(No Model.) 2 Sheets—Sheet 1.

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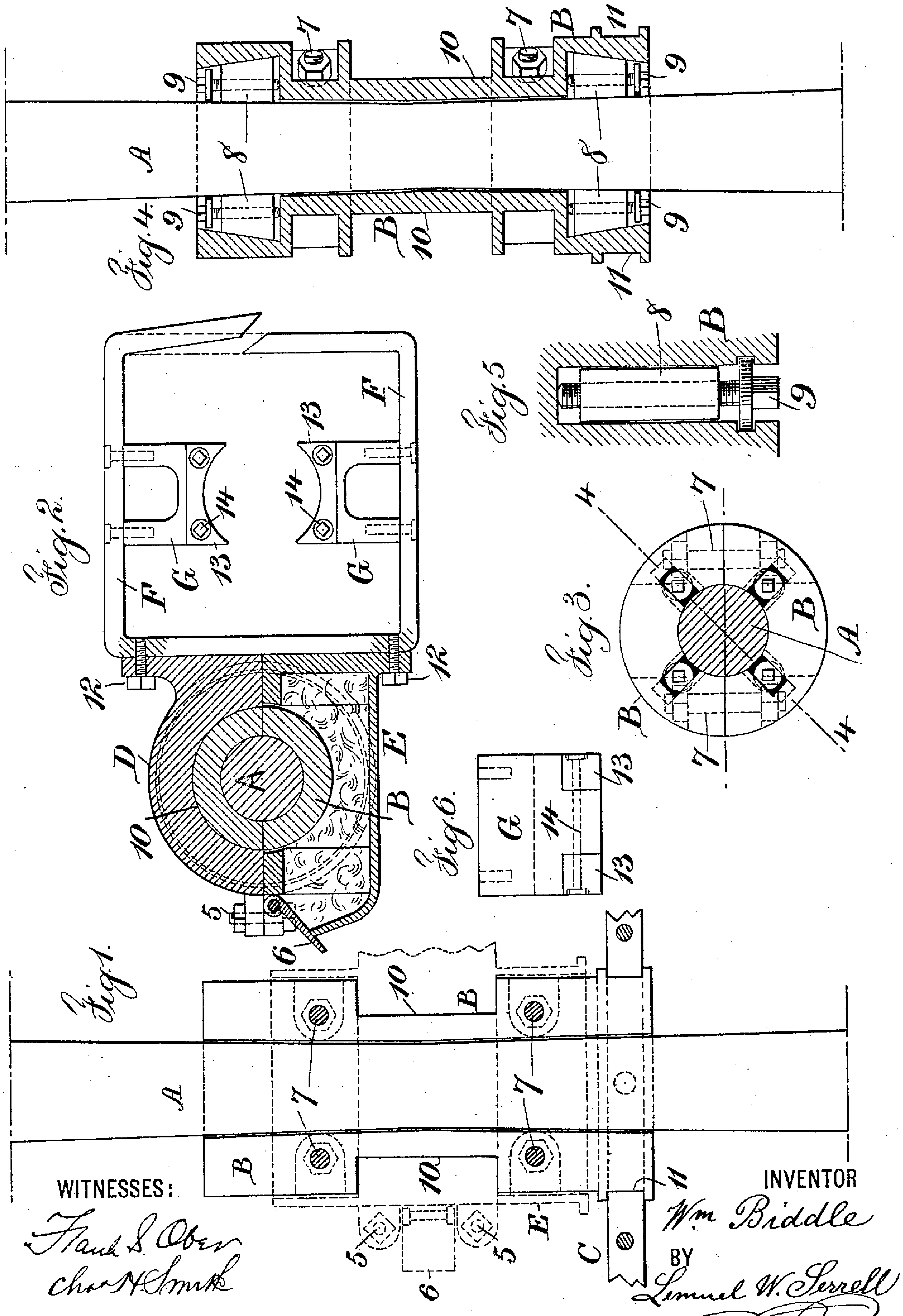
ELECTRIC CAR LIGHTING APPARATUS.

