(No Model.) 2 Sheets—Sheet 1.

C. SELDEN.

ELECTRIC LIGHTING SYSTEM.

No. 480,375. Patented Aug. 9, 1892.

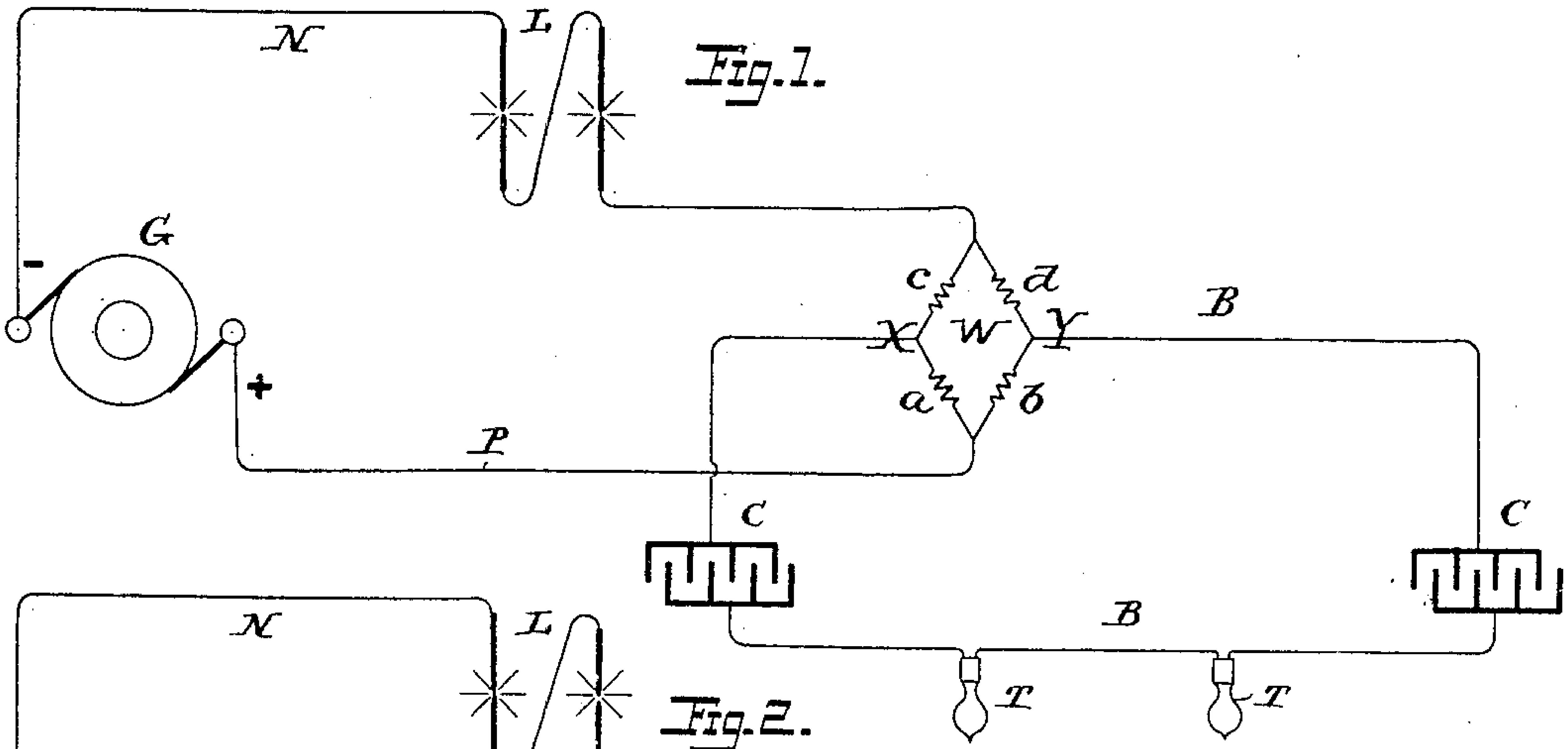

Fig. 1.

