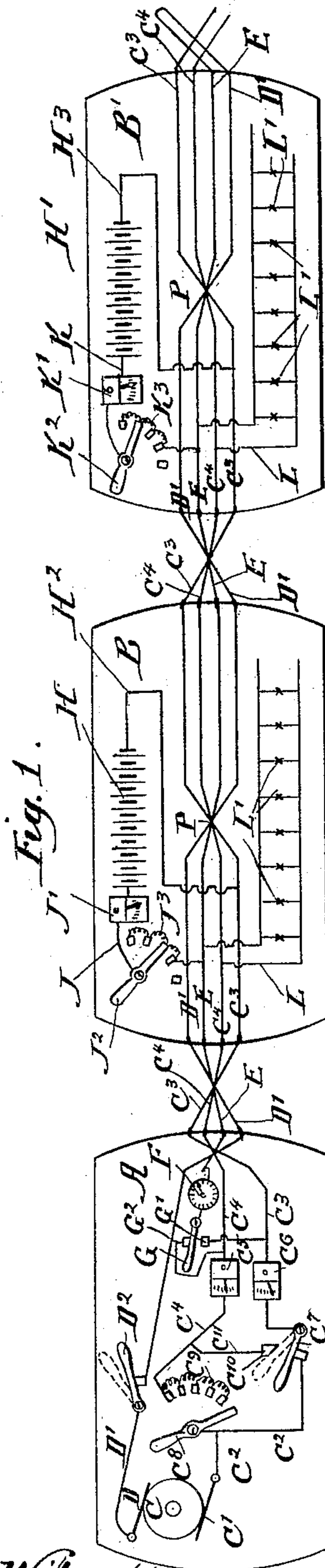


(No Model.)