No. 547,835. Patented Oct. 15, 1895.



WITNESSES:

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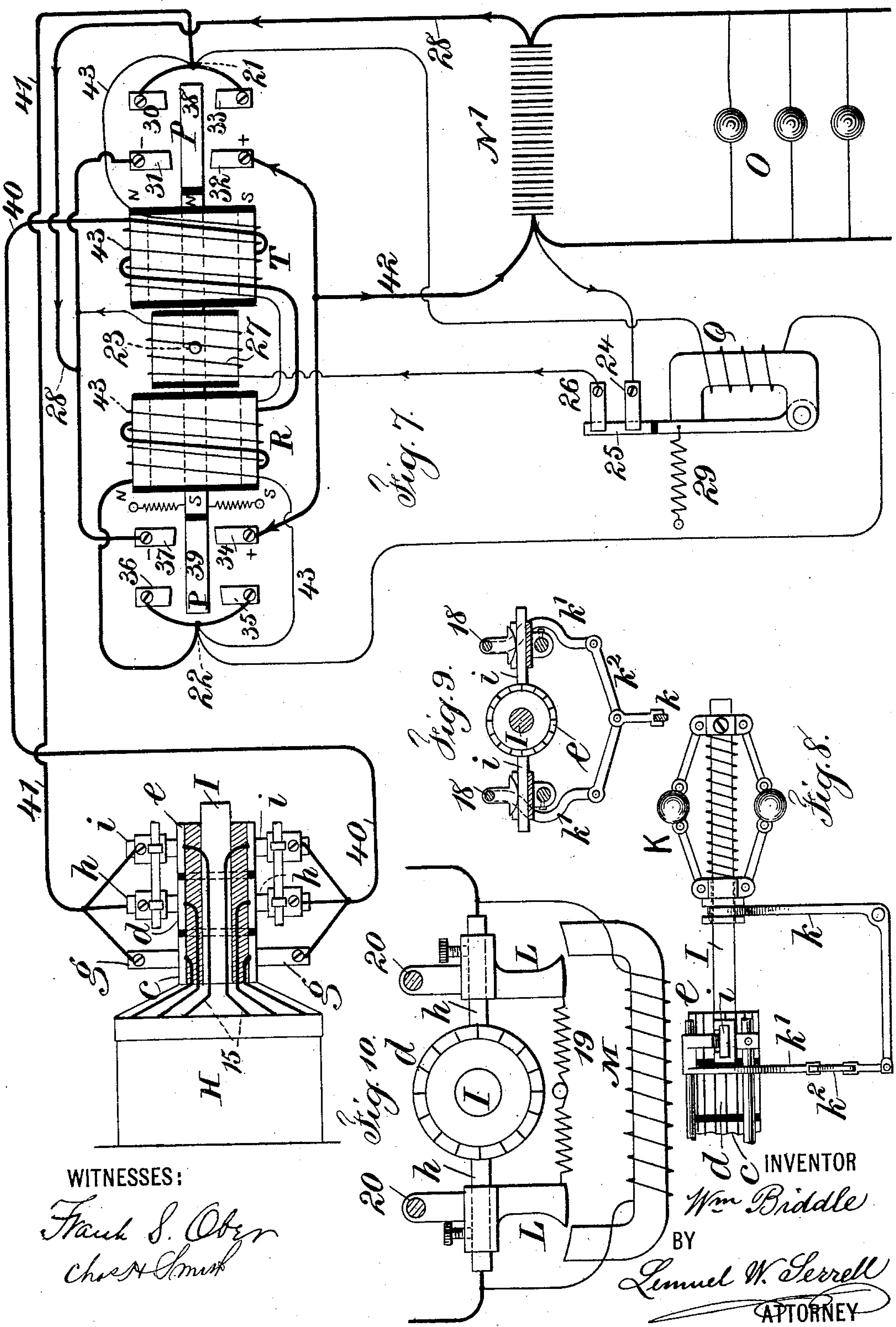

UNITED STATES PATENT OFFICE.

WILLIAM BIDDLE, OF BROOKLYN, NEW YORK.