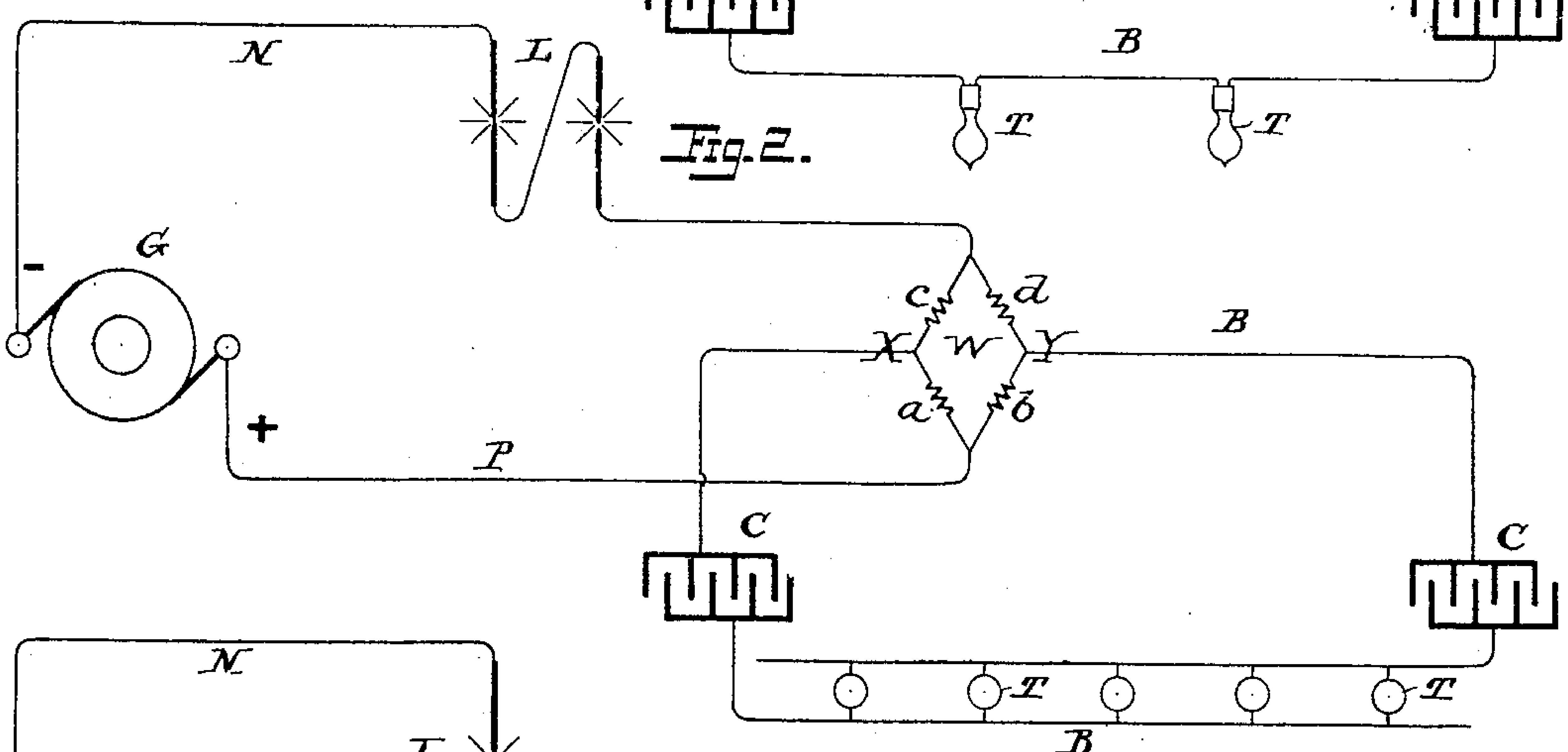

Fig. 2.