H. W. LEONARD & A. HANSON.
SYSTEM OF ELECTRIC LIGHTING FOR RAILWAY CARS.

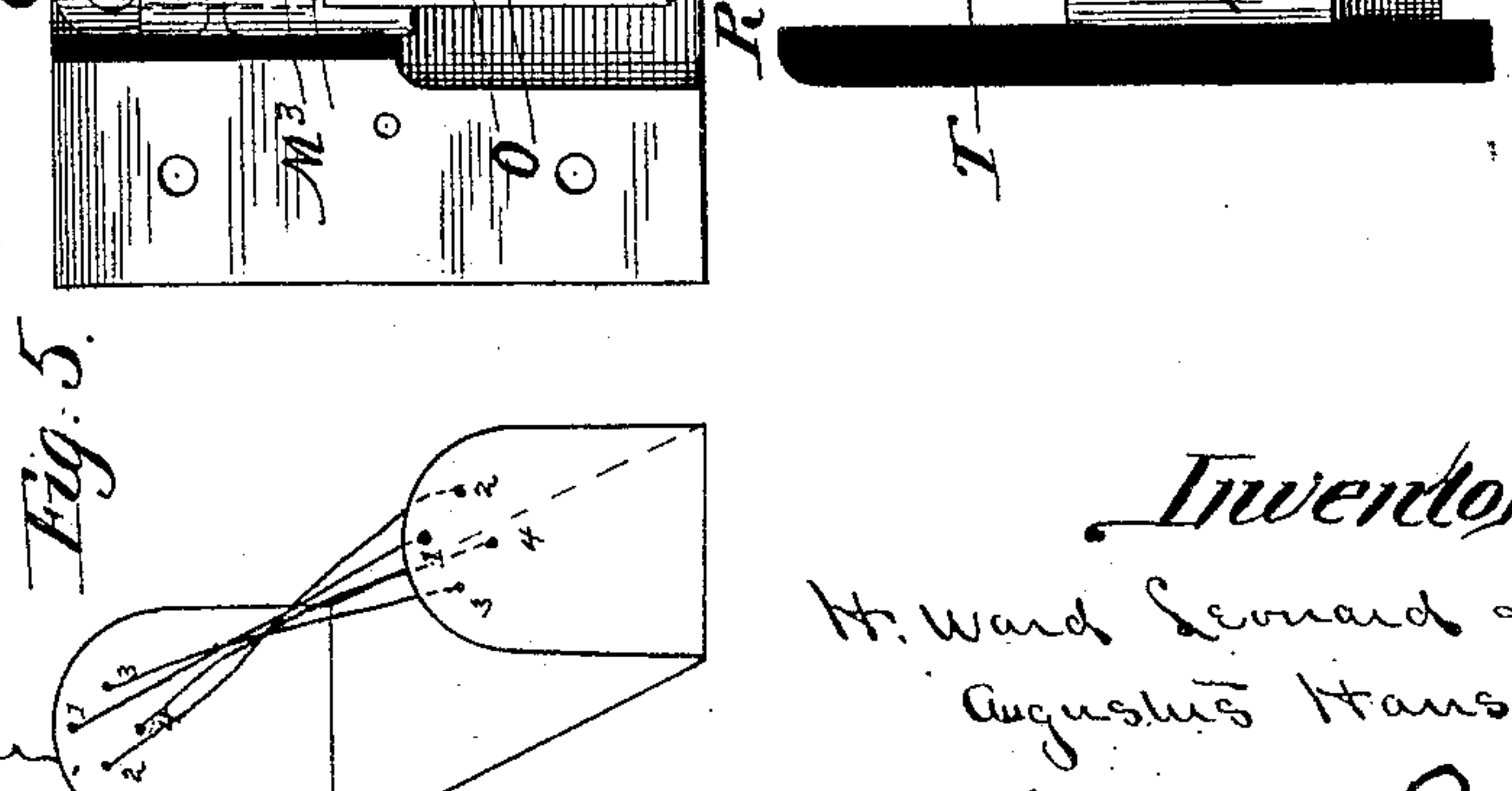
