(No Model.)

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C. E. BUELL.

SYSTEM OF ELECTRIC LIGHTING FOR RAILWAY TRAINS.

No. 259,362. Patented June 13, 1882.

Fig. 1.

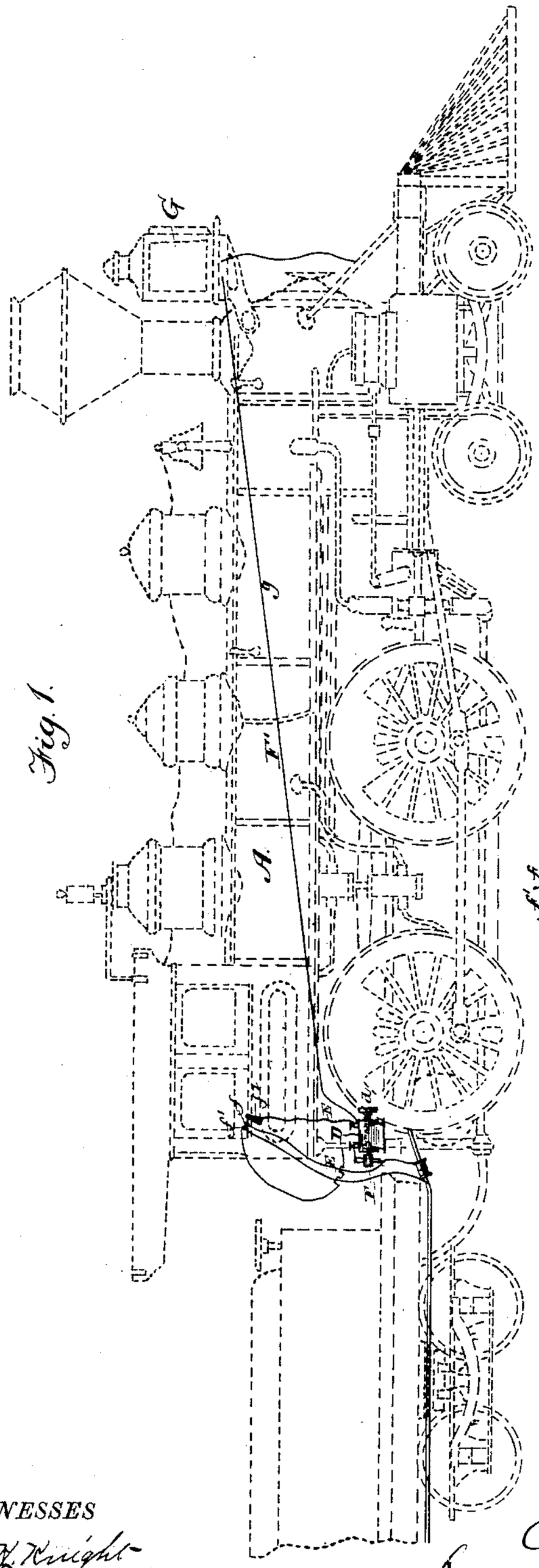
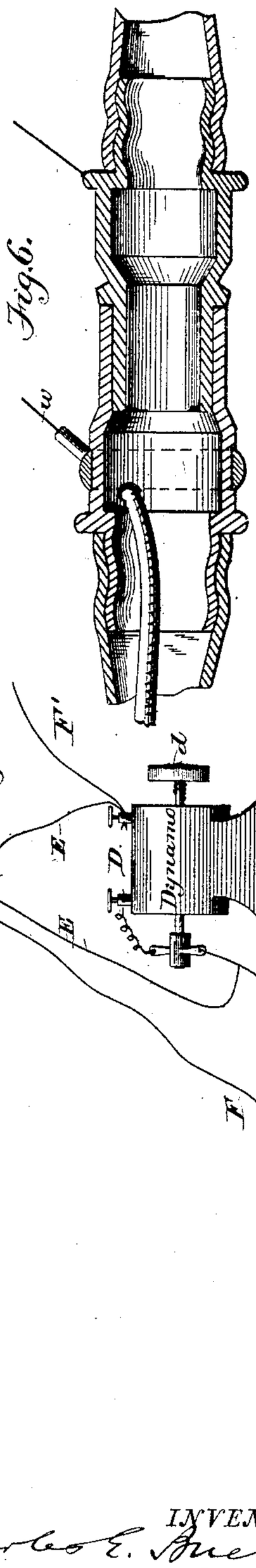


Fig. 6.



