivalent device is utilized to haul mine cars along tracks, it will be apparent that the invention may be applied to other vehicles and kindred devices where it is necessary to move such vehicle or device, and, during movement, supply the motive power from some extraneous source.

The term "locomotive," therefore, as used in this disclosure, is to be taken to mean any motor vehicle or device receiving power from an external supply.

What I claim is: —

1. In a system of mine haulage, the combination with a wheel supported carriage having a motor arranged to actuate the wheels to propel the carriage, of a flexible conductor permanently connected with a stationary source of energy supply and detachably connectible with said motor to transmit energy thereto while said carriage is traveling, and means to prevent said conductor being disconnected from said motor while energy is being supplied thereto.

2. In a system of mine haulage, the combination with a wheel supported carriage having a motor arranged to actuate the wheels to propel the carriage, of a plurality of flexible conductors permanently connected with a stationary source of energy supply and detachably connectible with said motor to transmit energy thereto while said carriage is traveling, and means to prevent said conductor being disconnected from said motor while energy is being supplied thereto.

3. In a system of mine haulage, the combination with a wheel supported carriage having a motor arranged to actuate the wheels to propel the carriage, of a plurality of flexible conductors permanently connected with a stationary source of energy supply and alternately detachably connectible with said motor to transmit energy thereto while said carriage is traveling, and means to prevent said conductor being disconnected from said motor while energy is being supplied thereto.

4. In a system of mine haulage, the combination with a wheel supported carriage having a motor arranged to actuate the wheels to propel the carriage, of a flexible conductor permanently connected with a stationary source of energy supply and detachably connectible with said motor to transmit energy thereto while said carriage is traveling, and devices adapted to simultaneously control the supply of energy to said motor and to prevent said conductor being disconnected from said motor while energy is being supplied thereto.

5. In a system of mine haulage, the combination with a wheel supported carriage having a motor arranged to actuate the wheels to propel the carriage, of a flexible conductor permanently connected with a stationary source of energy supply and detachably connectible with said motor to transmit energy thereto while said carriage is traveling, means to prevent said conductor being disconnected from said motor while energy is being supplied thereto, and automatically acting means upon said carriage to hold the excess length of said conductor.

6. In a system of mine haulage, the combination with a wheel supported carriage having a motor arranged to actuate the wheels to propel the carriage, of a flexible conductor permanently connected with a stationary source of energy supply and detachably con-

nectible with said motor to transmit energy thereto while said carriage is traveling, automatically acting means upon the carriage to take up and hold the excess length of said conductor, and devices associated with said holding means to prevent said conductor being disconnected from said motor while energy is being supplied thereto.

7. In a system of mine haulage, the combination with a wheel supported carriage having a motor arranged to actuate the wheels to propel the carriage, of a flexible conductor permanently connected with a stationary source of energy supply and detachably connectible with said motor to transmit energy thereto while said carriage is traveling, automatically acting means upon the carriage to take up and hold the excess length of said conductor, and manually controllable devices associated with said taking up means to prevent said conductor being disconnected from said motor while energy is being supplied thereto.

8. In a system of mine haulage, the combination with a wheel supported carriage having a motor arranged to actuate the wheels to propel the carriage, of a feeder conductor connected with a source of energy supply, a flexible conductor permanently connected with said feeder conductor and detachably connectible with said motor to transmit energy thereto while said carriage is traveling, an automatically acting winding device upon said carriage adapted to wind said flexible conductor as said carriage approaches its point of connection with said feeder conductor and to pay out said flexible conductor as said carriage recedes from said connection, and means to prevent said flexible conductor being disconnected from said motor while energy is being supplied thereto.

9. In a system of mine haulage, the combination with a wheel supported carriage having a motor arranged to actuate the wheels to propel the carriage, of a feeder conductor connected with a source of energy supply, a flexible conductor permanently connected with said feeder conductor and detachably connectible with said motor to transmit energy thereto while said carriage is traveling, an automatically acting winding device upon said carriage adapted to wind said flexible conductor as said carriage approaches its point of connection with said feeder conductor and to pay out said flexible conductor as said carriage recedes from said connection, and means associated with said winding device to prevent said flexible conductor being disconnected from said motor while energy is being supplied thereto.

10. In a system of mine haulage, the combination with a wheel supported track guided carriage having a motor arranged to actuate the wheels to propel the carriage along the track, of a feeder conductor arranged adjacent the track and connected with a source of energy supply, a plurality of spaced apart branch conductors permanently connected with said feeder conductor and detachably connectible with said motor to transmit energy thereto while said carriage is traveling along said track, and means to prevent said conductors being disconnected from said motor while energy is being supplied thereto.