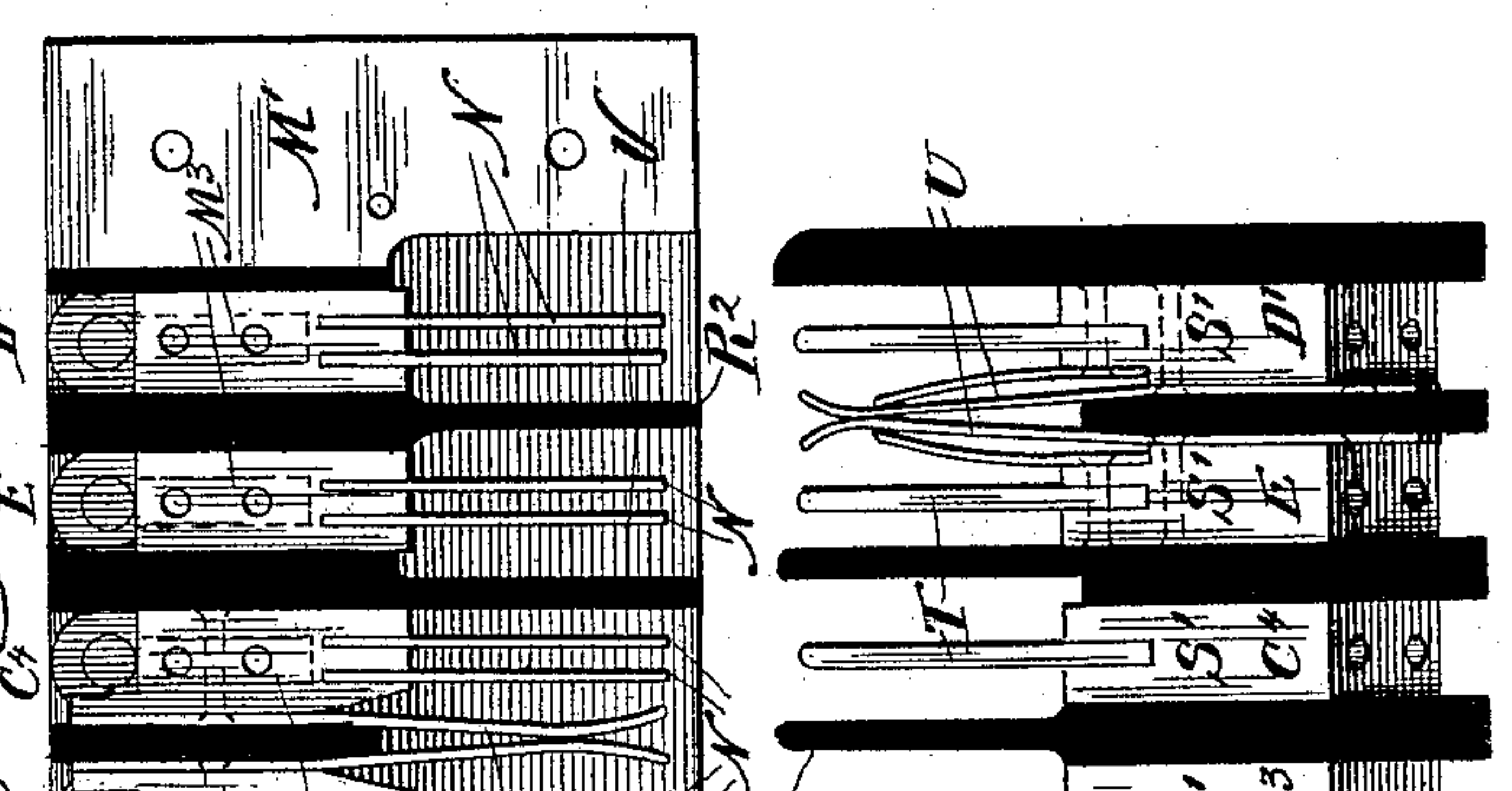
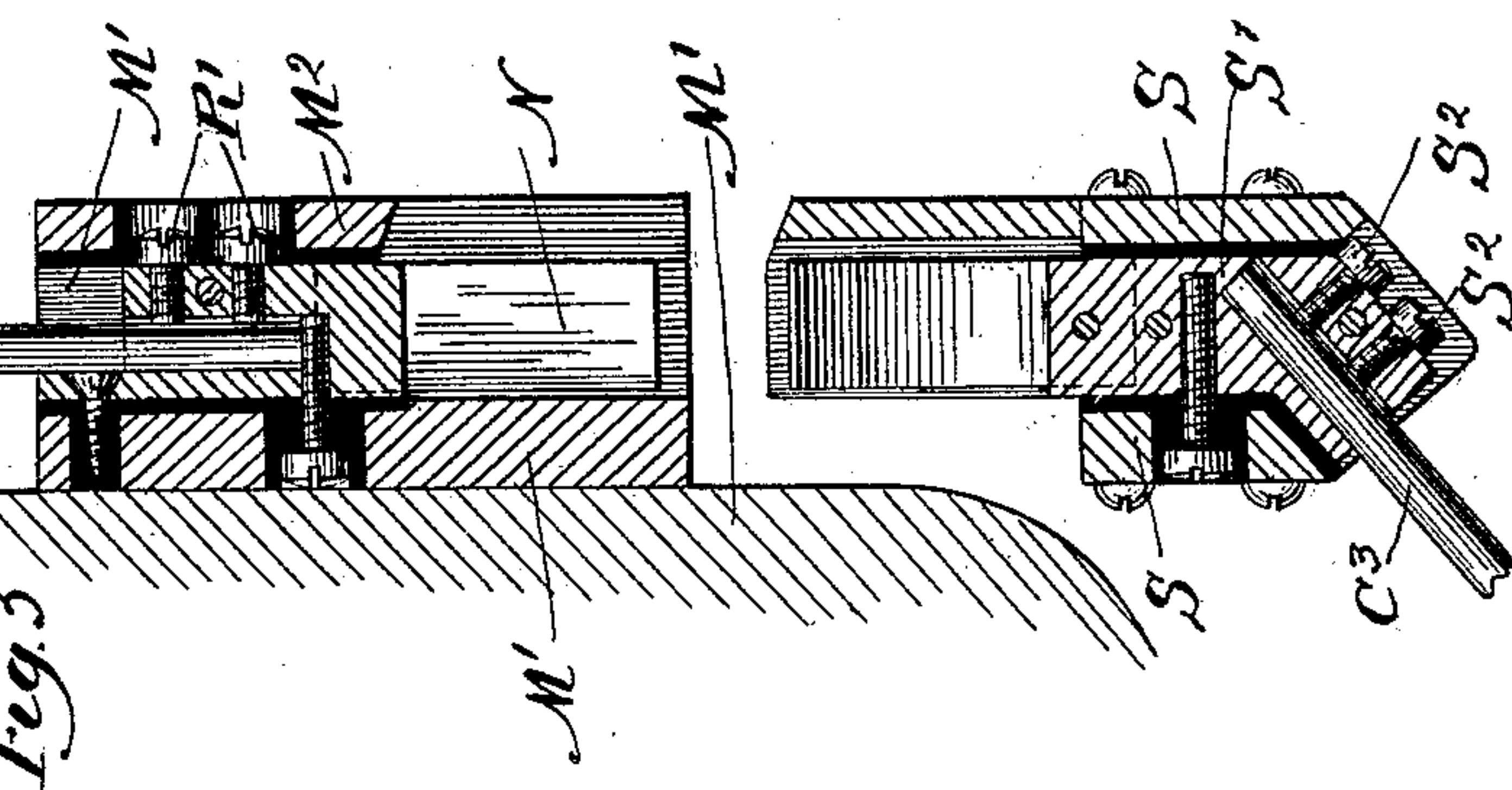