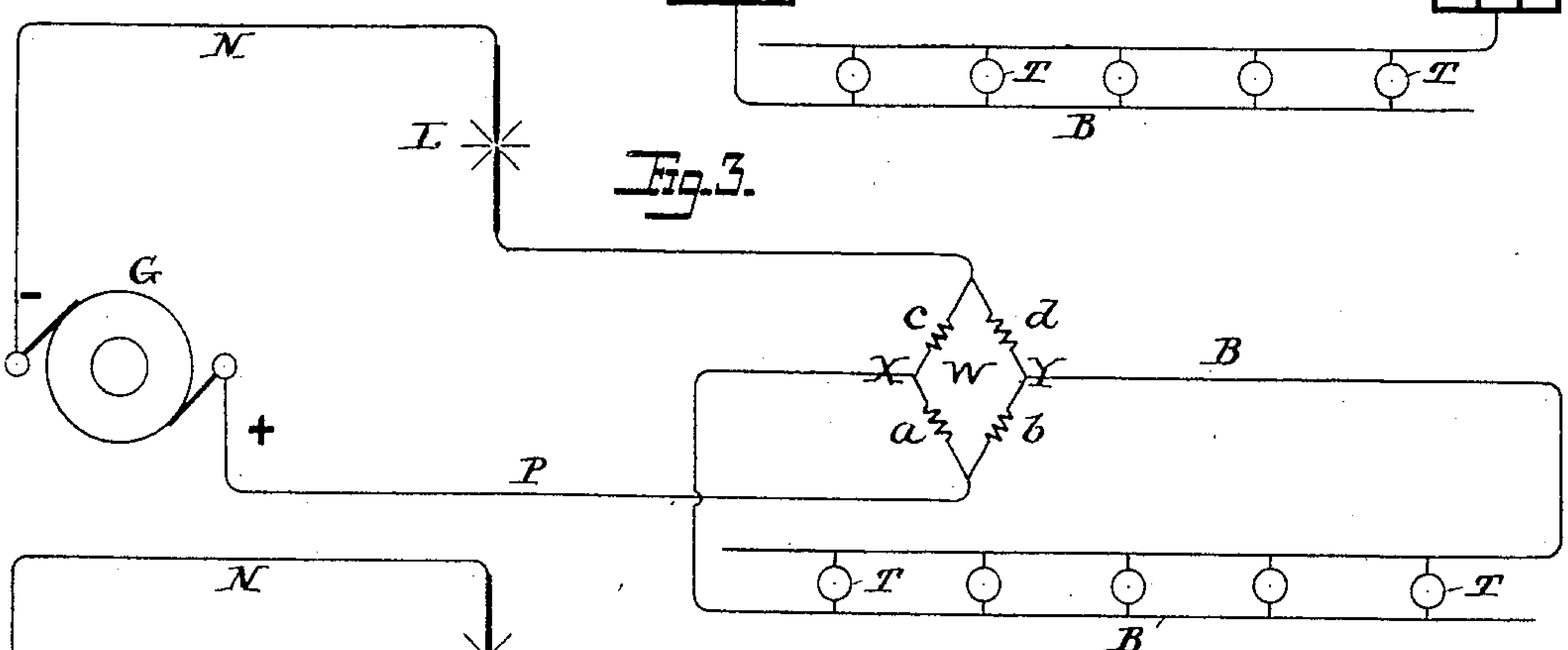

Fig. 3.

