No. 734,298. PATENTED JULY 21, 1903.

M. BÜTTNER.

ELECTRIC ILLUMINATION FOR RAILROAD CARS.

APPLICATION FILED APR. 25, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

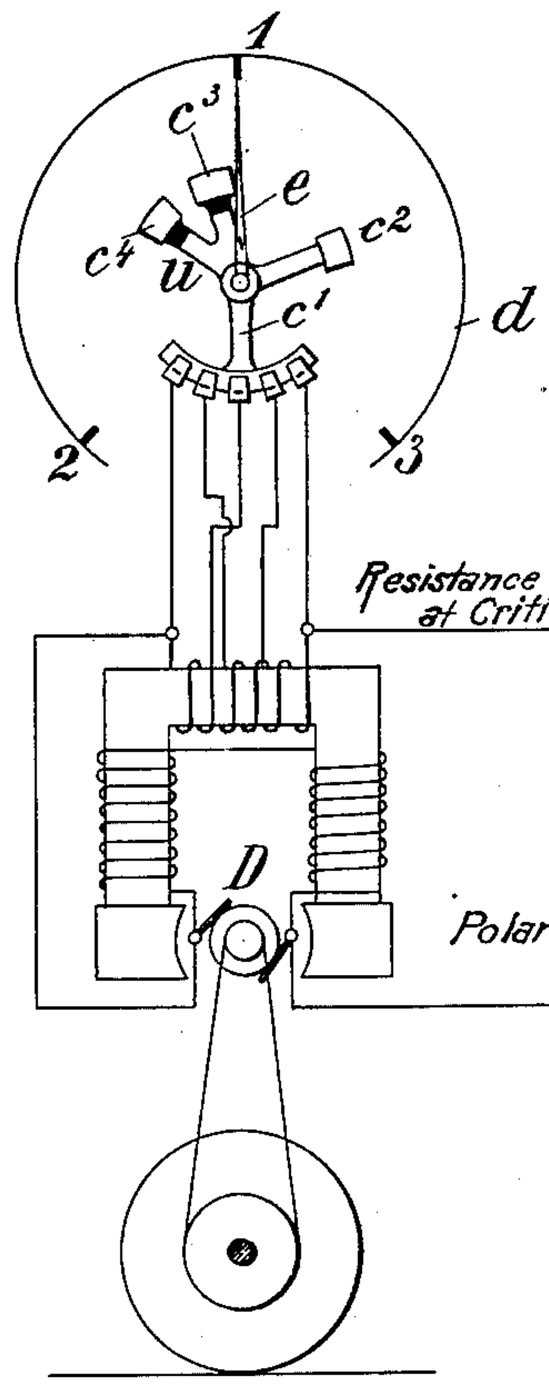

Fig. 1.

Fig. 2.

WITNESSES:

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NO MODEL. 4 SHEETS—SHEET 2.

Fig. 3.