WITNESSES

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5 Sheets—Sheet 2.

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SYSTEM OF ELECTRIC LIGHTING FOR RAILWAY TRAINS.

No. 259,362. Patented June 13, 1882.

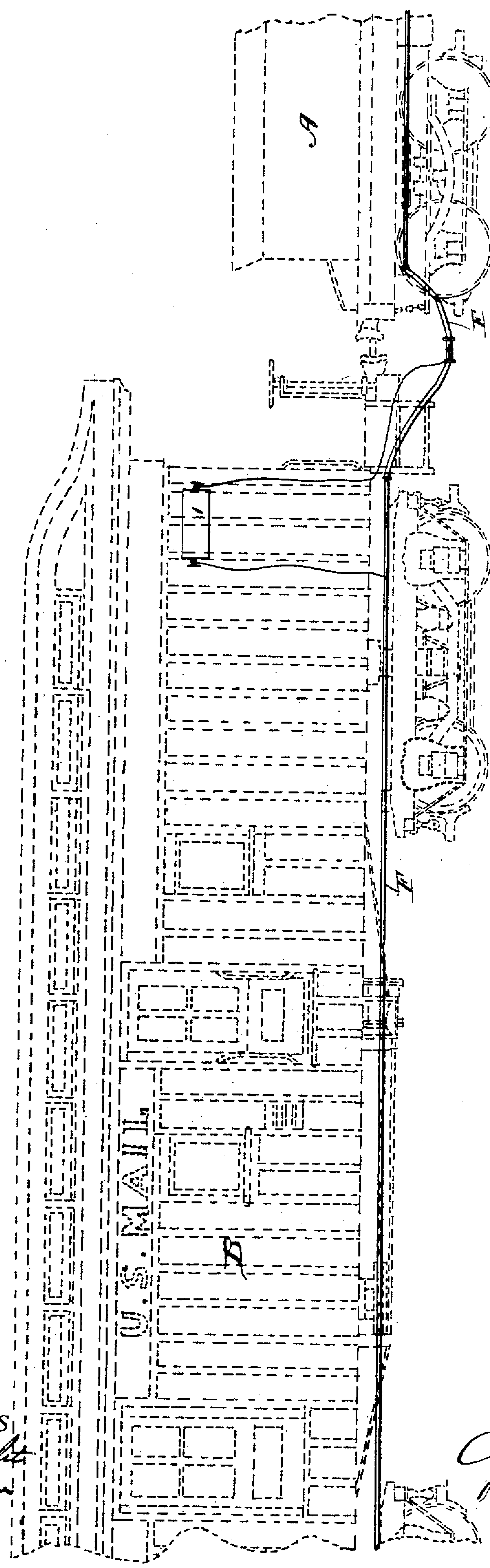

Fig. 2.

Fig. 7.