ELECTRIC CAR-LIGHTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 547,835, dated October 15, 1895.

Application filed January 16, 1895. Serial No. 535,083. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM BIDDLE, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented an Improvement in Electric Car-Lighting Apparatus, of which the following is a specification.

In order to regulate the current passing from the dynamo under the differences in speed of the armature, I make the armature-coils in sections and provide for cutting out one or more of the sections of the armature-coil when the speed of rotation and the development of electromotive force exceed the maximum required in lighting the car, and I provide with the dynamo and the storage-battery circuit connections whereby the current is properly directed to the storage-battery and the circuit to the dynamo broken when the voltage of the dynamo becomes less than that of the storage-battery, and the dynamo is constructed with reference to attaching it to car-axles already in use and to making the dynamo as light as consistent with the strength necessary under the circumstances of its use.

In the drawings, Figure 1 shows a portion of an axle and one part of the two-part journal. Fig. 2 is a cross-section through the axle and journal-box. Fig. 3 is an end view of the two-part journal. Fig. 4 is a section of the two-part journal at the line 4 of Fig. 3. Fig. 5 shows one of the adjusting-wedges in larger size. Fig. 6 is a detached view showing the side of one of the pole-pieces. Fig. 7 is a general diagram of the circuit connections. Fig. 8 illustrates the use of a governor for regulating the commutator-brushes. Fig. 9 is an end view of the commutator and part of the connections to the governor, and Fig. 10 is an end view illustrating the manner in which the commutator-brushes can be regulated by the electric current.

The axle A is to be of any desired character, and only a portion of the same is represented in the drawings. Such axle is to be provided with wheels and is one of the truck-axles of the car. The two-part journal B is adapted to set against the sides of the axle A, and there are screws 7 passing through the two-part journal, the heads and nuts of the screws being received into recesses or countersinks in the two-part journal, as illustrated in Fig. 3, so that there is nothing projecting beyond the cylindrical portions of such two-part journal. I have represented at *c* a portion of the gear which is fastened upon one end of the two-part journal, the same being received into an annular recess 11 in the journal between the collars or flanges, and such gear being in two parts and bolted together.

It is usually advantageous to make the two-part journal with a hole through it that is rather larger than the axle itself, so as to allow for adjusting the two-part journal to bring the same concentric with the axis of rotation of the axle; and with this object in view I make recesses in the end portions of the two-part journal, such recesses being advantageously four in number at each end, as illustrated in Fig. 3, and into these recesses wedges 8 are placed, having through them adjusting-screws 9, and it is advantageous to make in the opposite faces of the recesses grooves to receive a disk at the head of each screw 9, as seen in Fig. 5, so that the screw may be held in position by the disk entering such grooves; but the screw can be rotated to move the wedge in one direction or the other, and in so doing adjust the parts of the journal and hold the same rigidly upon the axle, so that the two may rotate together and the journal will be concentric with the axis of rotation of the axle.

The two-part journal B is reduced in size in the central portion, as at 10, to form a bearing for the dynamo, and the dynamo-frame F has at one side a journal-box D, projecting over the reduced portion or bearing 10 of the journal and also an oil-box E beneath the journal-box, such oil-box being connected with the journal-box by screws 5, and it is advantageous to provide a cover 6 to the oil-box, and there are screws 12 for connecting the journal-box D and oil-box E rigidly upon the side of the dynamo-frame F. It is advantageous to make this dynamo-frame F of a band of wrought-iron of the proper width and thickness to obtain the necessary strength, and by bending up this band into the form of a rectangular frame and bringing the ends of such band together in the manner illustrated in Fig. 2 the ends can be welded, so as to make a strong, reliable, and light dynamo-frame, which also becomes the connection or keeper to the pole-pieces of the dynamo. These pole-pieces G are preferably of soft iron and U-shaped and screwed upon the dynamo-frame, the opposite faces of the pole-pieces being arcs of cylinders described from the axis of rotation of the armature, and it is desirable to make use of steel pole-pieces 13, introduced into recesses in the pole-pieces G and secured by screws 14, so that there may be sufficient residual magnetism in the steel pole-pieces for starting the dynamo after the same has been at rest.