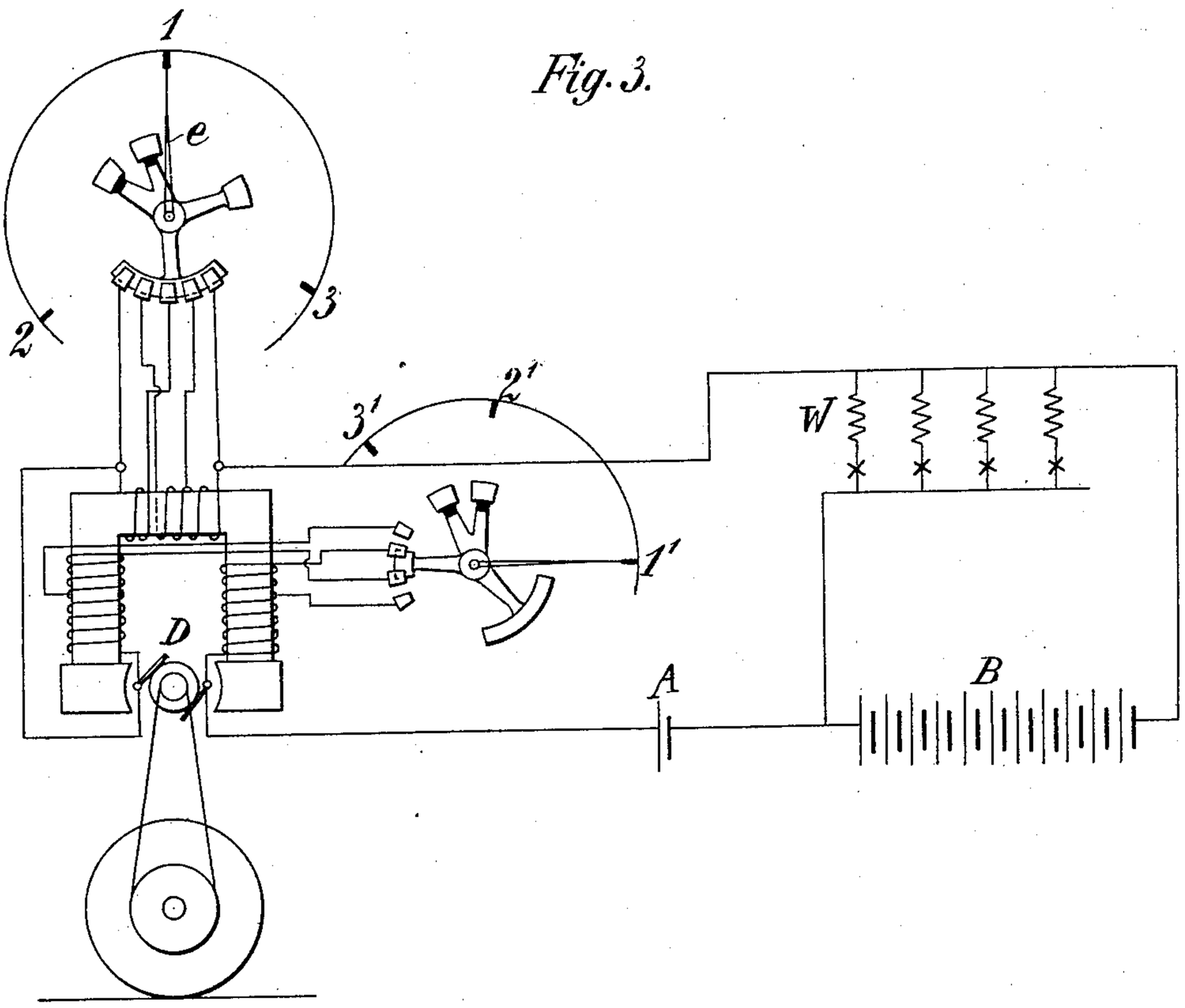
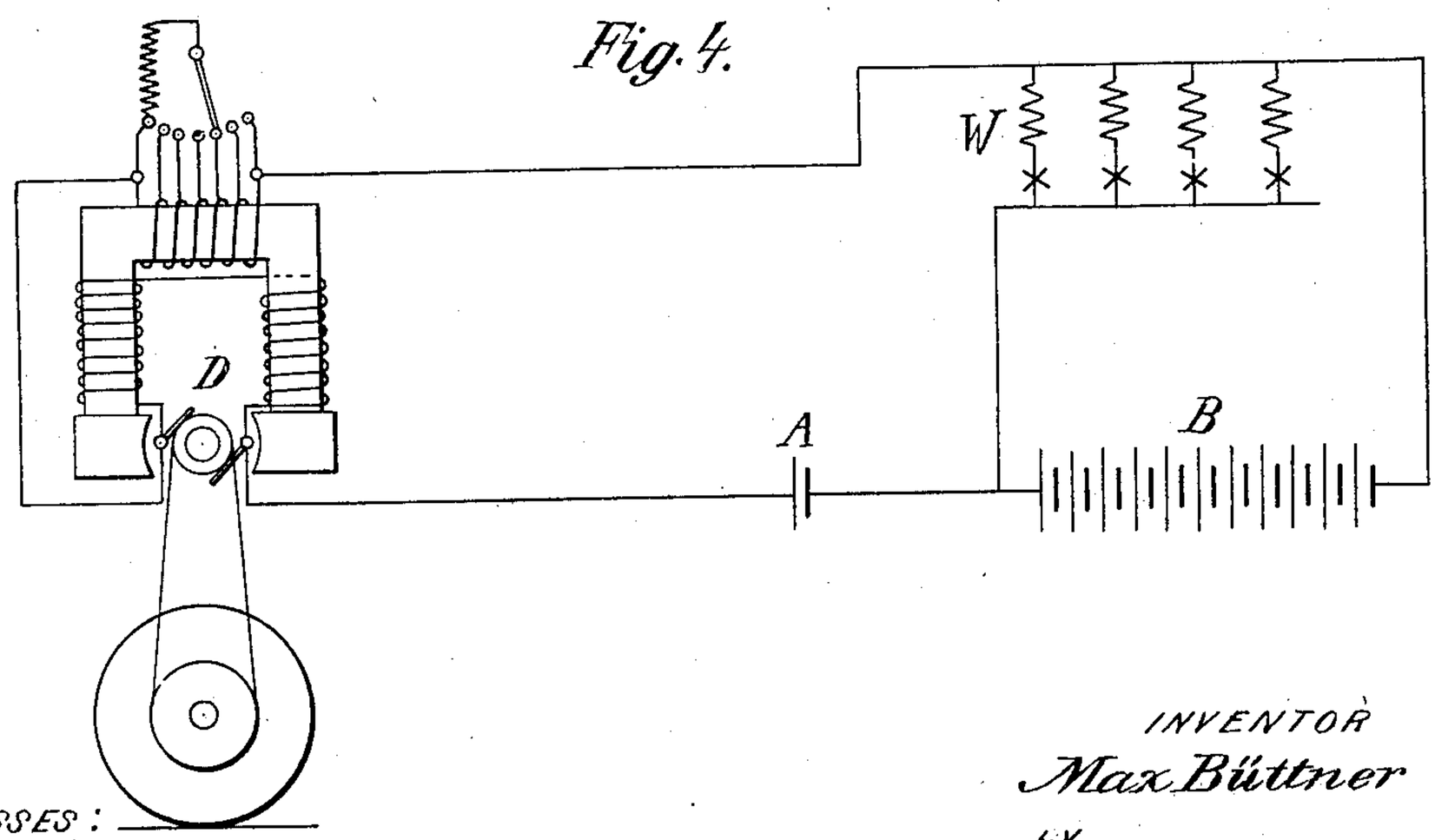