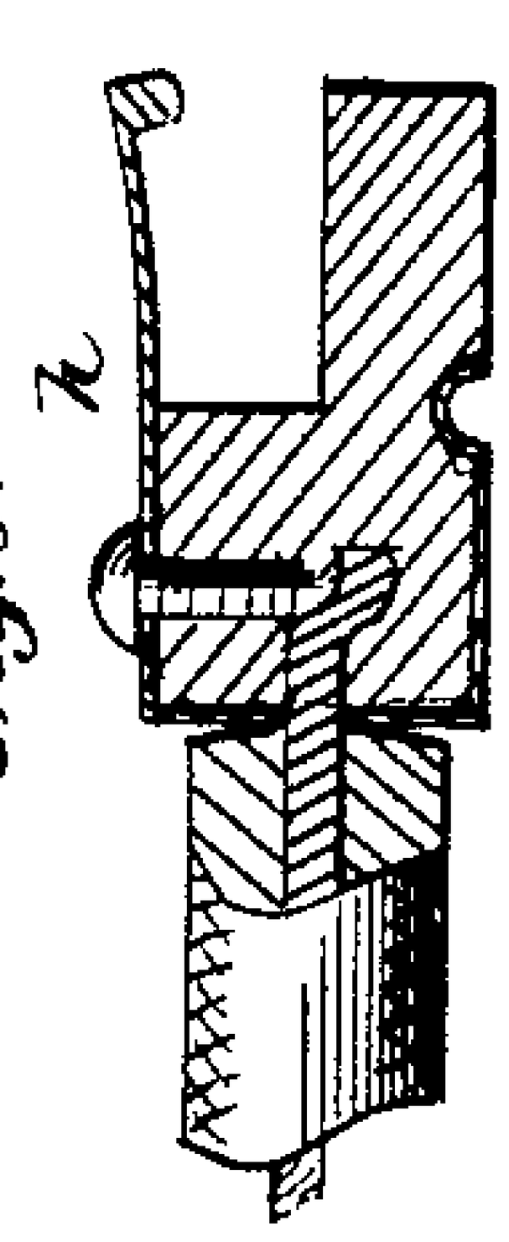

Fig. 8.

WITNESSES

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N PETERS. Photo-Lithographer. Washington, D. C.

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C. E. BUELL.

SYSTEM OF ELECTRIC LIGHTING FOR RAILWAY TRAINS.

No. 259,362. Patented June 13, 1882.

Fig. 3.

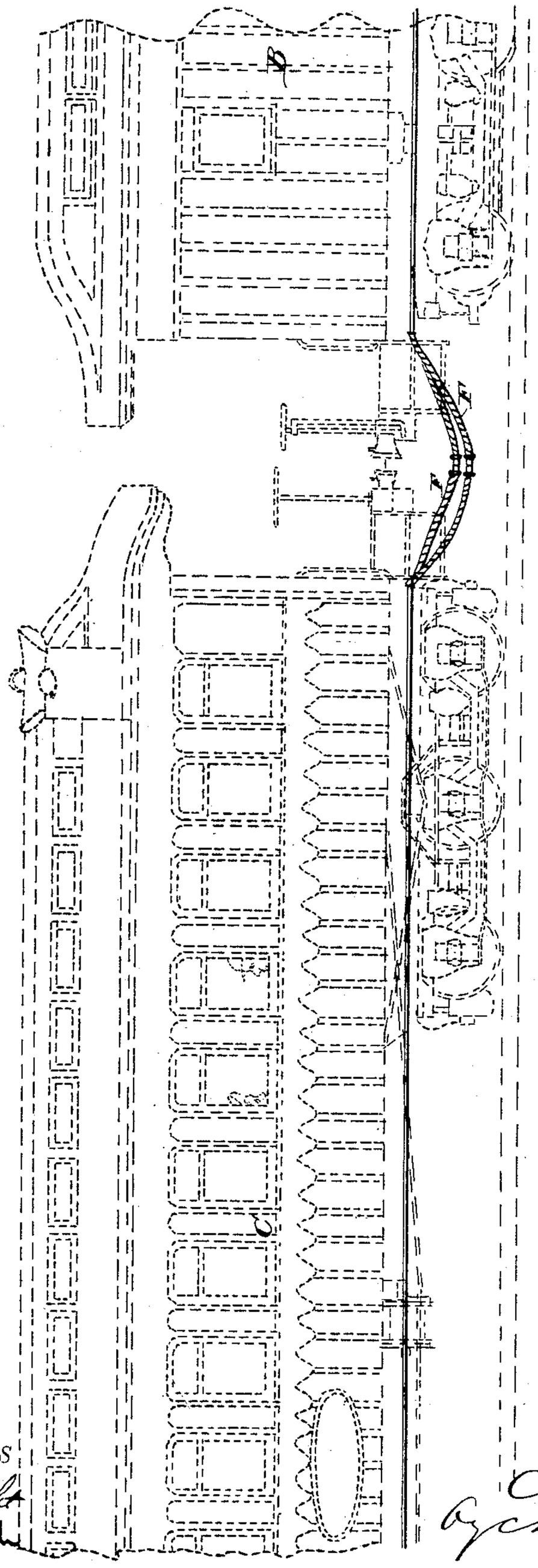

Fig. 10.