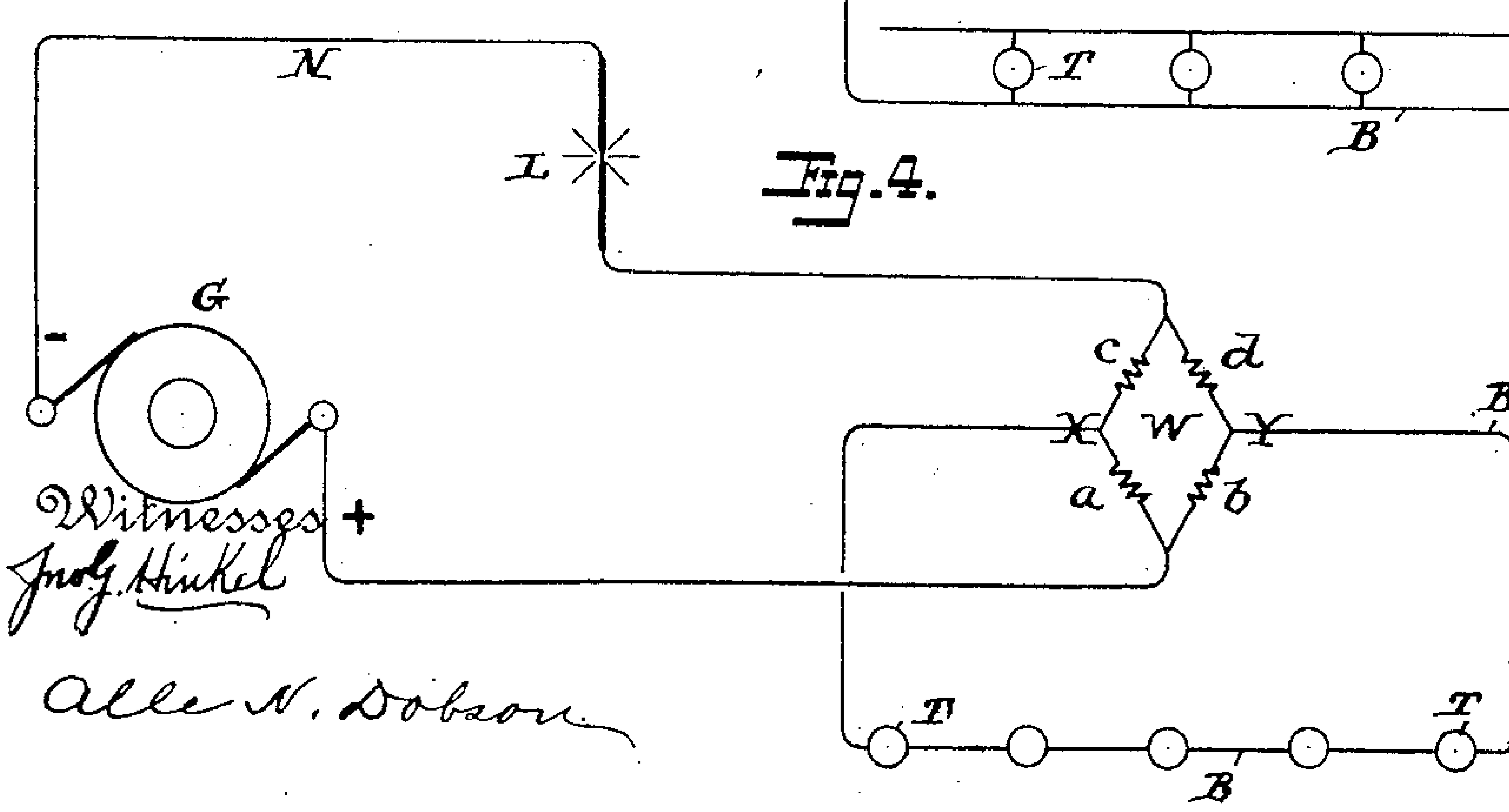

Fig. 4.

Witnesses
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(No Model.) 2 Sheets—Sheet 2.

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Fig. 5.