Fig. 4.



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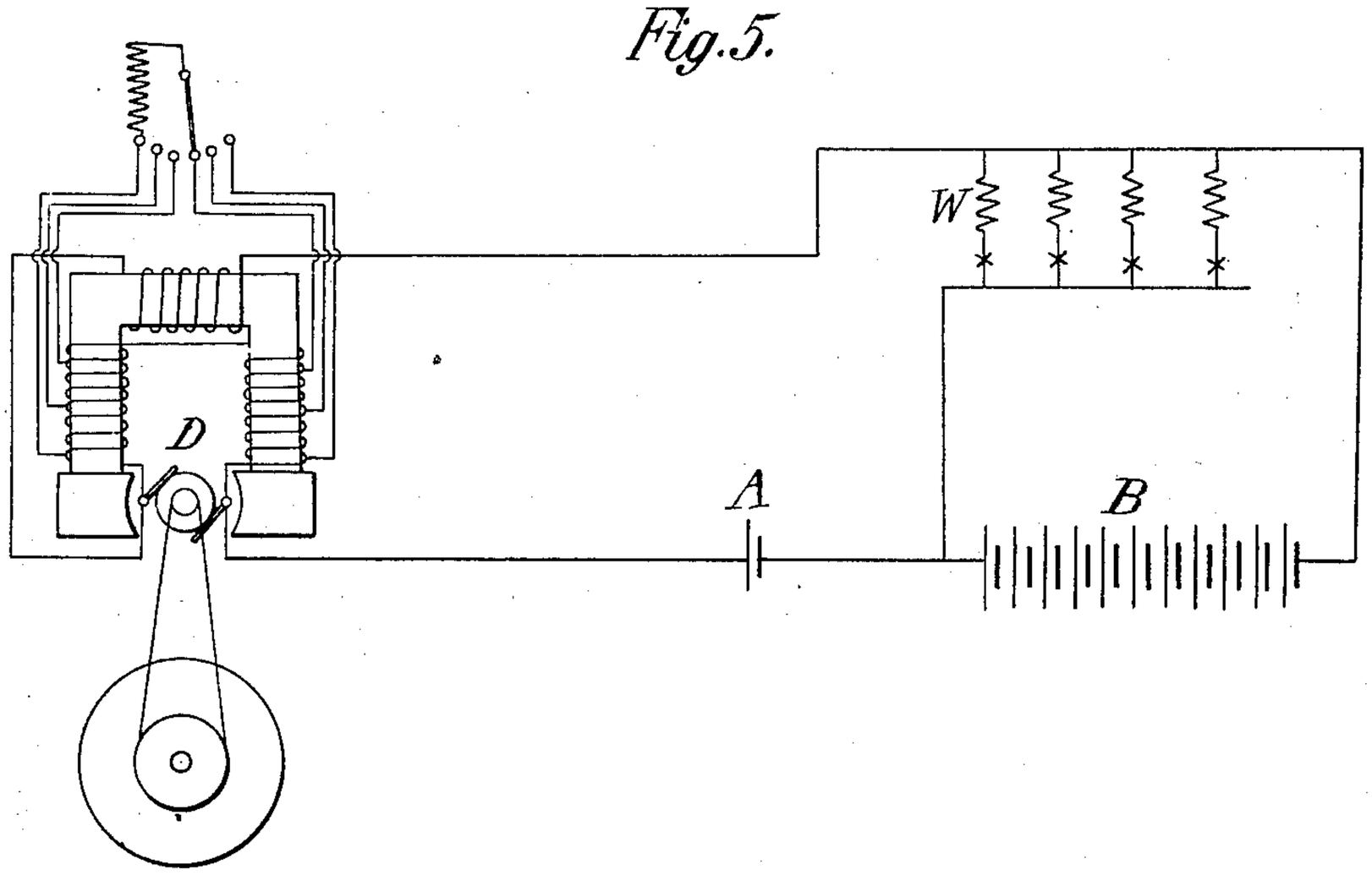
NO MODEL. 4 SHEETS—SHEET 3.