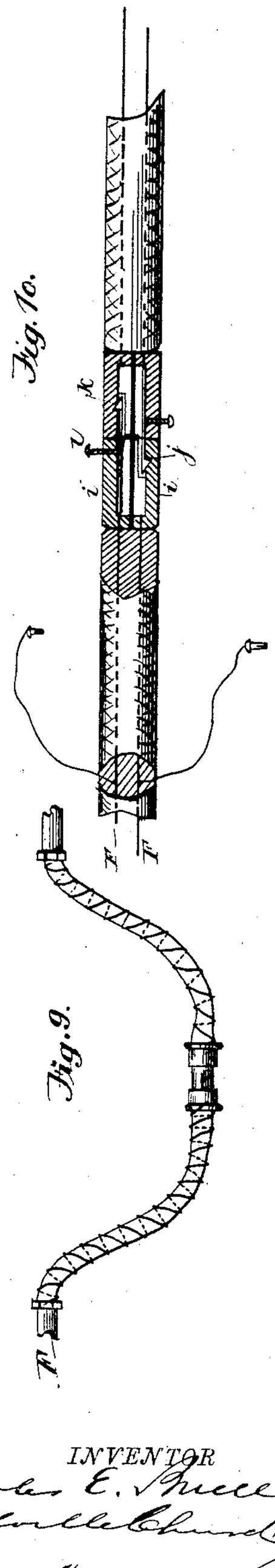

Fig. 9.

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(No Model.) 5 Sheets—Sheet 4.

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SYSTEM OF ELECTRIC LIGHTING FOR RAILWAY TRAINS.

No. 259,362. Patented June 13, 1882.

Fig. 4.

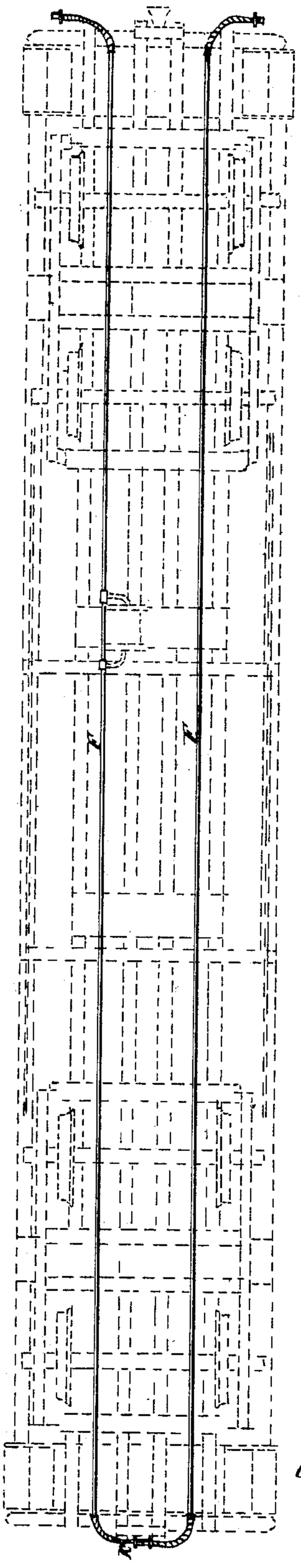
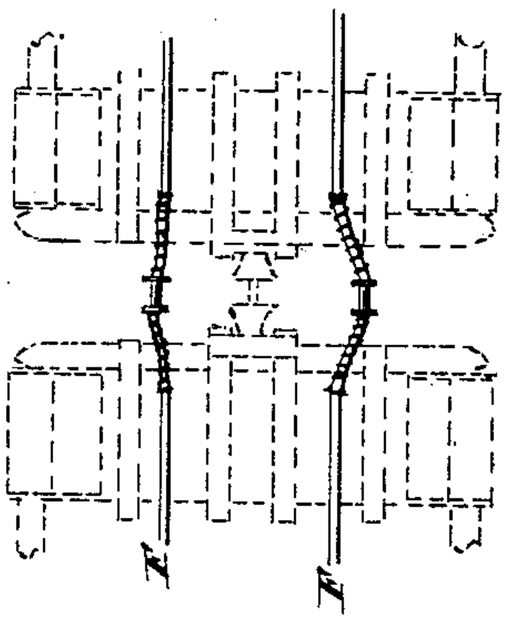


Fig. 11.