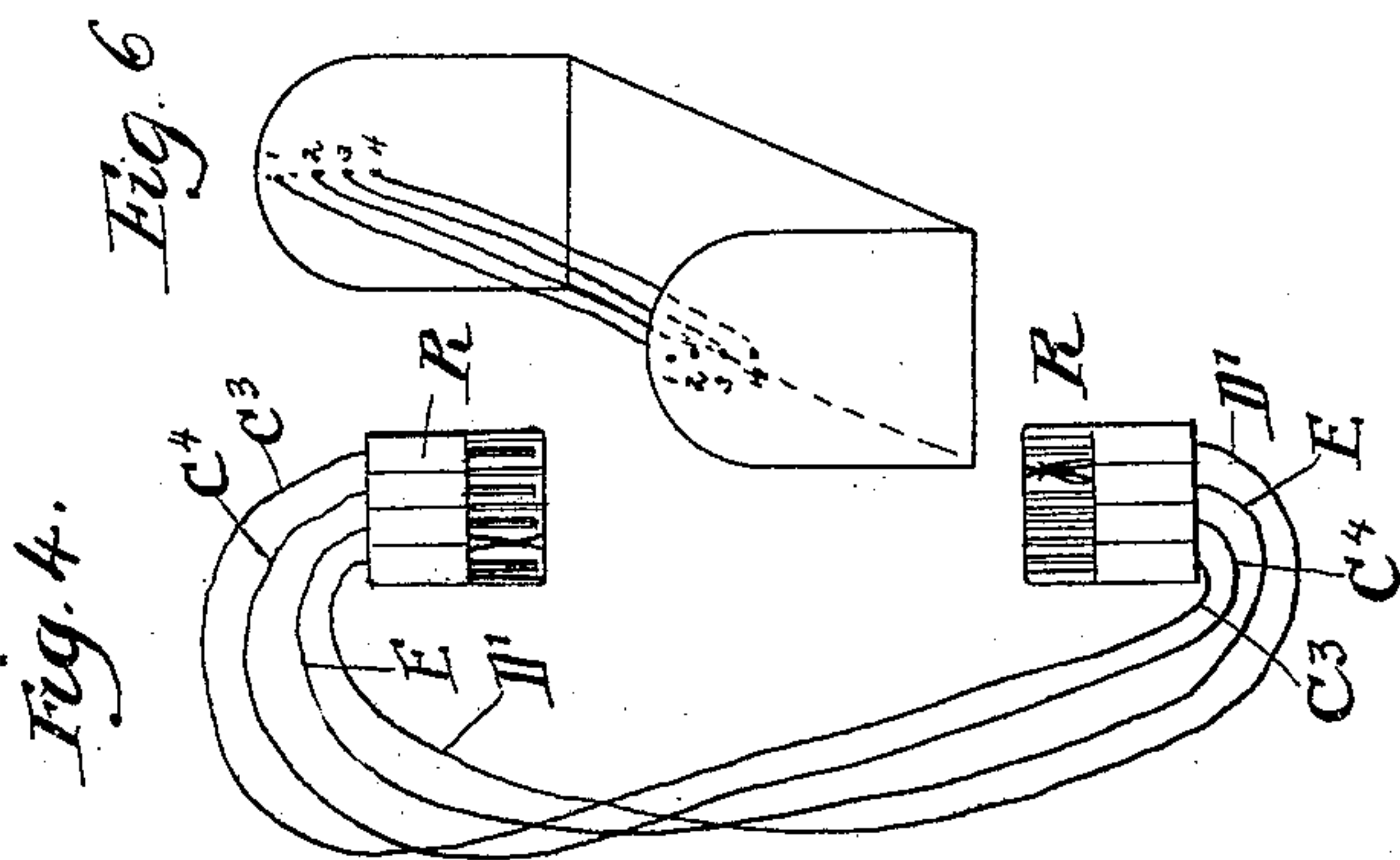
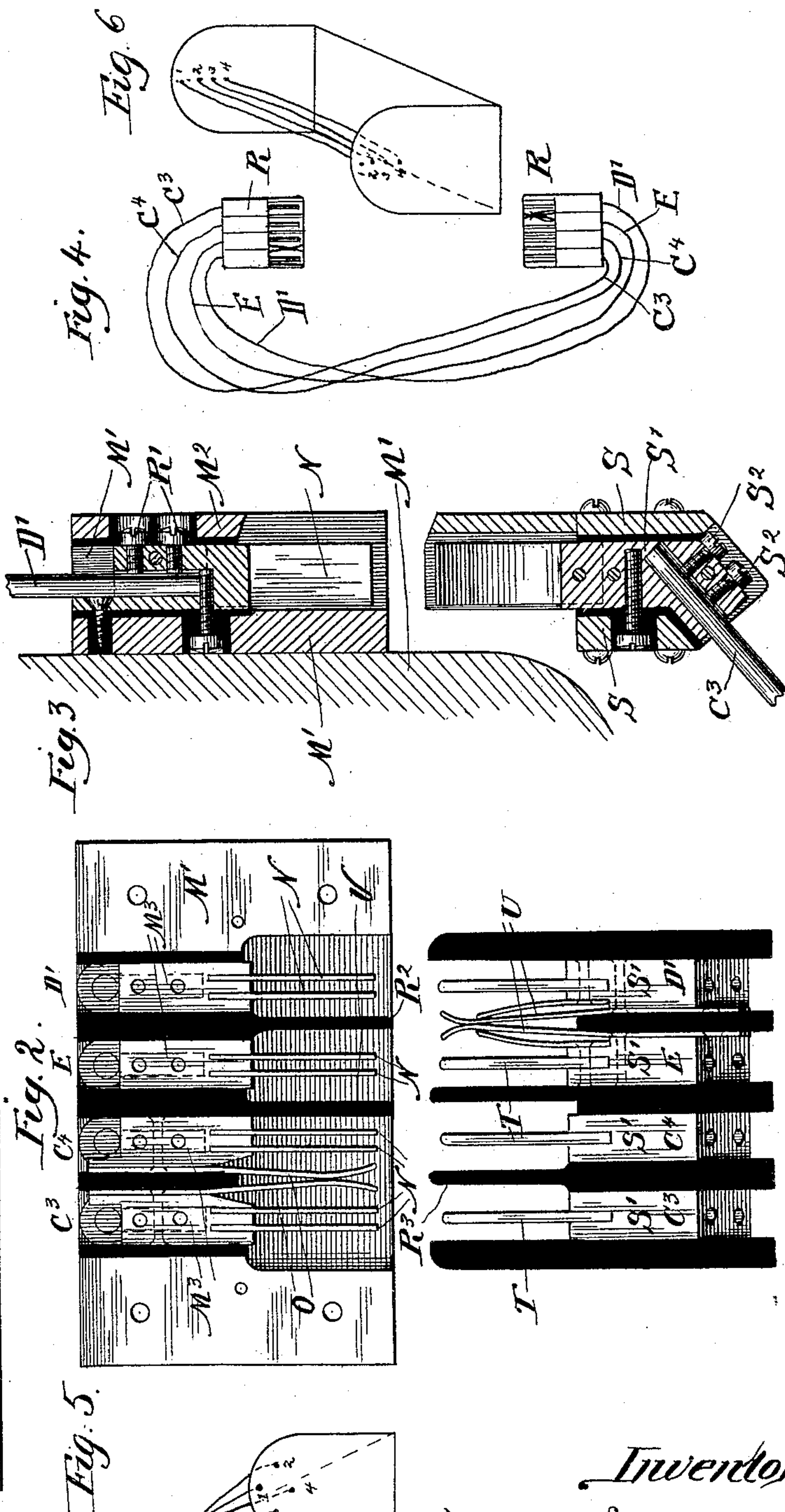
No. 405,897.