Fig. 5.



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NO MODEL. 4 SHEETS—SHEET 4.

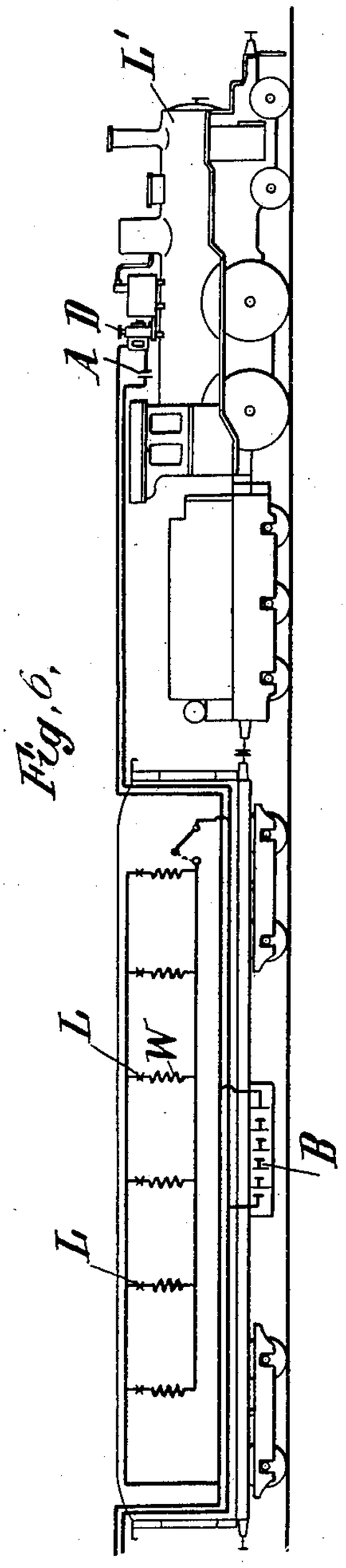

Fig. 6.

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No. 734,298. Patented July 21, 1903.

UNITED STATES PATENT OFFICE.

MAX BÜTTNER, OF DEUTSCH WILMERSDORF, GERMANY.

ELECTRIC ILLUMINATION FOR RAILROAD-CARS.

SPECIFICATION forming part of Letters Patent No. 734,298, dated July 21, 1903.

Application filed April 25, 1902. Serial No. 104,626. (No model.)

To all whom it may concern:

Be it known that I, MAX BÜTTNER, a subject of the King of Saxony, residing in Deutsch Wilmersdorf, Germany, have invented new and useful Improvements in Electric Illumination for Railroad-Cars, of which the following is a full, clear, and exact description.

The invention relates to railroad-cars carrying a dynamo driven from one of the car-axles or by a steam-engine or a steam-turbine fed with steam by the locomotive for generating an electric current for the electric lamps.

The object of the improvement is to provide certain new and useful improvements in electric illumination of railroad-cars whereby the incandescent lamps burn uniformly at a predetermined candle-power irrespective of the varying speed of the train and without the use of electromagnetic regulators.

The invention consists of combinations of known features and parts of the same, as will be more fully described hereinafter and then pointed out in the claims.

