(No Model.)

S. H. SHORT.

ELECTRIC RAILWAY.

No. 404,873. Patented June 11, 1889.

Fig. 2.

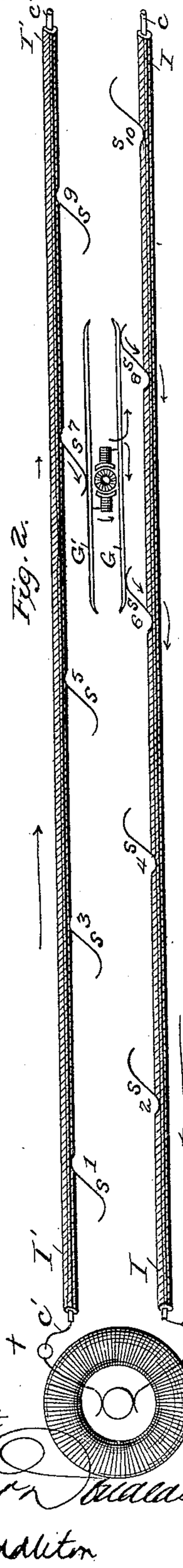


Fig. 3.

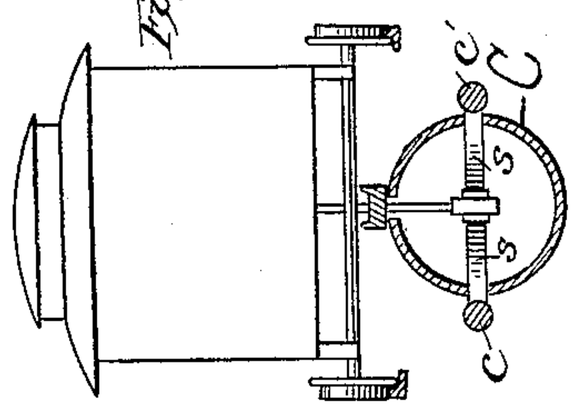
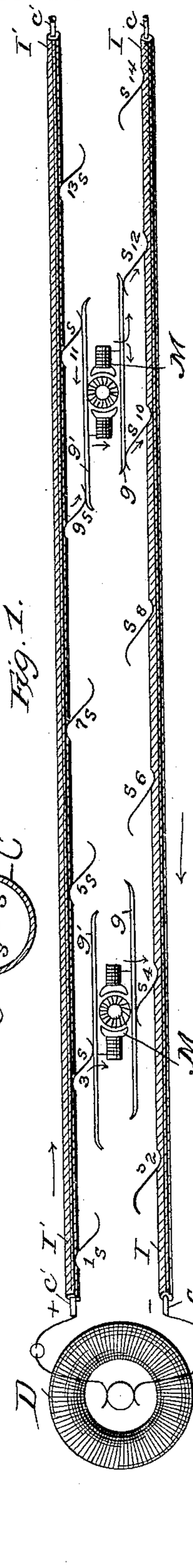


Fig. 1.



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UNITED STATES PATENT OFFICE.

SIDNEY HOWE SHORT, OF DENVER, COLORADO, ASSIGNOR TO THE UNITED STATES ELECTRIC COMPANY, OF SAME PLACE.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 404,873, dated June 11, 1889.

Application filed February 16, 1887. Serial No. 227,796. (No model.)

To all whom it may concern.

Be it known that I, SIDNEY HOWE SHORT, of Denver, in the county of Arapahoe and State of Colorado, have invented a new and useful Improvement in Electrical Railways; and I do hereby declare that the following is a full, clear, and exact description of the same.

My invention relates to electrical railways in which the cars are propelled by a current from a generating-machine through conductors extended in suitable relation to the way.

The object of the invention is to provide an electric railway in which the cars can be run in multiple arc, and to provide also in such a railway a system of conductors insulated throughout their entire length, except at intervals, by means of insulating material, such as that used for underground cables and for electric-light and telegraph wires.

By the device described herein the great difficulty which is met in the ordinary multiple-arc railways of insulating the entire length of a bare conductor or pair of bare conductors in a conduit is to a great extent avoided. The liability to short-circuit the conductors is also greatly reduced by their being exposed only at intervals. The expense of insulation is also greatly reduced, as only the places where the conductors are exposed need be provided for.

In the accompanying drawings, Figure 1 represents in diagrammatic form the conductors with their contact-points in their proper relation to the contact-pieces which are connected to the motor and with the dynamo-connections. Fig. 2 is a similar figure representing another arrangement of the contact-pieces. Fig. 3 represents the cross-section of a conduit and with the conductors and points in their relation to the railway.

Referring to the drawings, Figs. 1 and 2 show two arrangements of contacts made with the conductors and two arrangements of the current-collector.