Patented June 25, 1889.



Witnesses.

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UNITED STATES PATENT OFFICE.

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SYSTEM OF ELECTRIC LIGHTING FOR RAILWAY-CARS.

SPECIFICATION forming part of Letters Patent No. 405,897, dated June 25, 1889.

Application filed January 31, 1889. Serial No. 298,187. (No model.)

To all whom it may concern:

Be it known that we, HARRY WARD LEONARD and AUGUSTUS HANSON, citizens of the United States, and residents of Chicago, county of Cook, and State of Illinois, have invented a new and useful Improvement in Systems of Electric Lighting for Movable Cars, of which the following is a specification.

Our invention relates to means and apparatus for lighting by electricity the cars of moving trains, and has for its object to provide convenient means therefor.

Our invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a diagrammatic view of a train of cars containing our improvement. Fig. 2 is a plan view of the coupling-block and one coupling-piece. Fig. 3 is a cross-section of the same. Fig. 4 is a detail of the coupler containing the two coupling-pieces and cable or connecting conductors or wires. Fig. 5 is a detailed diagrammatic view showing the car-conductors arranged so that their terminals issue at the ends of the cars in such manner as to form a square, as shown, in which event it will be observed that the wires 1 and 4 will not require to be crossed, while wires 2 and 3 must be crossed. Fig. 6 is a similar diagrammatic view with the terminals issuing in a vertical line, in which case none of the wires will have to be crossed.

Like parts are indicated by the same letter in all the figures.

A is a baggage-car; B B', the passenger-cars.

C is a generator having the brush C', from which the current passes onto the conductor C², from which lead the two branches C³ and C⁴. These branches contain the ampère-meters C⁵ and C⁶, and C² contains the switch C⁷. At one terminal of the wire C² is the switch C⁸, adapted to make connection through the variable resistance C⁹ with the branch conductor C⁴. The branch conductors C⁴ and C³ and the conductor C², I term together the "compound conductor." The switch C⁷ is also adapted to engage the block C¹⁰ on the conductor C¹¹, which leads to the branch conductor C⁴.

D is the other brush, by which the current

returns connected with the conductor D', which contains the switch D².

E is a return-wire, which is connected to the voltmeter F, from which connections lead to the switch G, which is adapted to connect with either of the branch wires C³ or C⁴, as shown in Fig. 1, by bringing it into engagement with either block G' or block G². To the branch conductor C³ are coupled the storage-batteries H and H' by the conductors H² and H³, respectively. From the other end of the battery H leads the conductor J, through the ampère-meter J', switch J², and variable resistance J³, to the return-conductor E. In like manner from the end of the battery H' leads the conductor K, through ampère-meter K', switch K², and variable resistance K³, to the return-conductor E.

From the branch C⁴ of the compound conductor lead the connectors L L' to the lamps L' L', thence to the return-conductor E. The switch G is normally closed, as shown in Fig. 1, and is used to connect conductor E with the conductors C³ and C⁴ through the voltmeter to indicate the pressure.

The several conductors leading from end to end of the car are called the "car-conductors," and they are twisted or crossed somewhere in the car, as at P, so as to bring the terminals of each upon opposite sides of the others at the opposite ends of the cars.