A practical embodiment of the invention is represented in the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a diagrammatic view of the improvement in case the dynamo is driven from one of the car-axles, and Figs. 2, 3, 4, and 5 are similar views of modified forms of the improvement. Fig. 6 shows a diagrammatic view of the improved arrangement in case the dynamo is driven from a steam engine or turbine fed with steam by the locomotive.

In electric car illumination as heretofore practiced a dynamo driven from one of the car-axles was employed to generate a current for the lamps and to feed a storage battery, suitable electromagnetic regulators being used, which only function when the train reaches a predetermined speed and which serve to switch the dynamo onto the lamps and the storage battery or the storage battery onto the lamps. The electromagnetic regulators employed for the purpose do not work properly, however, under the varying conditions incident to a car moving at given speeds between its terminals, so that the illumination is frequently interrupted and the installation deranged, and this is especially objectionable when the train is in motion, as then desired repairs cannot be made.

By my improvement, presently to be described in detail, the use of electromagnetic regulators is entirely dispensed with and constant uniform burning of the lamps is insured at all times.

As shown in Fig. 1, the shunt-dynamo D has its armature driven from one of the car-axles E to generate a current for the parallel incandescent lamps L, contained in the main circuit, which also contains a storage battery B. One or a plurality of aluminium cells A is also arranged in the main circuit between the negative commutator-brush and the storage battery and lamps, as plainly indicated in the drawings.

Each lamp L is provided with an iron-wire resistance W, and a switch U serves to short-circuit some of the windings of the main or series coil on the field-magnet of the dynamo. Now when the train is in motion the electromotive force of the dynamo increases, and when the armature makes a certain number of revolutions then the series line is supplied with the current, and until this takes place an energizing of the field-magnet is accomplished through the shunt-coil, which receives the current from the dynamo or from the storage battery B. The series coil is so arranged on the field-magnet that the force of the shunt-coil is reduced, so that in case the armature of the dynamo rotates at an exceedingly high rate of speed then the current is not increased correspondingly to cause injury to the plant.

Any one of the well-known devices for reversing purposes is provided.

The storage battery B is arranged parallel to the dynamo, and in case the car is at a standstill or moves slowly it supplies the electric lamps with the necessary current, and when the armature of the dynamo rotates at a very high rate of speed the storage battery receives the surplus current and is thus charged. Now in order to prevent the current from passing from the storage battery B to the dynamo and unnecessarily heating the latter and causing loss of electricity whenever the car comes to a standstill I provide one or more aluminium cells A, each having

one electrode made of aluminium and the other out of a metal insoluble in the electrolyte. The last-mentioned metal may be iron, nickel, or platinum, and for the purpose of forming the electrolyte or liquid of the cell bicarbonate of sodium, phosphate of sodium, flourid of sodium, bicarbonate of potassium, perchlorate of potassium, bichromate of potassium, carbonate of ammonium, or the like may be employed. If both electrodes were of the same metal—for instance, of iron—the tension between both electrodes would amount to from two to three volts, depending upon the current passing through the cell, whatever may be the direction of the current; but if one of the electrodes is made of aluminium and the second electrode is composed of iron, for instance, quite another effect will be obtained, depending on the direction of the current. If the dynamo-current passes through the aluminium electrode out of the cell after having entered the latter by the other electrode, but little polarization will result; but if the current is flowing in the reverse manner the polarization will be of a considerable amount. This fact has been made use of as follows: The cell or cells are arranged in the series line so that the dynamo-current flowing to the negative commutator-brush of the dynamo will leave the aforesaid cell or cells through the aluminium electrode. Now by this arrangement a return movement of the current from the storage battery B to the dynamo D is prevented, as the current could not flow in the reverse manner through the aluminium cell or cells in view of the large amount of polarization caused or electromotive force opposed by the cells to the flow of current in the latter direction.

In order to protect the lamps from a too high current, I provide each of the lamps with an iron-wire resistance W. Iron possesses a high coefficient of resistance at a critical temperature. Experiments have proved that the same varies in iron from 0.0048 to 0.018, so that it will be immediately evident that iron resistances are better for the present purpose than resistances of any other metal. If the iron is heated by the current to nearly a dark red, it has at such a temperature a relatively high coefficient of resistance which increases rapidly with slight increase in temperature beyond that point. Now the resistances are so proportioned as to be heated by the normal current to nearly a dark red, so that but a slight increase in the current is sufficient to increase the resistance to such an extent that by an increase of the tension of the storage-battery current the lamps receive hardly any more current than previously, so that the candle-power of the lamps is not visibly influenced—that is, no noticeable fluctuations in the light take place.