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(No Model.) 5 Sheets—Sheet 5.

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SYSTEM OF ELECTRIC LIGHTING FOR RAILWAY TRAINS.

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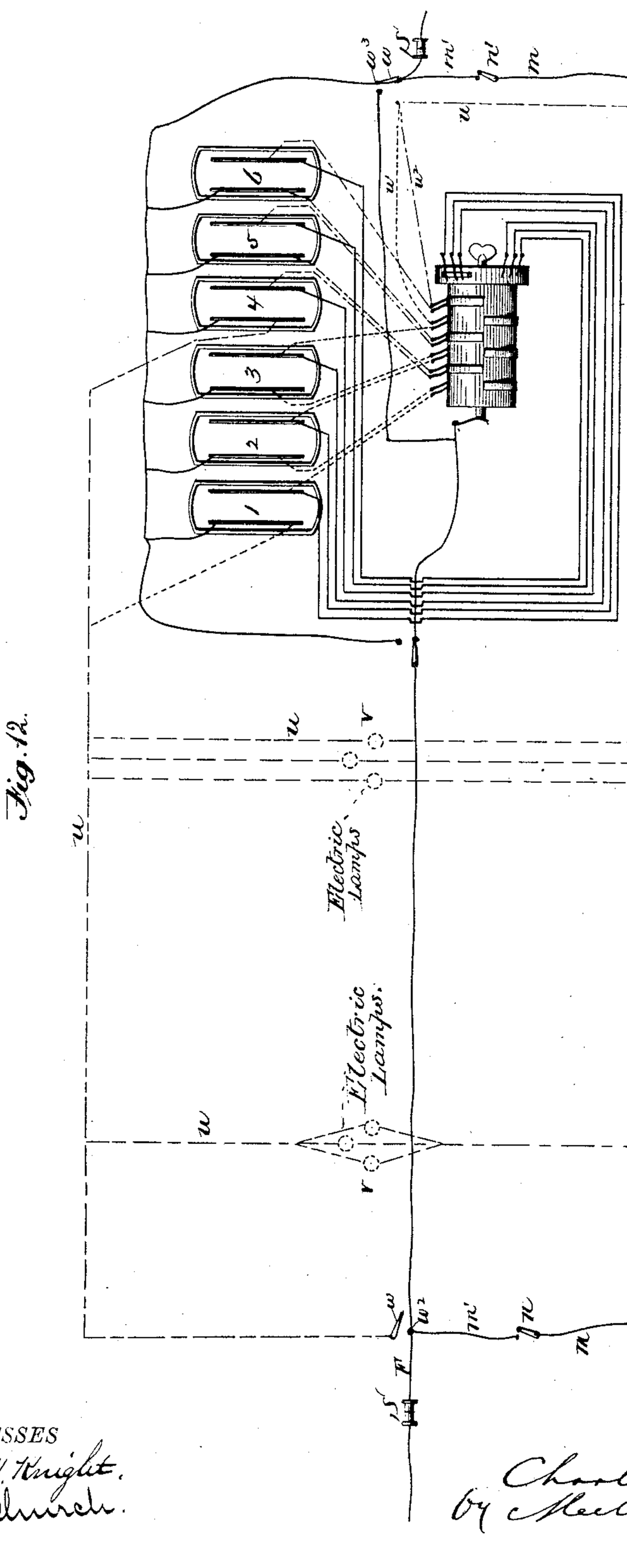

Fig. 12.

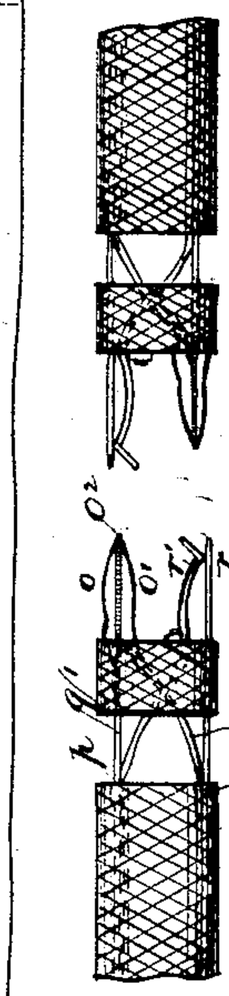

Fig. 13.