The object of the variable resistance C⁹ is to enable the operator to send currents of varying strength into the lamps and the batteries at the same time, and the object of the switch C⁷ and block C¹⁰ is to enable the operator to couple the conductors C⁴ and C³ together in the baggage-car, so as to enable the battery to supply the lamps when the generator is out of circuit. It might be dispensed with. The automatic switch D² is to cause the connection through the generator to be broken when the voltage of the generator is less than that of the battery. The coupling-block M, composed of the base M' and cover M² and containing contact-clamps M³, insulated from each other, as indicated, is placed on the inside of the outer pendent edge of the vestibule or platform, and the car-conductors are connected therewith in the order indi-

cated in Fig. 2, as seen when looking out of
 the car. From each of these contact-clamps
 project the contact-plates N N, and from the
 two which are attached to conductors C³ and
 5 C⁴ project the spring contact-plates O O, nor-
 mally in contact when the coupler is not in
 place. There is one of these coupling-blocks
 on each end of each car, and the coupling
 proper consists of two fac-simile coupling-
 10 pieces R R, having each a series of insulated
 clamping-blocks S' S', secured in the case S
 and provided each with an aperture and
 clamping-screws S² S² to secure the conduct-
 15 the projecting contact-plates T T.

U U are contact-plates normally in contact
 when the coupler is detached, and which con-
 nect such blocks S' S' as are intended to form
 connection with the conductors E and D'.

20 R' R' are clamping-screws on the block.

R² is an insulation-plate adapted to sepa-
 rate the contact-plates U U, and R³ is an in-
 insulation-plate projecting from the coupling-
 piece R and adapted to separate the spring
 25 contact-plates O O. The conductors of the
 coupling-piece are thus twisted, as indicated
 in Fig. 4.

The use and operation of our invention are
 as follows: When the cars are coupled to-
 30 gether, as indicated in Fig. 1, the coupling-
 block being fixed upon the inner side of the
 outer pendent edge of the vestibule of each
 car, so as to be seen, as shown in Fig. 2, when
 looking from the car, and a coupler having
 35 been inserted between the adjacent cars simi-
 lar to and in a position similar to that sug-
 gested in Fig. 2, and the switches being placed
 as shown in full lines, except switch C⁸, which
 should engage the varying resistance, and the
 40 generator being in operation, a current will
 pass from the generator through conductor
 C², switch C⁷, ampère-meter C⁶, conductor C³,
 through the various intervening coupling-
 pieces, as follows: block M³, contact-plates
 45 N N, contact-plate T, block S'; thence through
 the coupler to C³ in the next car; thence along
 conductor C³; thence a portion through con-
 ductor H², battery H, ampère-meter J', con-
 ductor J, switch J², resistance J³, return-wire
 50 E, to the end of the train, to block M³, con-
 tact-plates N, contact-plate T, block S'; thence
 through the last coupler on the rear of the
 last car, through the contact-plates U U, nor-
 mally in contact, back along conductor D',
 55 through the various cars and couplers, to the
 dynamo whereby the battery is fed and stored.
 If, now, it is desired while the process of stor-
 ing the battery is going on to feed the lamps
 from the generator, the switch C⁸ is placed
 60 upon the resistance C⁹, so that a current from
 thence will pass through ampère-meter C⁵,
 conductor C⁴, through the various intervening
 couplings, to conductor L, lamps L', back to
 conductor E; thence through the final coup-
 65 ling, as last above described, and thence
 through conductor D' to the generator. By
 properly locating the switch C⁸ with reference

to the variable resistance C⁹, a suitable cur-
 rent may be supplied to the lamps, while a
 much stronger current may be supplied to the
 70 battery. By properly adjusting the switch
 C⁸ on resistance C⁹ and regulating the press-
 ure of the generator the pressure on the bat-
 teries and lamps may be varied relative to
 each other, so that the current taken by bat-
 75 teries and lamps may be independently varied,
 as described. The lamps might be run alone
 without the battery by disconnecting the
 switch C⁷ from line C² and connecting it to
 block C¹⁰. The switch G, during the opera-
 80 tion of the dynamo, is normally in the posi-
 tion shown, indicating the pressure on the
 lamp-circuit. When, however, it is desired
 to test the electro-motive force between E and
 C³, it may be done by throwing the switch
 85 against block G'. When the dynamo is dis-
 connected by the opening of the automatic
 switch D², the lamps will be fed from the stor-
 age-battery, for a current passes from battery
 H, through ampère-meter J', conductor J,
 90 switch J², resistance J³, conductor E, to lamps
 L', by conductor L to conductor C⁴, through
 ampère-meter C⁵, resistance C⁹, switch C⁸, con-
 ductor C³, switch C⁷, ampère-meter C⁶ on con-
 ductor C³, back to conductor H², to battery.
 95 When the conductors C³ and C⁴ are connected
 in the baggage-car, the two ampère-meters
 are in series in line with the battery and
 lights.

When a car is entirely detached from all
 100 others and with the coupling removed at one
 end, by an examination of Fig. 2 it will be
 seen that the conductors C³ and C⁴ will be
 connected at such end of the car by the con-
 105 tacts O O; hence the lamps on such car are in
 this instance run from the battery in such car.
 The rear coupler must be retained when the
 lamps are being lighted from the dynamo.

