

(No Model.)

A. L. DUWELIUS.

ELECTRICAL CONDUCTOR FOR RAILWAY TRAINS.

No. 366,209.

Patented July 12, 1887.

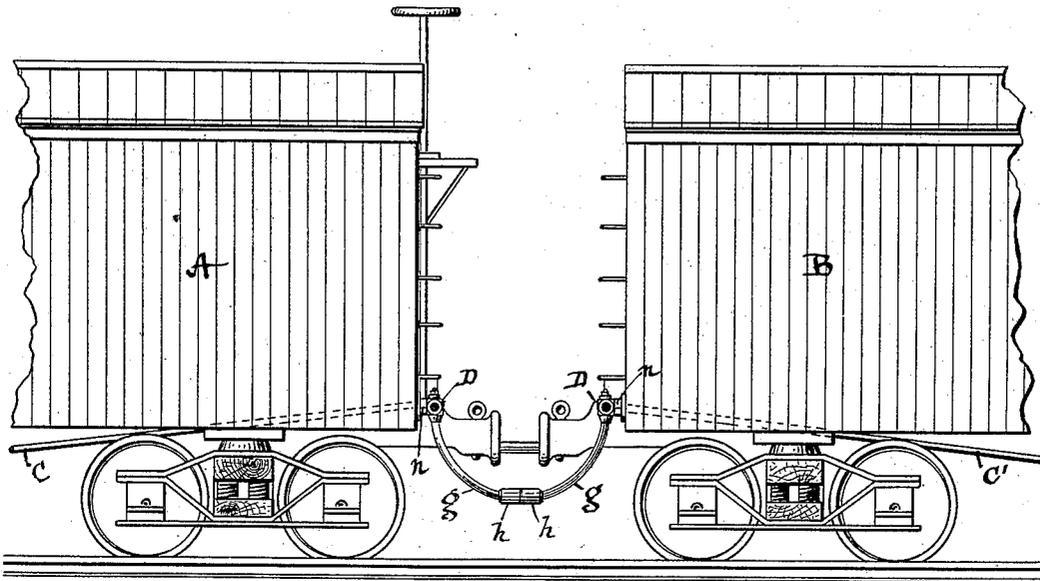


Fig. 1.

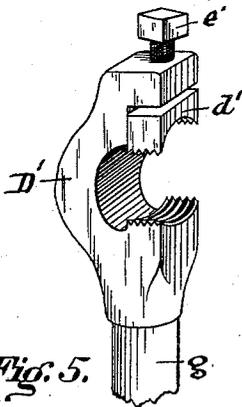


Fig. 5.

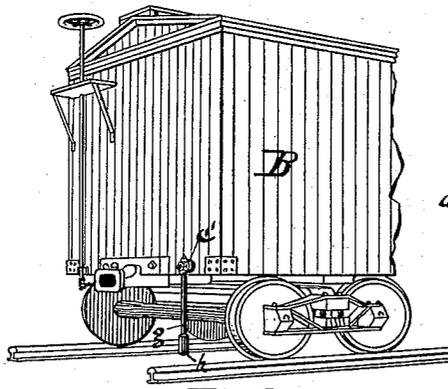


Fig. 2.

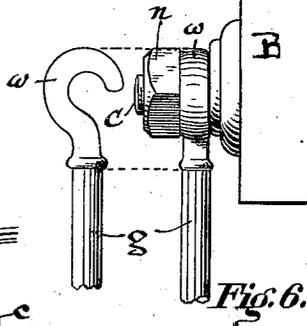


Fig. 6.

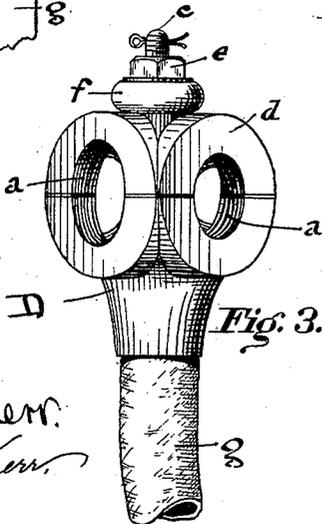


Fig. 3.