The armature H is upon a shaft I, driven by gearing that connects the same to the axle A, and this armature H is composed of coils or helices wound in any desired manner; but instead of being wound with the ends of the wires of the respective sections connected to one range of commutator-plates I make use of two, three, or more ranges of commutator-plates. I have shown three ranges of commutator-plates *c d e*, and the ends of the coils in the armature are connected in regular order with the respective commutator-plates, and to the said commutator-plates brushes or carbons or similar contacts are provided in pairs, marked, respectively, *g h i*, and the main-circuit wires are connected to all of these commutator-brushes by branches, as illustrated in Fig. 7, so that when all of the brushes are in contact with the commutator-plates at opposite sides, as usual, all of the currents set up in the armature are directed to the main-circuit wires; but when one or more of the commutator brushes or carbons is drawn back the circuit will be broken at that particular range of commutator-plates, and the output of current from the armature will be correspondingly lessened.

It is generally advantageous to act upon the commutator-brushes in pairs, so as to separate both brushes at one particular range of commutator-plates and then both brushes at another range of commutator-plates, and thus cut down the output of current from the armature when the same becomes excessive in consequence of the increased speed of the armature as the same may be driven by the car-axle, or when the speed of rotation lessens such commutator-brushes are restored to contact with the plates.

Any suitable mechanism may be employed for giving motion to the commutator-brushes and separating the same from the commutator-plates. In Fig. 8 I have represented a governor K upon the armature-shaft, such governor acting through a lever k upon the links k^2 and levers k', that are pivoted at 18, and such levers k' are connected with and adapted to move the commutator-brushes. I have represented such levers k' as carrying the commutator-brushes i. Hence when the governor K is rotated faster than the predetermined speed the lever k, acting through the links k^2 and levers k', draws back the brushes i and cuts out of circuit those coils in the armature which are connected by the wires 15 with the commutator-plates e, and when the speed of rotation of the armature becomes sufficiently slow the spring on the governor moves the lever k and again brings the brushes i into contact with the plates e. If the speed of rotation is in sufficient excess for the governor K to act still further, it may do so by being connected with mechanism that moves back the brushes h. I have, however, represented an electrical device for drawing back such brushes h—namely, the armatures L, pivoted at 20 (see Fig. 10) and carrying such brushes h, there being a spring or springs 19 for drawing the armatures L and brushes h toward the commutator-plates d, and the electromagnet M is provided with two poles to act upon the armatures L to move the same when the magnetism set up in such electromagnet M is sufficient to overcome the springs 19.

It is generally advantageous to connect the helix of the electromagnet M in a shunt between the main-line wires connected with the brushes, so that the magnetism set up in the electromagnet M will be in proportion to the output of current from the armature and will cause the disconnection of one or more brushes from the commutator-plates or their restoration to position, according to the speed of rotation of the armature and the output of current therefrom. Hence by these means the current passing to the secondary or storage battery N′ can be rendered uniform, or nearly so.

In Fig. 7 I have represented the circuit connections which are advantageously made use of in connection with the aforesaid devices—that is to say, the pole-changer P acts to direct the current to the secondary battery, so that such current reaches the same in a uniform direction, regardless of the direction of rotation of the armature-shaft, and the circuit-breaker Q acts to break the electric circuit from the secondary battery whenever the voltage of such battery is in excess of the voltage of the armature, thus preventing the secondary battery discharging through the armature when the car is standing still or running at a slow speed.

I find it advantageous to construct the pole-changer P as a bar pivoted at 23 and polarized in one direction by a current passing from the secondary battery N′ by 24, 25, and 26, through the helix 27, by which such pole-changer P is polarized, the circuit passing from P by the wire 28 to the other pole of the secondary battery, and it will be noticed that the contact-plate 25 is on the armature of the circuit-breaker Q, and hence the current is broken between 24 and 26 whenever the spring 29 overcomes the electromagnet of the switch Q, which occurs whenever the voltage in the circuit from the armature-brushes becomes less than that from the secondary battery.