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UNITED STATES PATENT OFFICE.

CHARLES E. BUELL, OF NEW HAVEN, CONNECTICUT.

SYSTEM OF ELECTRIC LIGHTING FOR RAILWAY-TRAINS.

SPECIFICATION forming part of Letters Patent No. 259,362, dated June 13, 1882.

Application filed April 19, 1882. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. BUELL, of New Haven, in the county of New Haven and State of Connecticut, have invented a certain new and Improved System of Electric Lighting for Railway-Trains; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, and to the letters of reference marked thereon.

My invention relates to an improved system of electric lighting for railway-trains, comprehending the generation of the electricity in an economical manner by the motion of the train or otherwise, the conveying of the current from car to car, provision of suitable connection to permit of the separation of the cars and the uncoupling and disconnection of the electrical conductors between the same, the provision of suitable electric lamps and circuits in the cars, and the storing of the electricity in each car, so that each car can be lighted, whether coupled or not with other cars, the whole system being calculated to effect the lighting of the train in a more efficient, safe, and economical manner than heretofore.

My invention consists primarily in the combination of the following elements, namely: an electrical generating-machine mounted on the engine and propelled thereby, a main charging-circuit extending from the engine through the train, with circuit-connecting devices between the engine and the several cars, means for placing the generator in the charging-circuit, two series of secondary batteries and a normally-independent lamp-circuit in each car, and switching devices in each car, adapted to place one series of secondary batteries in the charging-circuit, coupled for quantity, and to simultaneously place the other series of said secondary batteries, coupled for intensity.

It further consists in the combination of the following-named elements in the equipment of each car, viz: electrical conductors forming part of a main charging-circuit, with means for connecting and disconnecting said conductors to and from those of an adjoining car, two series of secondary batteries and an independent lamp-circuit, and switching devices for interposing said series of secondary batteries separately alternately in the charging-circuit, coupled for quantity, and in a lamp-circuit, coupled for intensity, substantially as hereinafter set forth.

It further consists in the combination of the following-named elements in the equipment of each car, viz: electrical conductors forming part of a main charging-circuit, with means for connecting and disconnecting said conductors to and from those of adjoining cars, two series of secondary batteries, an independent lamp-circuit, switching devices for alternately connecting one series of secondary batteries into the charging-circuit, coupled for quantity, and for connecting the other series of said batteries into the lamp-circuit, coupled for intensity, and other switch devices for including at will one discharging series of secondary batteries or the independent lamp-circuit in the main charging-circuit, substantially as hereinafter described.

In the accompanying drawings, Figure 1 is a view of a locomotive-engine carrying and driving the dynamo-electric generator which furnishes the electrical power in my improved system of railway-lighting. Figs. 2 and 3 are views showing the electrical connections between the engine and cars. Fig. 4 is a bottom plan view of a car, showing the conductors thereto connected, composing part of the main charging-circuit. Fig. 5 is a view of the dynamo-electric generator, its several circuits, and the switching devices by which the engineer is enabled to control the same. Figs. 6, 7, 8, 9, 10, and 11 show various forms of conductors for the charging-circuit and couplings for the same between the cars. Fig. 12 is a diagram showing the equipment of each car of the train.

Similar letters of reference in the several figures denote the same parts.

A represents a locomotive-engine, B a mail-car, and C a passenger-car, composing a railway-train.

D is a dynamo-electric generator, mounted upon the engine, preferably beneath the engineer's seat, and having a friction-pulley, *d*, secured to its armature-shaft, and adapted to bear against the periphery, side, or inner portion of one of the driving-wheels of the engine, as shown in Fig. 1, so as to impart direct motion to the armature from said driving-wheel