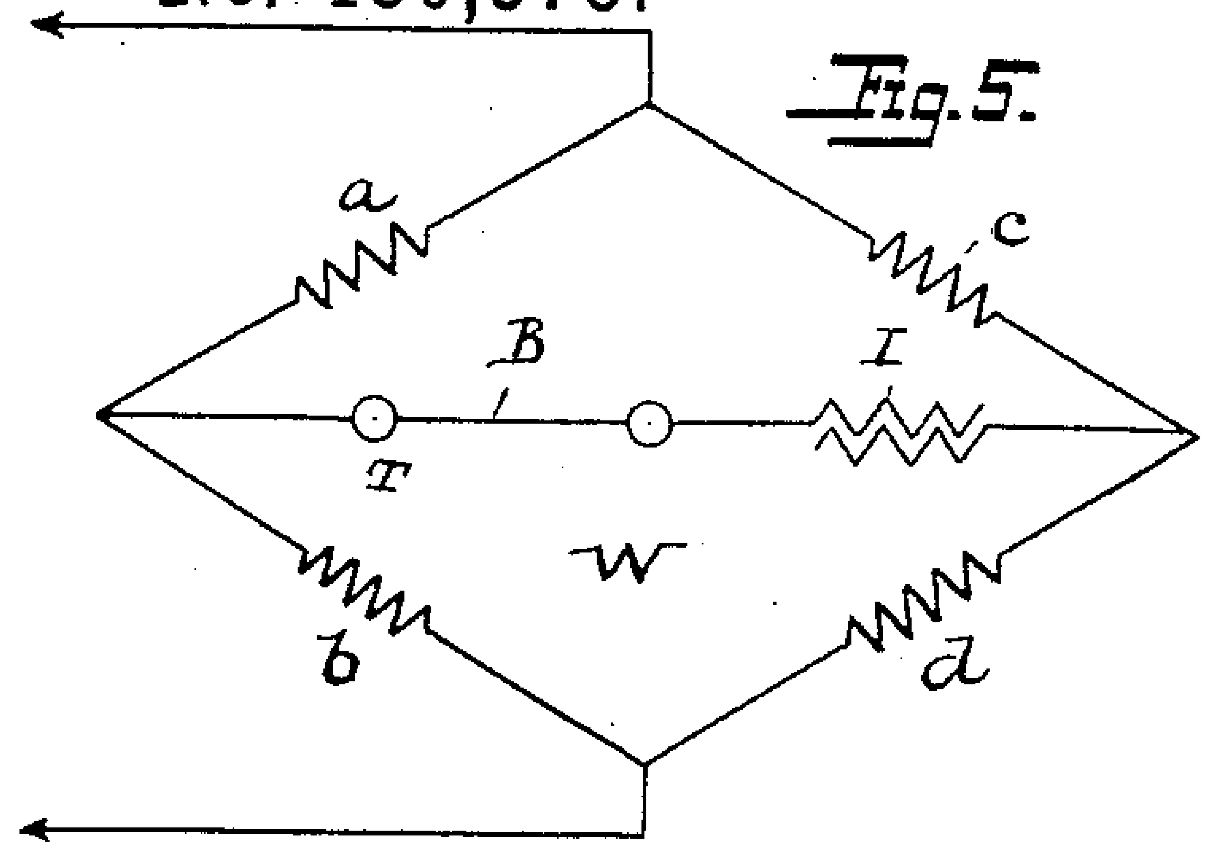


Fig. 6.