By the arrangement described the regulating devices controlled by electromagnets as heretofore practiced are completely dispensed with, and a very effective electric illumination of the car not influenced by local conditions is the result.

In order to work the described arrangement economically, it is necessary to arrange the field-magnet coils so that the electromotive force of the dynamo on an average speed of the car between its terminals corresponds to the tension of the storage-battery current. When the train runs at an average speed, then the dynamo supplies the current for the lamps; but when the train runs at a higher rate of speed then the dynamo also charges the storage battery, and when the speed of the train falls below an average speed then the storage battery aids the dynamo in supplying the necessary current for the lamps. As the car equipped with the improvement is liable to be coupled to express-trains or ordinary passenger-trains, its average speed between terminals varies correspondingly, and hence it is not desirable to permanently fix the ampere-coils for energizing the field-magnets, but to allow of regulating the same. This can be accomplished by the use of an adjustable resistance in the shunt-coils; but such device constantly converts electric energy into heat, thus causing loss of energy. In order to avoid this, it is desirable to employ a switch u for shunting a portion of the series coil or of the shunt-coil or of both either parallel or in series or completely cutting out a portion.

In the arrangement shown in Fig. 1 the series coil of the field-magnet is used to regulate the magnetic field of the dynamo. The regulating-switch v is provided with several contact-pieces c', c^2, c^3, and c^4 and with a hand e, moving over a scale d, to indicate the average speeds of express or other trains, the switch being set accordingly previous to the train starting on its journey. The regulating position 1, in which the series coil is completely cut out, will be used for normal average speeds, the position 2, in which parts of the series windings are parallel, may be used for somewhat higher average speeds, while the position 3, in which the series coil is completely cut in, can be used for highest average speeds.

In the arrangement shown in Fig. 2 the shunt-coil of the field-magnet is used to regulate the magnetic field in a similar way as above. In the position 1 the shunt-coil is completely cut in, in position 2 parts of the same are parallel, and in position 3 the series coil is partially cut out.

In Fig. 3 a combination of the arrangement illustrated in Figs. 1 and 2 is shown, the series coil and the shunt-coil being capable of regulation. The regulator positions 1 1′, 2 2′, and 3 3′ are those for normal, higher, and highest average train speeds.

A supplementary circuit may also be used for the purpose mentioned and switched

either with the series coil or a portion thereof, as shown in Fig. 4, or with the shunt-coil, as shown in Fig. 5.

The arrangement according to Fig. 6 differs from those already described only by the dynamo D not being driven from one of the car-axles; but the dynamo is driven by a steam-engine, a steam-turbine, or the like fed with steam by the locomotive. The previously-mentioned simplicity and advantages are also obtained in this arrangement. The aluminium cell or cells A are not absolutely necessary in this case.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination in an electric train-illuminating plant, of a dynamo, means for driving the same, a storage battery, incandescent lamps, and metallic resistances in series with said lamps, said resistances being so proportioned and maintained at such a temperature that any increase in the current flowing to said lamp causes a corresponding increase in the resisting power of the aforesaid metal resistances, whereby the candle-power of the lamps shall not be visibly influenced, substantially as set forth.

2. The combination in an electric train-illuminating plant, of a dynamo, means for driving the same, a storage battery parallel incandescent lamps, iron resistances in series with said lamps, said resistances being so proportioned and maintained at such a temperature that the candle-power of said lamps does not vary with the variations of the power of the current, and polarizing cells placed in the current-circuit between the dynamo and the battery and the lamps, substantially as set forth.

3. The combination in an electric train-illuminating plant, of a dynamo, a shunt-coil and a series coil for the field-magnets thereof, said coils acting in opposition, means for driving the dynamo, a storage battery, parallel incandescent lamps, iron resistances in series with the lamps so proportioned, and maintained at such temperature that the candle-power of said lamps does not vary with the variations of the power of the current, and polarized cells, substantially as set forth.

4. The combination in an electric illuminating plant, of a dynamo, means for regulating the effect of the shunt-coil and the series coil of the field-magnets, means for driving the dynamo, a storage battery, parallel incandescent lamps, iron resistances in series with said lamps so proportioned, and maintained at such temperature that the candle-power of said lamps does not vary with the varying power of the current, and polarized cells, substantially as set forth.

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

MAX BÜTTNER.

Witnesses:
JOHANNES HEIN,
HENRY HASPER.