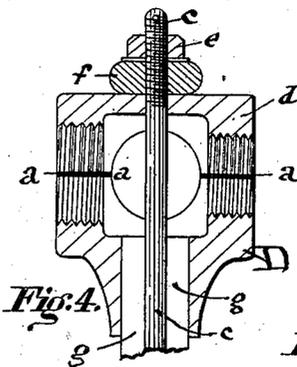


Fig. 4.

Attest.
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UNITED STATES PATENT OFFICE.

AUGUSTUS L. DUWELIUS, OF CINCINNATI, OHIO.

ELECTRICAL CONDUCTOR FOR RAILWAY-TRAINS.

SPECIFICATION forming part of Letters Patent No. 366,209, dated July 12, 1887.

Application filed January 13, 1887. Serial No. 224,202. (No model.)

To all whom it may concern:

Be it known that I, AUGUSTUS L. DUWELIUS, a citizen of the United States, residing at Cincinnati, Ohio, have invented new and useful Improvements in Electrical Conductors for Railway-Trains, of which the following is a specification.

My invention relates to electric conductors for railway-trains, having reference to systems of braking, signaling, lighting, &c., in which the electric current is employed as a controlling or as an actuating force or agent in connection with mechanical or other appliances upon cars connected and actuated in a system by means of a conductor extended through a train; and its object is to produce a system and apparatus for the conduction of the electric current for railway-trains which shall be efficient and answer the demands and conditions of actual railway service.

In order to present the nature of my invention clearly, it is necessary to refer briefly to the conditions of actual train service so far as they illustrate the difficulties to be overcome. The main condition or peculiarity of modern railway service which has heretofore offered an almost insuperable obstacle to the introduction of any system requiring a co-operation between appliances upon the different cars of a train may be illustrated by referring to the now universal custom of "billing" freight-cars through from their starting-point to their ultimate destination over the interconnecting lines of railway. To some extent the same custom has obtained as to passenger-coaches. As a result of this custom, trains (particularly freight-trains) are commonly made up of "local" and "through" cars belonging to different and widely-separated companies, and differing in structure, size, and general character. The obstacle afforded by this condition, and standing in the way of the application of any such system, may be illustrated by the fact that it is found impracticable to introduce generally into freight service even so simple a device as the "bell-cord" commonly in use for signaling on passenger-trains. The serious character of the obstacle may be measured by the fact that, although a practicable braking system for freight-train service has long been earnestly desired as a matter of the ut-

most importance and a solution of the difficulty sought for years by railway-operators, yet to this day no system has been devised which is generally accepted as practicable in view of the difficulty above mentioned.

It is obvious that any system involving the co-operative action indicated requires as an essential condition either that those cars upon which the desired effect is to be produced should be concentrated in the train or that some means of transmitting or controlling the exercise of the local actuating force be employed which may be extended over the "foreign" cars, or those unprovided with the formal appliances for such transmission. The difficulty in question is equally serious in the case of electrical transmission; and I have been led to the present invention as the result of many years' practical experience and effort in devising and adapting to successful use a system of braking for railway-trains, employing the electric current as the controlling or initial braking force. This experience early developed the nature and extent of the difficulty before mentioned.

At first glance the transmission of electrical energy throughout a train would seem to present no material difficulty, inasmuch as a properly-insulated wire attached in sections to the several cars and suitably connected would appear to answer all the requirements of the problem. In actual use, however, such a wire I have found to be incapable of continuously-successful use. Notwithstanding the utmost care in the selection of material and in the location and arrangement of the wires upon the car, I have found it extremely difficult to protect the conductor thus formed from injuries of various kinds, due to the unfavorable conditions of use. Summing up my experiences upon this point, such wires are frequently broken or the insulation destroyed by rough usage of various kinds on the part of employes in the ordinary operation of trains or in cleaning or repairing cars, or by the inter-movement of the elements of the car-frame by lost motion between parts under the constant strains to which they are subjected. I have frequently traced the breakage of the conducting-wires to the crystallization induced by continual vibration. The difficul-

