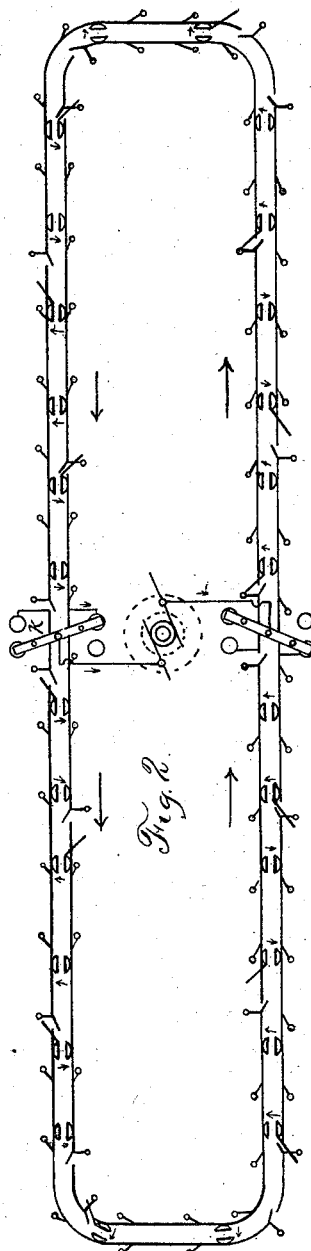
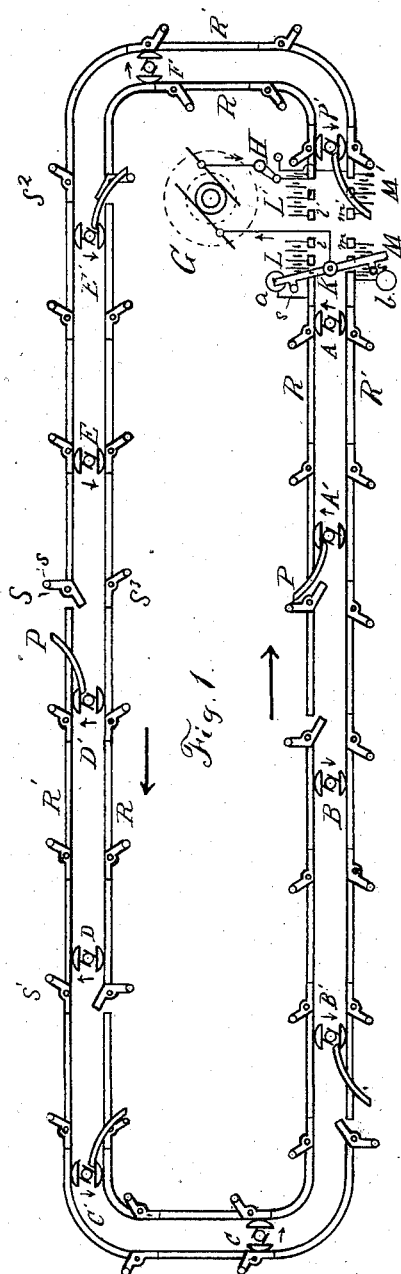


(No Model.)

W. H. KNIGHT.
ELECTRIC RAILWAY.

No. 305,694.

Patented Sept. 23, 1884.



WITNESSES

Harry Knight
W. H. Knight

INVENTOR

Walter H. Knight
By Brantley & Knight
Attorneys

UNITED STATES PATENT OFFICE.

WALTER H. KNIGHT, OF CLEVELAND, OHIO.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 305,694, dated September 23, 1884.

Application filed August 6, 1884. (No model.)

To all whom it may concern:

Be it known that I, WALTER H. KNIGHT, a citizen of the United States, residing at Cleveland, Ohio, have invented certain new and useful Improvements in Electric Railways, of which the following is a specification.

My invention consists in an arrangement whereby the locomotives on an electric railway may be divided into groups containing constantly the same number of locomotives, the locomotives of each group being in multiple arc and the groups being in series.

In the accompanying drawings, Figure 1 shows my invention applied to a road in which the central station is at one end of a double-track or belt-line road, and Fig. 2 shows the same with the central station at the middle point of a double-track road.

In my invention two main conductors, R and R', extend along the line of the railway, and two brushes connected with the propelling-motor depend from the locomotive and make connection with the opposite rails, respectively, in the usual manner. These two conductors, R and R', are constructed in segments shorter than the minimum distance between any two groups of locomotives, which segments, before the starting of any locomotives, are connected by switches S, pivoted like a bell-crank lever, so as to form continuous conductors.

When the locomotives are sent out, they are divided into multiple-arc groups of a size proportionate to the business demands of the road at the time, by providing the last car or locomotive of a group with a projection, P, which is adapted to strike pin *s* on the successive switches S, and, moving the switch on its pivot, break the continuity of the main line at that point. The projection can be attached to every second, third, tenth, or any other locomotive of the series, so that the group in multiple arc will consist of two, three, ten, or any desired number, according to the demands of the traffic at any hour of the day. In practice the projection may be attached to one of the contact brushes or shoes, as is shown in the drawings. With any increase in the number of locomotives on a section the quantity of current will of course be simultaneously increased by varying the generative capacity of

the source of supply. The alternate projections P on the locomotives, which may be called the "opening locomotive" or the "opener," operate on one of the two conductors R R'. Thus every other one opens the switches of R, and every other one those of R'.