It is evident, of course, that one or more of
 the storage-batteries might be dispensed with,
 110 and that, in fact, one in the baggage-car or one
 in any other car could in some instances an-
 swer for all purposes. It is equally clear that,
 so far as the compound conductor is con-
 cerned, in many instances substantially the
 115 same results could be attained by placing the
 resistance at the end of the train or car and
 connecting the two conductors C³ and C⁴
 through the same. The return-loop is virtu-
 120 ally nothing more nor less than the main con-
 ductor passing from that car, and should be
 so considered in regarding the claims. The
 arrangement of the terminals has been sug-
 gested as being in a horizontal line. Of
 course, if these terminals were arranged in a
 125 vertical line or in a circle or otherwise at the
 end of the car, some or all of them would be
 situated so that the twist or crossing would
 be unnecessary.

The essential object sought to be obtained
 130 by crossing the wires, or by such arrangements
 as suggested when the crossing is dispensed
 with, is to arrange the cars and couplers so that
 no mistakes could be made in coupling them.

Of course, if there is no twist in the conductors in the cars, there would be none in the conductors in the couplers.

A point from which to observe the terminals of the car-conductors, so as to bring them into the relative positions referred to in the claims, would be outside at one end and in the line of the length of the car.

With several sets of storage-batteries operating in multiple are the total charging or discharging current does not in practice divide proportionately among the several sets of batteries. It is essential for best results that this should be accomplished, and for the purpose of equalizing the current in the different batteries, both in charge and discharge, we insert a variable resistance in series with each group of storage-batteries. In the drawings this resistance is shown at one end of the series of cells composing a set of batteries; but of course it could be placed in any portion of the battery-circuit as long as it is in series with the battery.

We claim as new and desire to secure by Letters Patent—

1. The combination of a car with a series of conductors therealong so arranged that the terminal of each is on opposite sides of each of the other terminals at the two ends of the car.

2. The combination of a car with a series of conductors therealong, two of which together constitute, when in action, a return-loop, said conductors so arranged that the terminals of the two conductors forming the loop have opposite relative position with reference to the remaining conductor-terminals at each end of the car.

3. The combination of a series of cars with a series of conductors in each car and connectors between such conductors, said connectors containing wires so arranged that the conductor-terminals in one car are connected each with oppositely-located conductor-terminals on the adjacent car.

4. The combination of a series of cars with a series of conductors therealong so arranged that the terminal of each is on opposite sides of each of the other terminals at the two ends of the car, and a connector provided with wires so arranged that the conductors of one car are connected each with the oppositely-arranged conductors on the adjacent car.

5. In a system of electric lighting for cars, a connector to couple adjacent cars, consisting of two similar coupling-pieces, having a series of terminals and crossed wires leading from one to the other, and coupling-blocks having each a series of terminals.

6. In an electric-lighting system for cars, the combination of cars and conductors with coupling-blocks at each end of each car containing two terminals normally in contact, so as with their conductors to make a return-loop closed at such coupling-block, and two terminals normally not in contact with a

coupler adapted to open such loop and connect all the terminals with the terminals of the coupler.

7. In an electric-lighting system for cars, a coupler provided with two similar coupling-pieces and connecting-wires, each piece having two terminals normally in contact and two normally not in contact, in combination with a coupling-block containing the terminals of the car-conductors, said closed terminals on the coupler adapted to be opened and connected with terminals in the coupling-block when the two are brought together.

8. In an electric-lighting system for cars, a coupler provided with two similar coupling-pieces and connecting-wires, each piece having two terminals normally in contact and two normally not in contact, in combination with a coupling-block containing the terminals of the car-conductors, two of which are normally in contact, and contact-breaking plates on the block and the coupling-piece, so that when interlocked such connected terminals are separated.

9. In an electric-lighting system for cars, the combination of the cars, conductors, and coupling-blocks which contain the terminals of such conductors, two of said terminals normally in contact and two normally not in contact, with a coupler consisting of coupling-pieces and connecting-wires, said pieces containing the terminals of said wires, and two of such terminals normally in contact and two normally not in contact, and contact-breakers, one on the block and one on each coupling-piece, so that when the block and pieces are interlocked all of such closed terminals are opened and each car-conductor is connected with its respective coupler-wire.

10. In an electric-lighting system for cars, the combination of cars and their conductors with coupling-blocks, one at each end of each car, containing the terminals of such conductors, two of such terminals normally in contact and two normally not in contact, with a coupler consisting of two coupling-pieces and connecting-wires, the terminals of such wires in such coupling-pieces, and two at each end normally in contact and two normally not in contact, and one contact-breaker on each block and each piece.

11. In an electric-lighting system for cars, the combination of a generator with a main conductor leading from one pole, a compound conductor leading from the other, storage-batteries, and lamps, as required for the cars, said batteries coupled between the main and one branch of the compound conductor, and the lamps between the main and the other branch of the compound conductor.

12. In an electric-lighting system for cars, the combination of a generator with a main conductor leading from one pole, a compound conductor leading from the other, storage-batteries having a variable resistance in series with each set, should more than one set be used, and lamps, as required for the cars,

said batteries coupled between the main and one branch of the compound conductor, and the lamps between the main and the other branch of the compound conductor.