ties thus enumerated apply, as will be seen, to that portion of a system of transmission constructed and arranged under the most favorable circumstances of permanency, and it will be readily understood that the difficulties are largely increased when temporary wire connections are made across foreign cars unprovided with such formal appliances. These experiences have led me ultimately to abandon the use of separate wires to complete the electric circuit through the cars of a train and to utilize a certain element of the structure of the cars themselves common to all cars of modern construction, and which is available only for transmission of the electric current. I refer to the longitudinal "truss-rods" forming an integral part of the structure of the car-body, which rods (ordinarily from two to six in number) extend from end to end of the car-body, and are secured thereto, ordinarily, by nuts threaded upon the ends projecting beyond the car-sills. The peculiar nature of the truss-rods and of their surroundings, relative location, and terminal peculiarities, considered with reference to their availability for electric conduction, are such as by their use in the manner and for the purposes hereinafter described to develop in them a new and valuable function in no wise analogous to any use previously made of them.

The peculiar availability of the car truss-rod for electric conduction results from the fact, first, that it occupies such a position relative to the car-body as to secure and protect it from any injuries affecting its electric conductivity—that is to say, it is partly embedded in and insulated by the dry wood constituting the bottom of the car, being roofed by the car-body built over it, and is freed from all the other enumerated objections attaching to insulated wires; secondly, being itself the longitudinal strengthening and holding element of the car-frame, it is not liable to be displaced or parted by the strains or lost motion of the frame-timbers; thirdly, its situation is such as to bring its terminals into the most convenient of all positions for the application of connecting devices between cars, and, lastly, its terminal construction is such as to facilitate in an extraordinary degree the attachment of connecting devices in a manner at once practicable, efficient, and durable. Moreover, the situation and character of the threaded projecting ends afford a means of connecting the truss-rods of contiguous cars by a flexible and easily-applied conductor in such manner as to permit the freest oscillation between moving cars or the accidental separation of the train without injury to the remainder of the general conducting-line, and when not in use to be entirely out of the way and free from liability to accidental injury.

My invention may be said to consist, primarily, in an electric conductor for railway-trains consisting of a truss-rod of a car connected by a flexible electric conductor with

the conductor or truss-rod of the car next in series.

It consists, also, in a removable connecting head or clamp adapted to be applied to the contiguous ends of truss-rods upon adjacent cars, to constitute with an intervening flexible coupling a practically-continuous electrical conductor upon or throughout such train.

Mechanism embodying my invention is illustrated in the accompanying drawings, forming part of this specification, in which—

Figure 1 is a partial elevation of two contiguous freight-cars, showing the truss-rods and their electrical connection. Fig. 2 is a perspective end view of a car, showing one of the electrical couplings attached to the end of a truss-rod. Fig. 3 is a perspective view, enlarged, of one of the connecting heads or clamps detached. Fig. 4 is a vertical cross-section of the same, and Figs. 5 and 6 are views of a modified form of connection.

Referring, now, to the drawings, A and B designate two contiguous cars, respectively, of a railway-train, and C and C' the truss-rods of said cars, respectively. These rods extend from end to end of each car, project through the end sills, and are there secured by holding-nuts *n*. The truss-rods so arranged are of wrought-iron, which is a good conductor of electricity, are of ample size to carry any quantity of current used for railway purposes, and are so embedded in the wooden portion of the car-frame where they pass through the same, and are so carried outside of the same as to be practically insulated as electric conductors. In almost all cases the threaded ends of the rod project beyond the holding-nuts, and where such is not the case it is possible to obtain such projection for the purposes hereinafter set forth by tightening said nut upon the rod, or by removal or substitution of washers, or by other means obvious to the mechanic. There is thus available an iron rod of ample conducting capacity, and practically insulated, extending from end to end of every car, and there is only needed an electrical connection between the contiguous truss-rods of adjacent cars to constitute a continuous conductor for such train; and as there are usually at least two of such truss-rods upon each car, totally independent of each other, there may be formed in a similar manner, when required, a continuous metallic circuit with outgoing and incoming branches. In order, however, to render the truss-rods available, as above set forth, it is necessary to provide a means of connection which shall accommodate itself to the conditions and requirements of railway service, and here a difficulty arises from the fact that the exposed ends of the truss-rods are nearly always encrusted with rust, paint, grease, or dirt, and consequently some provision must be made for making a clean metallic connection, notwithstanding these impediments. A further condition is that the connection shall be simple, efficient, strong, and durable, capable of