11. In a system of mine haulage, the combination with a wheel supported track guided carriage having a motor arranged to actuate the wheels to propel the carriage along the track, of a feeder conductor arranged adjacent the track and connected with a source of energy supply, a plurality of spaced apart flexible branch conductors permanently connected with said feeder conductor and alternately detachably connectible with said motor to transmit energy thereto while said carriage is traveling along said track, and means to prevent said flexible conductors being disconnected from said motor while energy is being supplied thereto.

12. In a system of mine haulage, the combination with a locomotive, power devices mounted thereon, a flexible conductor permanently connected with a stationary source of energy supply, an automatically acting winding device upon the locomotive connectible with and adapted to wind said flexible conductor as said carriage approaches its point of connection with said source of supply and to pay it out as said carriage recedes from said point of connection, means associated with said winding device to connect said flexible conductor with said power devices to supply energy thereto, locking means to prevent said flexible conductor being disconnected from said winding device, and means interlocking therewith to interrupt the flow of energy through said conductor before releasing said locking device as and for the purpose set forth.

13. In apparatus of the class described, the combination of a locomotive, a source of power, a flexible power conductor connecting said source of power with said locomotive, a take-up and pay-out device for said conductor on said locomotive, a support of substantially the height of said locomotive extending from said source of power and adapted to receive said flexible conductor, and guiding means for said conductor carried by said locomotive and extending over said support.

14. In apparatus of the class described, the combination of a locomotive, a source of power, a power conductor connecting said source of power with said locomotive, a take-up and pay-out conductor reel carried by said locomotive, a terminal box lying within the periphery of said reel to which said conductor is coupled, and controlling means for said terminal box accessible at one face of the reel.

15. In apparatus of the class described, the combination of a locomotive, a source of power, a power conductor connecting said source of power with said locomotive, a take-up and pay-out conductor reel disposed on said locomotive to revolve upon a vertical axis, a terminal box lying within the periphery of said reel to which said conductor is coupled, and controlling means for said terminal box accessible from the upper side of said reel.

16. In apparatus of the class described, the combination of a locomotive, a source of power, a power conductor connecting said source of power with said locomotive, a take-up and pay-out conductor reel carried by said locomotive, a terminal box mounted within the hub of said reel to which said conductor is coupled, and controlling means for said terminal box accessible at one side of the reel.

17. In apparatus of the class described, the combination of a locomotive, a source of power, a power conductor connecting said source of power with said locomotive, a take-up and pay-out conductor reel carried by said locomotive and having a hollow hub with an opening through a side of the reel to the interior of said hub, a terminal box lying within the hub of said reel to which said conductor is coupled, and controlling means for said terminal box accessible exteriorly of the reel.

18. In an apparatus of the class described, the combination of a locomotive, a source of power, a power conductor connecting said source of power with said locomotive, a take-up and pay-out conductor reel carried by said locomotive and having a hollow hub provided with an opening through the side of the reel, a terminal box adapted to be inserted and removed from the hollow hub of said reel through the opening in the side thereof, and controlling means for said terminal box accessible from the outside of the reel.

19. A take-up and pay-out conductor reel for electric locomotives having a hollow hub provided with an opening through a side of the reel to give access to said hub and a rim having a conductor opening therein, a terminal box adapted to be placed in and removed from said hub through the opening in the side of the reel, and a power transmitting conductor connected with said terminal box and adapted to pass through the opening in the rim of the reel.

20. A take-up and pay-out conductor reel for electric locomotives having a hollow hub provided with an opening through a side of the reel to give access to said hub and a rim having a conductor receiver opening therein adjacent the opening in the side of the reel, a terminal box adapted to be placed in and removed from said hub through the opening in the side of the reel, and a power transmitting conductor connected with said terminal box and adapted to pass through the opening in the rim of the reel.

21. In a system of mine haulage, the combination of relatively permanent power conductors disposed along a path of travel, a carriage adapted to travel along said path adjacent said permanent conductors, a motor for driving said carriage, a plurality of flexible power conductors connected with said permanent power conductors at predetermined points, take-up and pay-out means for said flexible power conductors, means for detachably connecting any one of said plurality of flexible conductors with said motor to drive said carriage, and means to prevent detachment of a flexible power conductor when said carriage has travelled the effective length of that flexible power conductor if power is passing to said locomotive.

22. In a system of haulage, the combination with a carriage, a motor to drive the same, of an automatic take-up and pay-out reel mounted on said carriage, enclosure means carried by said reel and having conductors connected to said motor, a stationary continuous power transmitting element continuously charged and coextensive with the carriage travel, a plurality of movable constantly charged flexible conductors connected to said element at intervals and adapted to selectively transmit energy to said conductors of said enclosure means simultaneously upon their connection therewith without further adjustment of said flexible conductors, and means for locking said flexible conductors in engagement with said enclosure conductors.