In connection with the pole-changer P there are the contact-plates 30, 31, 32, 33, 34, 35, 36, and 37, and upon the pole-changer P are con-

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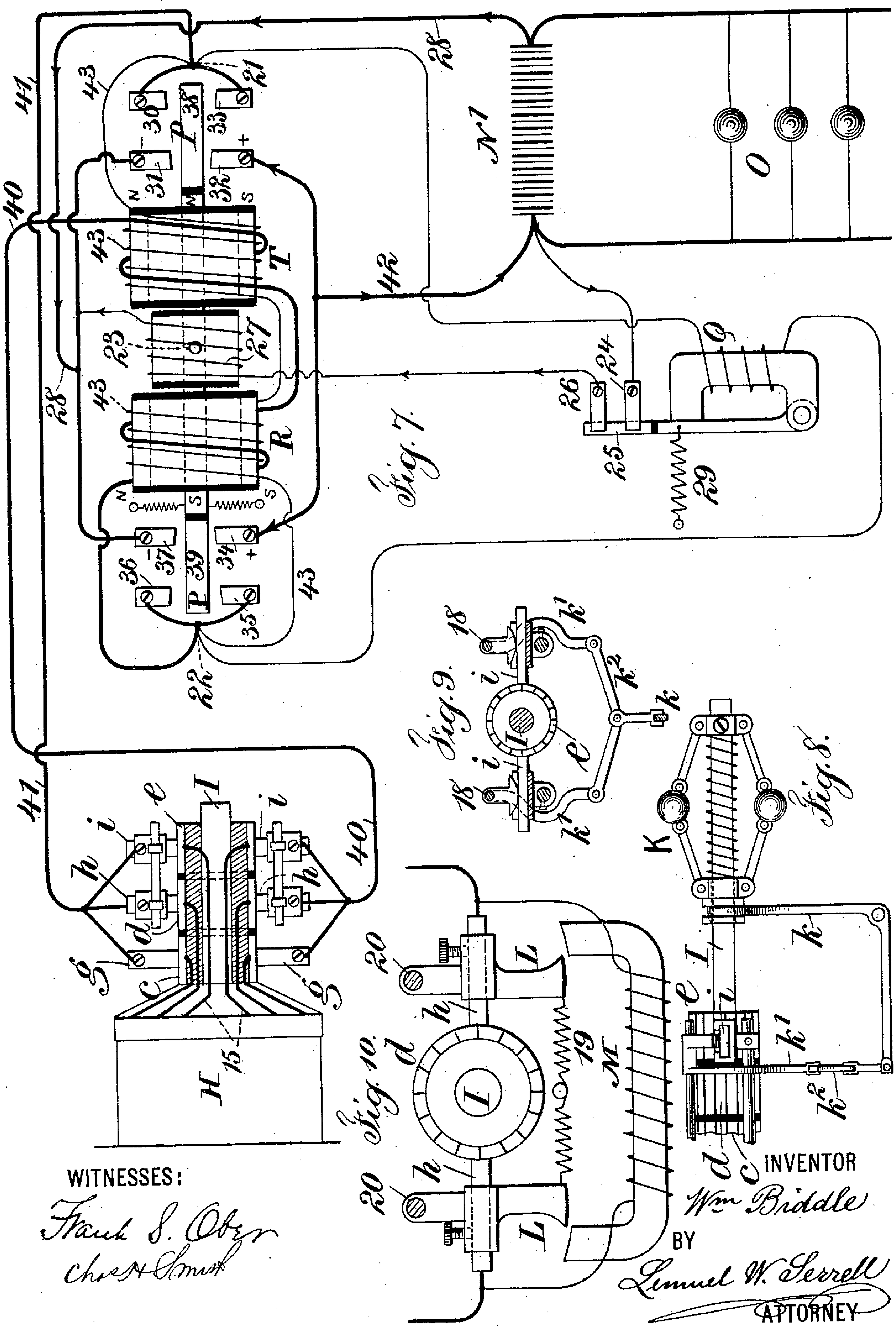

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