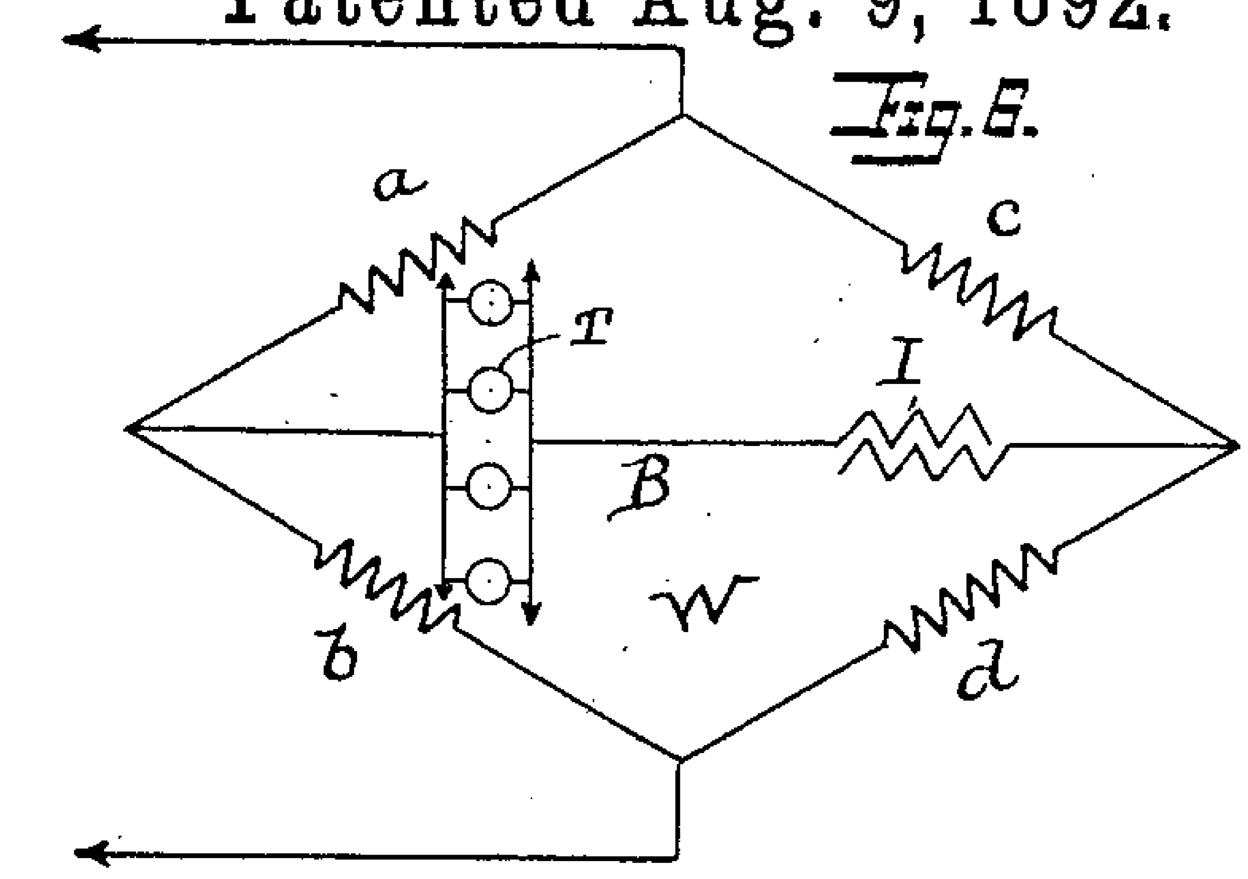


Fig. 7.