being quickly applied without requiring electrical knowledge or special skill on the part of the attendants. In this respect, also, a latent function of the truss-rod is brought into use—
 5 in this, that its screw-threaded end affords a means of making the proper connection in such a manner as to be peculiarly durable, and at the same time perfect the electrical connection by means of the elements constituting its holding quality. By this I refer particularly to the screw-threads on the end of the truss-rod, which, while they constitute a secure mechanical holding for any coupling engaging the same in the manner of a nut, also give a
 10 largely-increased contact-surface between the rod and the electric coupling, which surface is cleaned and the metallic contact perfected by the act of setting the coupling into its position upon the rod. For example, in a case
 20 where no specially-devised coupling is at hand an ordinary wire could be wound around and between the threads of the truss-rod, thereby obtaining double the amount of contact-surface that could be obtained with the same wire
 25 upon a cylindrical rod, and also all the advantages of secure holding which could be obtained by a nut, the wire so wound practically constituting a nut. The act of winding also tightens the wire in the wedge-form opening
 30 between threads and produces a rubbing of surfaces, insuring a practical contact. Such mode of connection I therefore deem within the spirit of my invention. I have, however, devised a more complete and commercially-practical form of connecting device, as illustrated
 35 in Figs. 1, 2, 3, and 4 of the drawings, which I will proceed to describe as the best for the purpose under all the circumstances of actual use. This consists of an adjustable head, D, or "screw-clamp," to which is attached a section of flexible conductor, *g*. In Fig. 1 I have shown two such connections with heads or screw-clamps for attachment to the truss-rods and separable coupling-heads *h* joining the
 40 flexible conductors together as one.

The construction of the flexible conductors and of the intervening coupling-heads need not be in detail described here, since any construction capable of uniting the two clamping-heads by a flexible electric connection will serve the purpose of the present invention.

For the purpose of the present application the flexible conductor-coupling *g g* between the clamping-heads (shown in Fig. 1) may be considered as integral. The clamping-head D, as I prefer to construct it, consists of a hollow head having four sides, each pierced centrally by a screw-threaded aperture, *a*, the four apertures thus practically constituting
 55 four nuts of different sizes, covering the range of sizes ordinarily employed in truss-rods for railway-cars. The head D is divided in the common axial plane of the apertures, the upper part or cap-piece, *d*, being held
 60 by and guided upon a central rod, *c*, firmly secured to the lower part and provided with a holding-nut, *e*, and an elastic or spring

washer, *f*. As thus constructed each aperture *a* is rendered capable of self-enlargement by the upward movement of the cap-piece *d* to receive or fit upon a truss-rod somewhat larger
 70 than the normal diameter of the aperture. It thus enables the clamping-head D to present the edges or corners of the two constituent parts in such relation to the circumference of the truss-rod that in screwing the clamping-head to its seat it cleans the threads of the
 75 truss-rod of any adhering matter—such as rust or dirt—and insures a clean metallic contact of the parts. The degree of clamping pressure is also under control of the attendant by manipulating the nut *e*, and the upper portion or cap, *d*, is rendered self-adjustable by its
 80 spring-washer *f*.

It will be obvious that the head D may be made with three, two, or even one such aperture, but as four may be provided as conveniently, the head so constructed possesses a wider range of adjustment, and this I find desirable in view of the various sizes of truss-rods employed on cars.

In Fig. 5 I exhibit a form of clamping-head embodying the same constructive principles, in which the main portion of the head D is formed as one piece, suitably hollowed
 85 out to receive the end of the truss-rod and carried around and over the movable part *d*, which forms the movable section of the screw-threaded clamp. A set-screw, *e*, passed through the projecting upper portion of the main head D, bears against and adjusts the part *d*, as
 90 desired.