with the least amount of gearing and within the most compact space. The dynamo is adapted to be worked upon an open circuit or to be included in a developing-circuit, E, or to be included in a charging-circuit split into a main circuit, F, extending through the train, and into a branch circuit, F′, leading to and including electric-lighting appliances at the front of the engine. Suitable contacts, *f f′*, and a switch, f^2, are arranged within the cab, to enable the engineer to control these circuits. When the switch is turned off both contacts, as shown in Figs. 1 and 5, the dynamo is permitted to run on an open circuit; but by turning the switch to contact *f* it is interposed in the developing-circuit. Then, by moving the switch so that it will rest upon both contacts *f* and *f′*, the current will be divided between the developing and the charging circuits; and then upon moving the switch still farther, so that it will rest upon the contact *f′* alone, the developing-circuit will be broken and the whole current directed into the charging-circuit. This arrangement of circuits and switching devices is necessary in order to prevent back flow of current over the charging-circuit from the storage-batteries interposed therein, as hereinafter explained, from affecting the field-of-force magnets of the dynamo.

The branch charging-circuit F may lead to the head-light G through an insulated wire, *g*, and return upon the metal parts of the engine, as shown; or it may both lead to and return from the head-light over insulated wires, if desired.

I preferably conceal a series of storage-batteries in the head-light, and adapt them to be interposed in the branch charging-circuit in any well-known manner to be charged and to discharge in a working circuit, including an electric lamp, as will be readily understood.

The main charging-circuit F extends to the extreme end of the train and back again to the dynamo over any suitable conductors, provision being made for the connection and disconnection of the conductors between the cars, in order that when the cars separate the conductors may also separate.

In extending the main charging-circuit through the train I find it convenient to make use of the pipes of the air or vacuum brake system, as shown in the drawings. Where only one metal pipe is employed in such brake system, as shown in Figs. 1 and 2, I make such pipe serve as one branch of the circuit and employ for the other branch of the circuit a return insulated wire, *w*, arranged preferably within said pipe, as shown in Fig. 6. Where, on the other hand, two pipes are employed, as shown in Figs. 3, 4, and 11, one pipe may be utilized as the outgoing branch of the circuit and the other as the return branch. In either system, as there are flexible sections of rubber or other non-conducting material at the ends of the pipes of each car, provision has to be made for bridging the gaps formed by these sections, and a very convenient way of accomplishing the object is to connect one end of an insulated wire to the end of the metallic pipe, and then wind it spirally about the flexible section and connect it to the metal coupling at the extremity, as shown in Fig. 9. When the couplings are brought together the circuit is completed. This will answer where the brake system employs two pipes. Where, however, a single pipe is employed with return-wire within the pipe, such wire may be led out through the side of the metal coupling, as shown in Fig. 6, and provided with an electric coupling such as shown in Fig. 7 at *h*, so as to connect it to a similar electric coupling on the conductor, leading from the pipe on the next car.

Instead of employing the pipes of a brake system, the outgoing and return branches of the charging-circuit may consist of separate insulated conductors united by couplings between the cars, as shown in Fig. 7; or both conductors may be inclosed in a single insulating-covering, as shown in Fig. 10, in which case a two-part coupling is employed on the end of the conductors of each car—such, for instance, as shown in Fig. 10, where *i i* represent two metal parts suitably insulated from each other, one part having a shoulder, *j*, formed in it and connected to one branch of the circuit and the other carrying a metal catch-spring, *k*, adapted to be operated by a button, *l*, and connected to the other branch of the circuit. This coupling is adapted to engage with a similar coupling on the conductors of the adjoining car, as will be readily understood by inspection of Fig. 10.

All of the electric couplings between the cars are preferably constructed so that they will automatically uncouple when the cars are separated.

As the uncoupling of any car ordinarily breaks the charging-circuit, it is necessary to provide means for connecting the conductors at each end of the car, so that the circuit may be completed whenever necessary. Where two brake-tubes are employed, as hereinbefore described, such connection can be effected by coupling the two tubes together, as shown in Fig. 4 at K′, or by providing branch conductors *m m′* and a switch, *n*, as shown in Fig. 12; but where both the outgoing and incoming branches of the circuit are within the same insulated covering, as in Figs. 10 and 14, a novel form of automatic coupling may be employed, such as shown in Fig. 14, that will not only automatically connect and disconnect with its counterpart on the adjoining car to continue each branch of the circuit, but will, when disconnected, automatically bring together both branches of the circuit, so as to complete the same. Referring to said Fig. 14, *o o′* represent two metal pieces separated by an insulator, o^2, the inner metal piece, *o′*, being electrically connected to the conductor *p* of the circuit by a wire or strip, *q*, while the outer metal piece, *o*, is connected to the conductor *p′* of the circuit by the wire or strip, *q′*. *r* is a rigid