23. In a system of haulage, the combination with a carriage, a motor to drive the same; of an automatic take-up and pay-out reel mounted on said carriage, gas tight switch means carried by said reel and having conductors connected with said motor, a stationary continuous electrical conductor continuously charged and coextensive with said carriage travel, a plurality of movable constantly charged electrical flexible conductors connected to said element at intervals and adapted to selectively transmit energy to said switch conductors simultaneously upon their connection therewith, and means operated by said switch means for locking said flexible conductors in engagement with said switch conductors simultaneously with the operation of said switch.

24. In apparatus of the class described, the combination of a locomotive, a source of power, a flexible power conductor connecting said source of power with said locomotive, a take-up and pay-out device on said locomotive and a stationary support arranged above the ground and extending from said source of power and adapted to receive said flexible conductor.

25. In apparatus of the class described, the combination of a locomotive, a source of power, a flexible power conductor mounted on the locomotive connecting said source of

power with said locomotive, a take-up and pay-out device for said conductor, and a stationary support arranged above the ground and extending from said source of power and adapted to receive said flexible conductor as it is paid out.

26. In apparatus of the class described, the combination of a locomotive adapted to travel along a predetermined path, a source of power, a flexible conductor connecting said source of power with said locomotive, a take-up and pay-out device for said conductor mounted on the locomotive, and a stationary support arranged above the ground and extending along the side of said locomotive from said source of power and adapted to receive said flexible conductor.

27. In apparatus of the class described, the combination of a locomotive adapted to travel along a predetermined path, a source of power, a flexible conductor connecting said source of power with said locomotive, a take-up and pay-out device for said conductor mounted on said locomotive, and a stationary support arranged above the ground and extending along the side of said locomotive from said source of power and adapted to receive said flexible conductor.

28. In apparatus of the class described, the combination of a locomotive, a source of power, a flexible power conductor connecting said source of power with said locomotive, and a support arranged above the ground and extending in different directions from said source of power and adapted to receive said flexible conductor.

29. In apparatus of the class described, the combination of a locomotive, a source of power, a flexible power conductor connecting said source of power with said locomotive, a take-up and pay-out device mounted on said locomotive, a stationary support arranged above the ground and extending from said source of power and adapted to receive said flexible conductor, and means to guide said conductor to said support.

30. In apparatus of the class described, the combination of a locomotive, a source of power, a flexible power conductor connecting said source of power with said locomotive, a take-up and pay-out device mounted on said locomotive, a stationary support arranged above the ground and extending from said source of power and adapted to receive said flexible conductor, and means carried by said locomotive to guide said conductor to said support.

31. In apparatus of the class described, the combination of a locomotive, a source of power, a flexible power conductor connecting said source of power with said locomotive, a take-up and pay-out device mounted on said locomotive, a stationary support arranged above the ground and extending from said source of power and adapted to receive said flexible conductor, and guiding means for said conductor carried by said locomotive and extending over said support.

32. In apparatus of the class described, the combination of a locomotive, a source of power, a flexible power conductor connecting said source of power with said locomotive, a take-up and pay-out device for said conductor on said locomotive, a support arranged above the ground and extending from said source of power and adapted to receive said flexible conductor, and guiding means for said conductor carried by said locomotive and extending over said support.

33. In apparatus of the class described, the combination of a locomotive adapted to travel along a predetermined path, a source of power, a flexible conductor connecting said source of power with said locomotive, a take-up and pay-out device carried by said locomotive for said conductor, and a support of substantially the height of the locomotive extending along the path of said locomotive from said source of power and adapted to receive said flexible conductor.

34. In a system of power transmission, the combination with a wheel supported carriage, an electric motor to actuate said wheels to propel the carriage; of stationary electric current conductor means connected with a source of electrical energy and extending along the path of carriage travel, said means including means for the supply and return of electrical current from and to said source, and a plurality of independent flexible conductors normally connected to said stationary electric conductor means at spaced points and being selectively connectible with said motor.

35. In a system of power transmission, the combination with a wheel supported carriage, an electric motor to actuate said wheels to propel the carriage; of a stationary electric current conductor connected with a source of electrical energy and extending along the path of carriage travel, a plurality of flexible electrical conductors normally connected to said stationary conductor at spaced points and being selectively connectible with said motor, each of said flexible conductors having electrical supply and return conduits.

In testimony whereof I have hereunto set my hand.

NILS D. LEVIN.