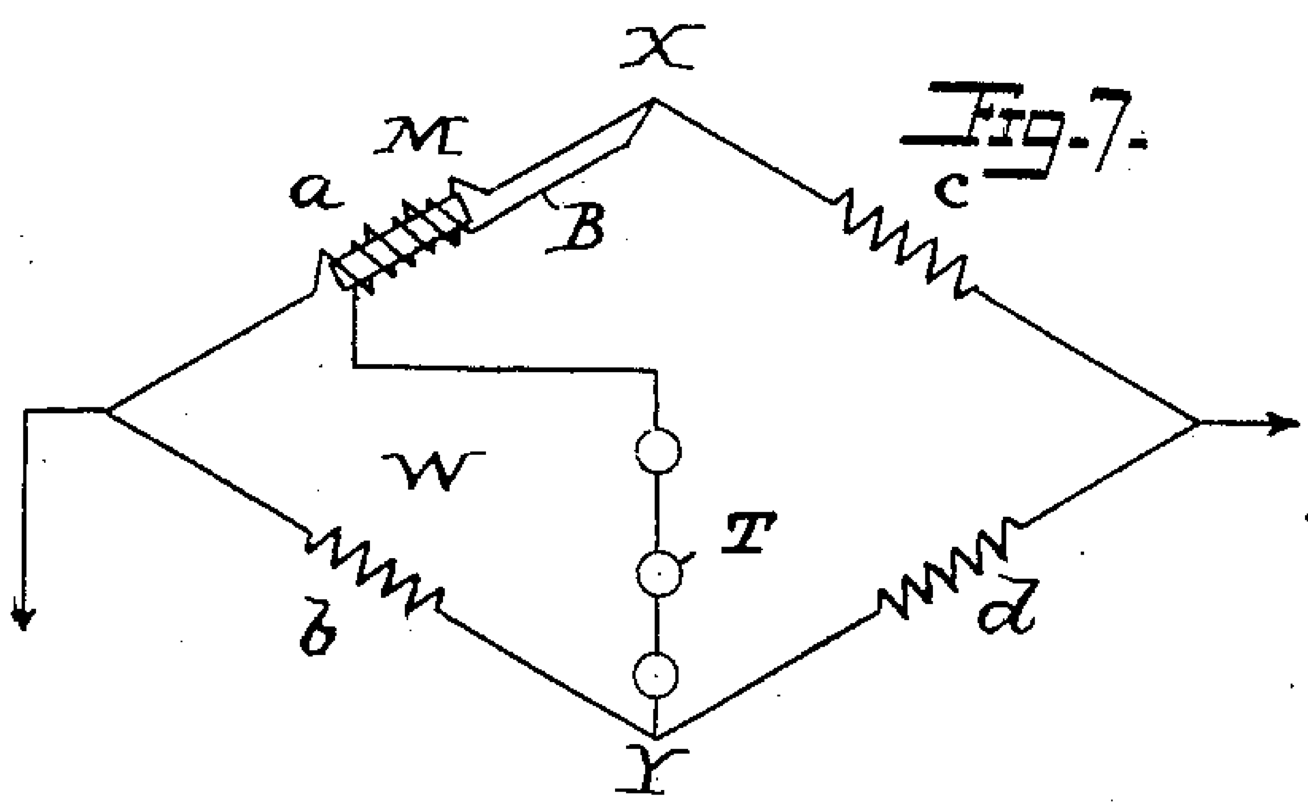


Fig. 9.

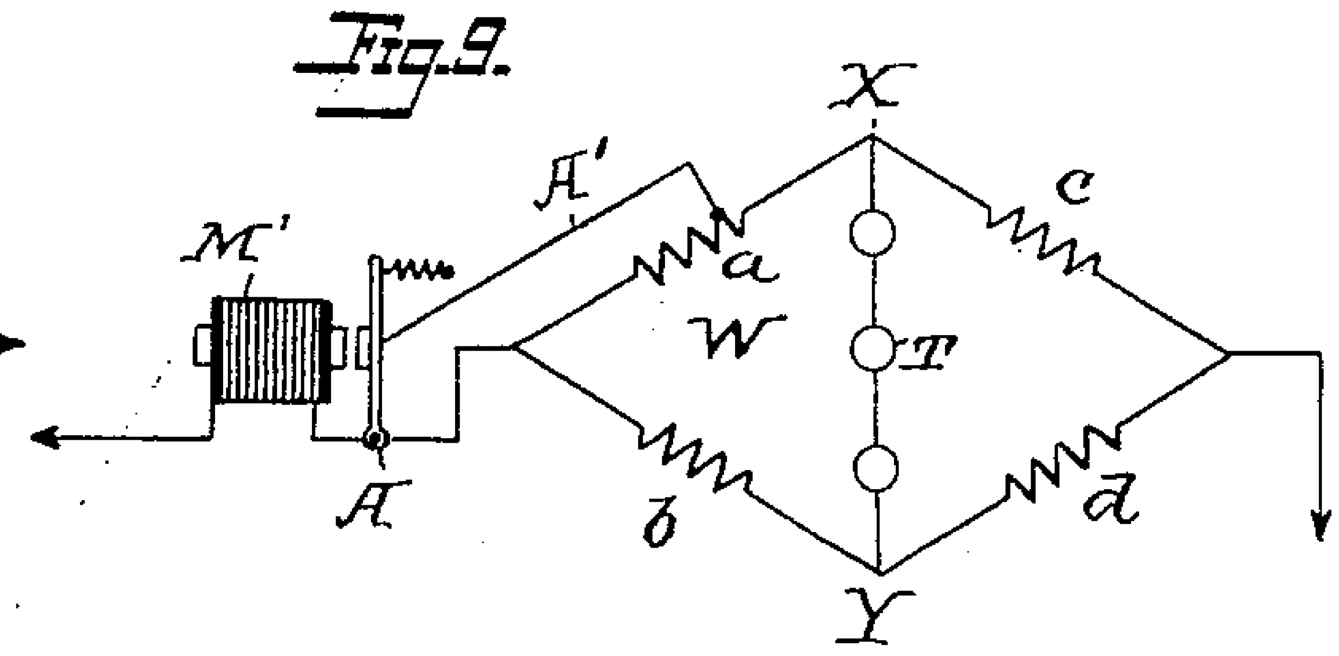


Fig. 8.