5 13. In an electric-lighting system for cars, the combination of a generator with a main conductor leading therefrom and a return-conductor connected therewith so as to form
10 a loop, and a compound conductor leading from the other pole, the storage-batteries, and lamps, as required for the cars, said storage-batteries coupled between the return-conductor and one branch of the compound conductor, and said lamps between the return-
15 conductor and the other branch of the compound conductor.

14. In an electric-lighting system for cars, the combination of a generator with a main conductor leading from one pole and a com-
20 pound conductor leading from the other, consisting of two branch conductors, one of which contains a variable resistance, and a voltmeter and connections from the main conductor to either of the branch conductors, so as to
25 test the difference of voltage between the main and either of the branch conductors.

15. In an electric-lighting system for cars, the combination of a generator with a main conductor leading from one pole and a com-
30 pound conductor leading from the other, and consisting of two branch conductors, one of which contains a variable resistance, storage-batteries, and lamps, as required for the cars, the lights coupled between the main con-
35 ductor and that branch of the compound conductor containing the variable resistance, and the storage-batteries between the main conductor and the other branch of the compound conductor.

40 16. In an electric-lighting system for cars, the combination of a generator with a main conductor leading therefrom, a return-wire connected with such main conductor so as to form a loop, a compound conductor leading
45 from the other pole of the generator having two branches, and a voltmeter and connections, so that such return or main wire may be connected through such voltmeter with either branch of the compound conductor.

50 17. In an electric-lighting system for cars, the combination of a generator with a main conductor leading therefrom, a return-wire connected with such main conductor so as to form a loop, a compound conductor leading
55 from the other pole of the generator having two branches, and a voltmeter and connections, so that such return or main wire may be connected through such voltmeter with either branch of the compound conductor,
60 and an ampère-meter in each branch of said compound conductor.

18. In an electric-lighting system for cars, the combination of a generator with a main conductor leading therefrom, a return-wire
65 connected with such main conductor so as to form a loop, a compound conductor leading

from the other pole of the generator and having two branches, and an ampère-meter in each branch of said compound conductor.

19. In an electric-lighting system for cars, 70 the combination of a generator with a main conductor leading therefrom, a compound conductor leading from the other pole of the generator having two branches, an ampère-meter in each of said branches, means for con- 75 necting the two branches when the generator is disconnected, and storage-batteries and lights coupled between the main and such branch conductors, respectively, so that when the generator is out of circuit and the branch 80 conductors connected the two ampère-meters will be coupled in series with the batteries and lights.

20. In an electric-lighting system for cars, the combination of a generator with a main 85 conductor leading therefrom, a return-wire connected with such main conductor so as to form a loop, a compound conductor leading from the other pole of the generator having two branches, and a voltmeter and connec- 90 tions, so that such return or main wire may be connected through such voltmeter with either branch of the compound conductor, and an ampère-meter in each branch of said compound conductor, and a variable resist- 95 ance in one branch thereof.

21. In an electric-lighting system for cars, the combination of a generator with a main conductor leading therefrom, a return-wire connected with such main conductor so as to 100 form a loop, a compound conductor leading from the other pole of the generator having two branches, and an ampère-meter in each branch of such conductor, and a variable resistance in one branch of such compound con- 105 ductor.

22. In an electric-lighting system for cars, the combination of a generator with a main conductor leading therefrom, a compound con- 110 ductor consisting of two branches leading from the other pole, and switches in the main conductor and both branches of the compound conductor.

23. In an electric-lighting system for cars, the combination of the generator with a main 115 conductor leading from one pole thereof, a compound conductor leading from the other pole thereof and composed of two conductors running through the train, a resistance in such compound conductor, so as to secure a 120 difference of potential on the two wires of the compound conductor, and lamps coupled between the main conductor and one branch of the compound, and batteries between the main conductor and the other branch of the 125 compound conductor.

24. In an electric-lighting system for cars, the combination of the cars with a series of car-conductors leading therealong and hav- 130 ing their terminals at each end of each car so arranged as always to occupy the same relative positions to each other when considered

as series, as from right to left in a horizontal line, from top to bottom in a vertical line, and the like, and viewed from without the car.

25. In an electric-lighting system for cars, 5 the combination of a car with a series of conductors therealong, said conductors so arranged that the terminals of some of them have opposite relative positions with reference to the remaining conductor-terminals at 10 each end of the car.

26. In an electric-lighting system for cars, the combination of a generator with a main conductor leading therefrom and a compound conductor leading from the other pole and 15 consisting of two branches, each of which contains an ampère-meter.

27. The combination of a generator with conductors leading therefrom, two or more sets of storage-batteries, and also lamps in multiple arc across such conductors, each set 20 of storage-batteries having each of its cells at all times in series with and therefore subjected to the same current as every other cell in that set, and each set of storage-batteries having a variable resistance in series with it. 25

Dated this 28th day of January, 1889.

HARRY WARD LEONARD.
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Witnesses:

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