In Fig. 6 is shown a simple washer, *w*, which may be annular or formed, as shown, in the form of a hook, to engage over the truss rod
 95 behind the nut *n* and form contact with the rear face of the nut. In this case the nut *n* becomes part of the electric-conducting element, and by its movement to give place for the washer *w*, cleans its threads for making
 100 the desired contact, and also cleans its contact-surface against the washer *w*.

Obviously for mechanical reasons the last-mentioned device when once in place should be permanent, inasmuch as the longitudinal
 105 strains upon the truss-rod would not admit of frequent removal of the nut.

In patent No. 296,319, granted to me April 8, 1884, I mentioned, incidentally, that connection could be made with truss-rods or other
 110 continuous iron parts of a railway-car in case of breakage of the proper conductors, which were then assumed to be necessarily separate conducting-wires attached to a car; but the special and peculiar advantages hereinbefore
 115 set forth as belonging to the truss-rods of a car, which have led me to adopt the truss-rod as an integral element of the electrical conductor, were not realized at that time, but arise wholly from subsequent experience and
 120 experiment.

I claim as my invention and desire to secure by Letters Patent of the United States—

1. In a system of electric conduction for

5 railway-trains, the combination, with the longitudinal truss-rod of a railway-car, of a detachable flexible coupling adapted to electrically connect said truss-rod with the electrical conductor or truss-rod of an adjacent car to constitute a substantially continuous conductor for the electric current over one or more cars, substantially as set forth.

10 2. In electric-conducting apparatus for railway-trains, a substantially continuous electrical conductor in sections composed of the longitudinal truss-rods of adjacent cars connected by flexible short conductor-couplings secured to contiguous ends of said truss-rods, substantially as set forth.

15 3. In electric-conducting systems for railway-trains, the combination of independent electrical conductors, as wires, attached in sections to railway-cars, with truss-rods of intervening or contiguous cars not so provided with independent conductors, and detachable couplings electrically connecting the terminals of said independent conducting-wires with the truss-rods of said intervening cars and combining the same as constituents of a continuous conducting-circuit for such train, substantially as set forth.

20 4. In combination with a railway-train and a conductor for the electric current, composed of sections attached longitudinally to cars and provided with detachable flexible conductor-couplings, one or more cars provided with truss-rods as structural constituents interposed in such train, said truss-rods being connected terminally with each other or with such sectional conductors by said detachable flexible couplings to bring such truss-rods into the general conductor as constituent sections thereof, substantially as set forth.

25 35 40 45 5. In an electric conductor for railway-trains, a truss-rod forming a structural constituent of a railway-car and provided with a projecting screw-threaded end combined with a connecting-head adapted to engage said truss-rod mechanically and electrically upon or by

means of said threaded end, and a flexible conductor joined to such head to form a coupling between adjacent cars, substantially as set forth.

50 6. In a sectional divisible electric conductor for railway-trains, an adjustable head or clamp provided with means for attaching the same electrically to the ends of the truss-rod of a railway-car for the purpose of engaging the rod as part of the general conducting-line with the fixed conductor or truss-rod of an adjacent car, as set forth.

55 7. In sectional electrical conductors, a connecting-head, *D*, having one or more adjustable screw-threaded openings and adapted to electrically engage a flexible conducting-section with the screw-threaded end of a fixed or rigid section, substantially as set forth.

60 8. In sectional electrical conductors, a connecting-head having one or more screw-threaded apertures constructed in two parts, one adjustable in relation to the other, to engage said head upon the screw-threaded ends of metallic rod-sections of different sizes, substantially as set forth.

65 70 9. In sectional electrical conductors, a connecting-head, *D*, having two or more openings, *a*, screw-threaded and adapted to engage upon screw-threaded rod-sections, divided in the axial plane of said orifices into two parts, the upper or movable part being held to the lower or fixed part adjustably, substantially as set forth.

75 80 10. The connection-head, as constructed, consisting of the head proper, *D*, or fixed portion, the cap or movable portion *d*, the central rod, *c*, nut *e*, and elastic washer *f*, combined and arranged as and for the purpose set forth.

85 In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

AUGUSTUS L. DUWELIUS.

Witnesses:

L. M. HOSEA,
C. D. KERR.