In the drawings, Fig. 1, the projections on A', C', and E' operate on the switches of R, while those of locomotives B', D', and F' actuate switches of R'.

Only two locomotives in a group are shown in the drawings, for reasons of economy in space; but any number may be included, as above explained. Opener C' is shown just approaching a switch, E', in the act of operation, and A' as just leaving a switch.

In operation the pin *s*, as the switch turns on its pivot, passes out of the path of projection P, and is thus left until it is closed by the leading locomotive of the next group. It will be seen that this action of the opener leaves the group to which it belongs constantly in series with any group or groups that may be behind it. Thus, in Fig. 1 the circuit may be traced, as indicated by the small arrows, from generator G, to switch H, to conductor R, through locomotives F' F' in multiple arc, to conductor R', and thence—E' having opened its switch before F has closed the preceding one—along R', through locomotives E' E' in multiple arc, to conductor R, whence it passes in succession through groups D' D', C' C', B' B', and A' A', to contact-point *a*, through pivoted bar K, back to the generator. By this arrangement the section of the main conductor devoted to any group is always conterminous with the distance between the first and last locomotive of the group, expanding or contracting as the locomotives become farther apart or nearer together. The locomotives will be independent of one another, and the only precaution necessary is that there shall always be the length of one segment between the first locomotive of one section and the last one of the preceding section.

K is a switch-bar connected to one generator terminal and pivoted at its center, so as to make contact with either point *a* or *b*, which are connected to conductors R and R', respectively, when in one or the other of its posi-

tions. It is provided with pins *s*, corresponding to pins *s* in switch *S*, and adapted to be struck in the same manner by projections *P* and thrown into its alternate positions by successive openers. This prevents the rupture of the main circuit by an opener leaving the end of the conductor to which *K* may be connected with an open switch in the same conductor behind it.

10 *H* shows the switch operated by hand.

The ends of the main conductors at the central station are connected to a series of gas or other secondary batteries, *L L'* and *M M'*, and contact-points *l l'* and *m m'* are connected to successive points in the series of batteries and are themselves in the path of the contact-brushes, so that as the brushes leave or approach the ends of the main conductors the resistance of the batteries is cut in or out of circuit with the locomotive. Thus, as *A* progresses from the position shown the circuit through it will be from *R'* to batteries *M*, contacts *m*, locomotive contacts *l*, batteries *L*, to conductor *R*. When the resistance and counter electro-motive force of the batteries are in circuit with the motor, the current through them is of course proportionately diminished, and any sparking occasioned by breaking the motor-circuit is equally diminished.

30 In Fig. 2 the generator is at the middle point of a double-track road, and its two terminals lead, respectively, to two switch-bars, *K*, which are operated as above described. From each of these bars *K* the current branches in two parts, which pass in opposite directions around the road and include each a number of locomotives in multiple series, as described with regard to Fig. 1.

In my invention it will be seen that by means of the switches *S* the segmental conductors *R R'* are constantly divided into sections corresponding to the groups of locomotives, and that an uninterrupted connection is maintained between two conductors of succeeding sections. Thus, in Fig. 1 the section corresponding to locomotives *D D'* is from *S'* to *S*, and the section for *E E'* is from *S* to *S'*, while a connection is maintained between conductors *R* of the two succeeding sections by means of switch *S'*.

50 What I claim is—

1. The combination, with a main generator, of two conductors extending along the line of an electric railway and divided at intervals into sections, a group of electric locomotives in multiple-arc connection with the opposite conductors of each section, and an uninterrupted connection between two conductors in adjacent sections, whereby the groups of locomotives in multiple arc may be in series with one another.

2. The combination of two conductors extending along the line of an electric railway, switches at intervals adapted to interrupt the continuity of the conductors, a series of electric locomotives in circuit between the conductors, and devices carried by certain locomotives in the series for controlling the said switches, whereby the main conductors may be divided into sections and the current be caused to pass *seriatim* through a number of multiple-arc groups of locomotives.

3. The combination of a main generator, sectional conductors extending along the line of an electric railway, a group of electric locomotives in multiple-arc connection with the opposite conductors of each section, a connection between two conductors in adjacent sections, and a series of switches in the main line adapted to be operated by the locomotives, whereby the sections may be always substantially continuous with the distance between the first and last locomotives in the group.

4. The combination of the segmental conductors, the switches adapted to connect the successive segments, a series of electric locomotives in connection with said conductors and divided into groups, and devices on the first and last locomotives of each group for actuating said switches, the said devices acting on the switches of the two conductors alternately.

5. The combination, with the two adjacent ends of two sections of electric railway-conductor and connecting-brush of an electric locomotive, of a series of insulated contact-points connected to successive points in a series of translating devices and placed in the path of said brush.

6. The combination of two contact-points connected, respectively, to the two conductors of an electric railway and a switch connected to one terminal of the generator with an operating projection in the path of an electric locomotive, so as to be automatically operated by the said locomotive and pivoted to make contact with either of said contact-points.

7. The combination, with the direct and return tracks of an electric railway, of a stationary generator situated at an intermediate point along the road and having its two terminals connected to the conductors of the two tracks, respectively, whereby branch currents may pass in opposite directions around the road.

WALTER H. KNIGHT.

Witnesses:

EDWIN H. HAWLEY,
EDWARD M. BENTLEY.