In Fig. 1 the insulated conductors *c* and *c'* are arranged along an electrical railway parallel with each other, and the + and — terminals of the dynamo D are connected with these conductors, as shown in the drawings. These are connected together at the other end and form with dynamo a complete circuit. These conductors *c* and *c'* are simply wires having a coating of insulation I and I' sufficient to admit of their being buried in the ground outside of the conduit *e*, through which the current-collector must pass. The insulation is removed from these conductors *c* and *c'* at intervals of any convenient length, as shown at 1 2 3 4 14. At points where the conductors are thus exposed springs *s s s* are attached to them, so that good electrical contact is made. These springs extend out into the conduit and approach each other closely enough to come in contact with the two metallic conducting-strips *g* and *g'*, (preferably of copper,) which are shown as arranged on the sides of the current-collector. These strips are connected electrically by the motor M, which is carried upon and adapted to propel the car. The current-collector may be a bar of wood or other insulating and otherwise fit material, as shown in Letters Patent granted to myself and John W. Nesmith on the 31st day of August, 1886, No. 348,477. In Fig. 1 these strips of copper *g* and *g'* are set one slightly ahead of the other, so that a current-collector which is used on a series system of railways (such, for example, as that shown in the Letters Patent of the United States, No. 348,476) may be used on this double-conductor multiple-arc system. This current-collector has its strips *g* and *g'* sufficiently long to reach from one pair of springs to another, as shown at s^{10}, s^{9}, s^{12}, and s^{11}. Here the strips *g* and *g'* are in contact with four springs at the same time—*g* with s^{10} and s^{12}, *g'* with s^{9} and s^{11}.

Two current-collectors, and hence two motors, are shown between the two conductors *c* and *c'* in Fig. 1. The current passing from the + terminal of the dynamo down through conductor *c'* finds a path out at springs s^{3}, through strip *g'* on the current-collector, through motor M, through strip *g* on the current-collector, and through spring s^{4} to the conductor *c*, along which it returns to the — terminal of the dynamo. Another portion of the current, however, has passed down the conductor *c'* and found two paths of escape. These are through s^{9} and s^{11}, through strip *g'* on the current-collector, through motor M,

through strip g on the current-collector, and through springs s^{10} and s^{12} to the conductor c, along which it also returns to the — terminal of the dynamo. The relative position of these contact-springs is a matter of construction. They may be placed as shown in Fig. 2. The springs on conductor c' may alternate with those on conductor c. There is an advantage in this arrangement, as by it the liability to short-circuit is greatly reduced. As current-collectors carried by the car can be made long, these springs can be placed far apart, and the possibility of a conducting-body that could reach from a spring on one conductor to a spring on the other would be slight.

In Fig. 2 the dynamo-terminals + and — are connected with the conductors c' and c, respectively. The current passes down through conductor c' until it reaches spring s^7, which is in contact with current-collector G and G'. It passes to strip G', thence through motor M, and finds its way back to the — terminal of the dynamo through strip G, springs s^6 and s^8, and conductor c. When current-collector G and G' is moved toward the dynamo, the lower end of strip G will leave spring s^8, but will still have electrical connection with conductor c through spring s^6. If current-collector and motor continue to move in the same direction, strip G' will finally come in contact with spring s^5, which is in electrical connection with conductor c'. Strip G' will then have contact with conductor c' through two springs s^5 and s^7. As movement continues, strip G' will leave spring s^7, but will still have contact with spring s^5. As the current-collector moves through the entire length of the conductors, it will be readily seen that its strips G and G' will at all times have contact with one or two springs and the current will be broken through motor M.

I do not wish to confine myself to these particular arrangements of the springs which are in contact with the insulated conductors. In my system simply two wires are used which are carefully insulated with the material used for underground cables. These are buried in the ground outside of the conduit or are attached to its inner walls. At intervals of convenient length this insulation is removed and metallic contact-pieces are attached to the cables. These contact-pieces are supported on insulators of proper construction and extend into the conduit in such a position that the current-collector in passing along under the car will come in contact with them. It will be observed that these contact-pieces do not at any time come into contact with each other, as in the aforesaid patent, and the connection is found only by the contact-pieces passing between them.

The cables and conduit G are shown in section in Fig. 3, which illustrates the relation of the parts; but my invention is not confined to this relation. In this the conducting-strips of copper are on a bar supported on a car B, Fig. 3, as in the aforesaid patent.

I claim as my invention—

1. The combination, in an electrical railway, of two conductors in circuit with a current-generator insulated throughout their entire lengths, excepting at intervals, where contact-springs are permanently attached thereto, the said conductors being arranged parallel to each other, and the contact-points extending into a conduit toward each other, but separated therefrom, and a current-collector suitably connected to the car and with its sides insulated from each other but connected electrically to a motor carried on the car, the said collector being adapted to travel within the conduit and to come in contact with the contact-springs of the two conductors, substantially as described.

2. In an electrical railway in which the motors are run in multiple arc, the combination of a generator, a conduit, an underground conductor insulated throughout its entire length except at intervals, where it is provided with spring contact-arms permanently connected therewith, a current-collector traveling in the conduit and adapted for contact with the spring-arms, a car, a motor on the car, and means for moving the collector with the car, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

SIDNEY HOWE SHORT.

Witnesses:

RODNEY CURTIS,

HARRY R. BURNS.