metal piece connected to the conductor *p*, and *r'* is a spring connected to the conductor *p'*, as shown. When two couplings constructed in this manner are brought together, so that the parts *o o'* of one will slide in between the parts *r r'* of the other, electrical connection between the parts of each branch of the circuit will be established; but when the couplings are separated the parts *r r'* of each will come together, and thus connect both branches of the circuit together. In this way the circuit between all the cars that remain attached to the engine is kept closed in working order, and is not left open if any of the cars become detached.

In Fig. 12 I show in diagram a complete electric lighting equipment such as I employ upon each car of the train, consisting of the conductors F F, forming part of the main charging-circuit and carrying the couplings S S at their ends, the branch wires *m m'* and switches *n n'* for joining the branches of the charging-circuit at either end of the car, two series of storage-batteries, 1 2 3 and 4 5 6, a working or lamp circuit, *u*, (shown in dotted lines,) including electric lamps *v v*, and a switching device such as shown in my Patent No. 255,249, granted March 21, 1882, for alternately interposing one series of said storage-batteries in the charging-circuit in multiple arc to be charged and the other series in the working or lamp circuit in tension-series to be discharged. Said diagram also shows switches *w* and *w'*, which, when closed to their contacts w^2 w^3, connect the lamp-circuit directly into the main charging-circuit. This provision renders it practicable to run the lights either on the circuit supplied by the storage-batteries or on the main charging-circuit supplied directly from the dynamo.

Switches *w* and w^4 may also be employed, if desired, to interpose the lamp-circuit directly into the main charging-circuit.

The storage-batteries and switching apparatus on each car may be arranged in the closets thereof, or between the floors, or in a receptacle beneath the car, or elsewhere out of the way; but wherever placed provision should be made to prevent them from freezing—as, for instance, by surrounding them with sawdust or other non-conducting material, running steam-pipes in proximity to them, or by other well-known modes of protection.

The disposition of the several electric circuits in each car can be varied to suit the fancy of the constructer.

While I have shown the dynamo as mounted upon and driven by the locomotive-engine, and regard such an arrangement as probably the most practicable, it is obvious that it might be located elsewhere on the train and be driven from any of the transporting-wheels thereof.

The manner of insulation of the various conductors employed in the system I have not dwelt upon, it being necessary only to state that all such conductors are sufficiently well insulated to serve the purpose for which they are intended.

Having thus described my invention, I claim as new—

1. In a system of electric lighting for railway-trains, the combination of the following elements, namely: an electrical generating-machine mounted on the engine and propelled thereby, a main charging-circuit extending from the engine through the train, with circuit-connecting devices between the engine and the several cars, means for placing the generator in the charging-circuit, two series of secondary batteries and a normally-independent lamp-circuit in each car, and switching devices in each car, adapted to place one series of secondary batteries in the charging-circuit, coupled for quantity, and to simultaneously place the other series of secondary batteries in the lamp-circuit, coupled for intensity.

2. In a system of electric lighting for railway-trains, the combination of the following-named elements in the equipment of each car, viz: electrical conductors forming part of a main charging-circuit, with means for connecting and disconnecting said conductors to and from those of an adjoining car, two series of secondary batteries and an independent lamp-circuit, and switching devices for interposing said series of secondary batteries separately alternately in the charging-circuit, coupled for quantity, and the lamp-circuit, coupled for intensity, substantially as set forth.

3. In a system of electric lighting for railway-trains, the combination of the following-named elements in the equipment of each car, viz: electrical conductors forming part of a main charging-circuit, with means for connecting and disconnecting said conductors to and from those of adjoining cars, two series of secondary batteries, an independent lamp-circuit, switching devices for alternately connecting one series of secondary batteries into the charging-circuit, coupled for quantity, and for connecting the other series of said batteries into the lamp-circuit, coupled for intensity, and other switch devices for including at will one discharging-series of secondary batteries or the independent lamp-circuit in the main charging-circuit, substantially as described.

CHARLES E. BUELL.

Witnesses:
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