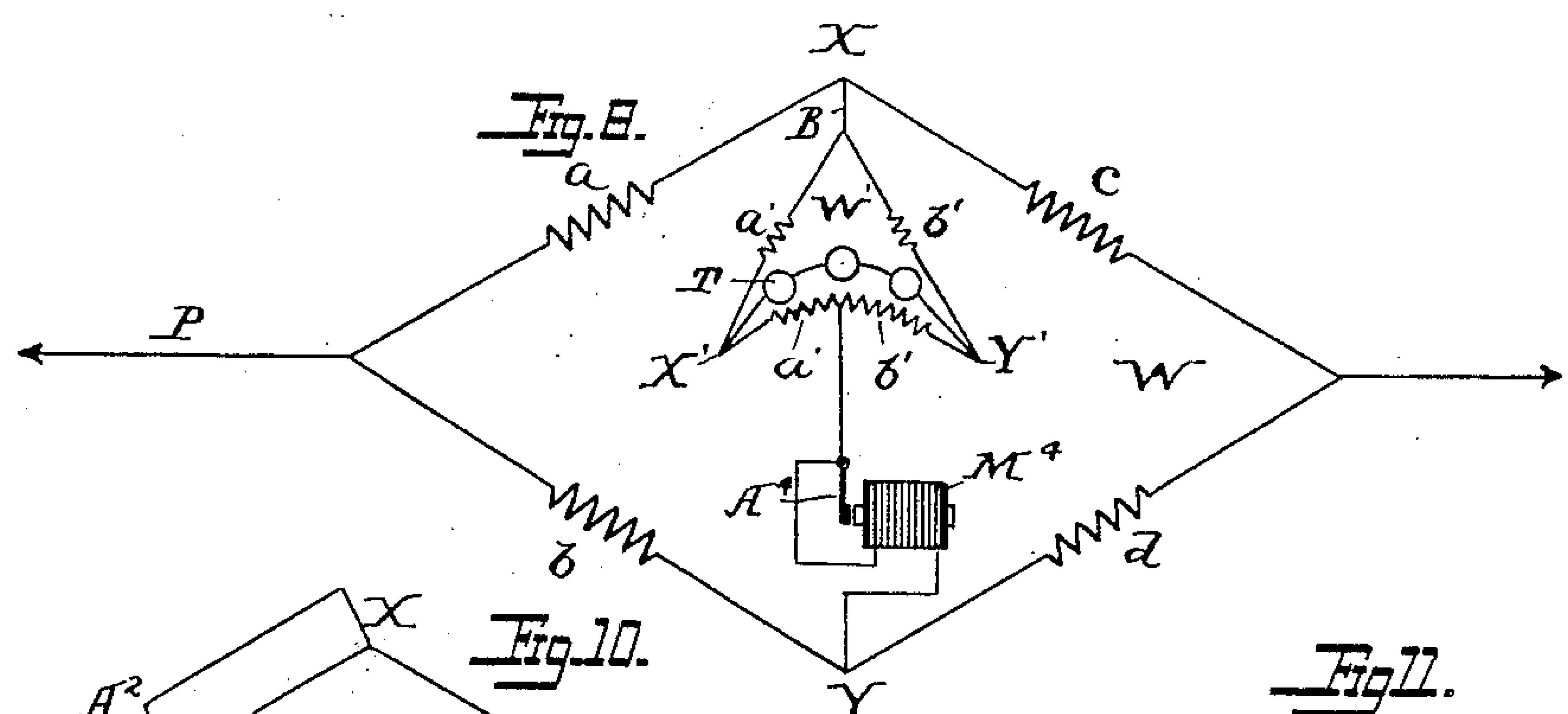


Fig. 10.

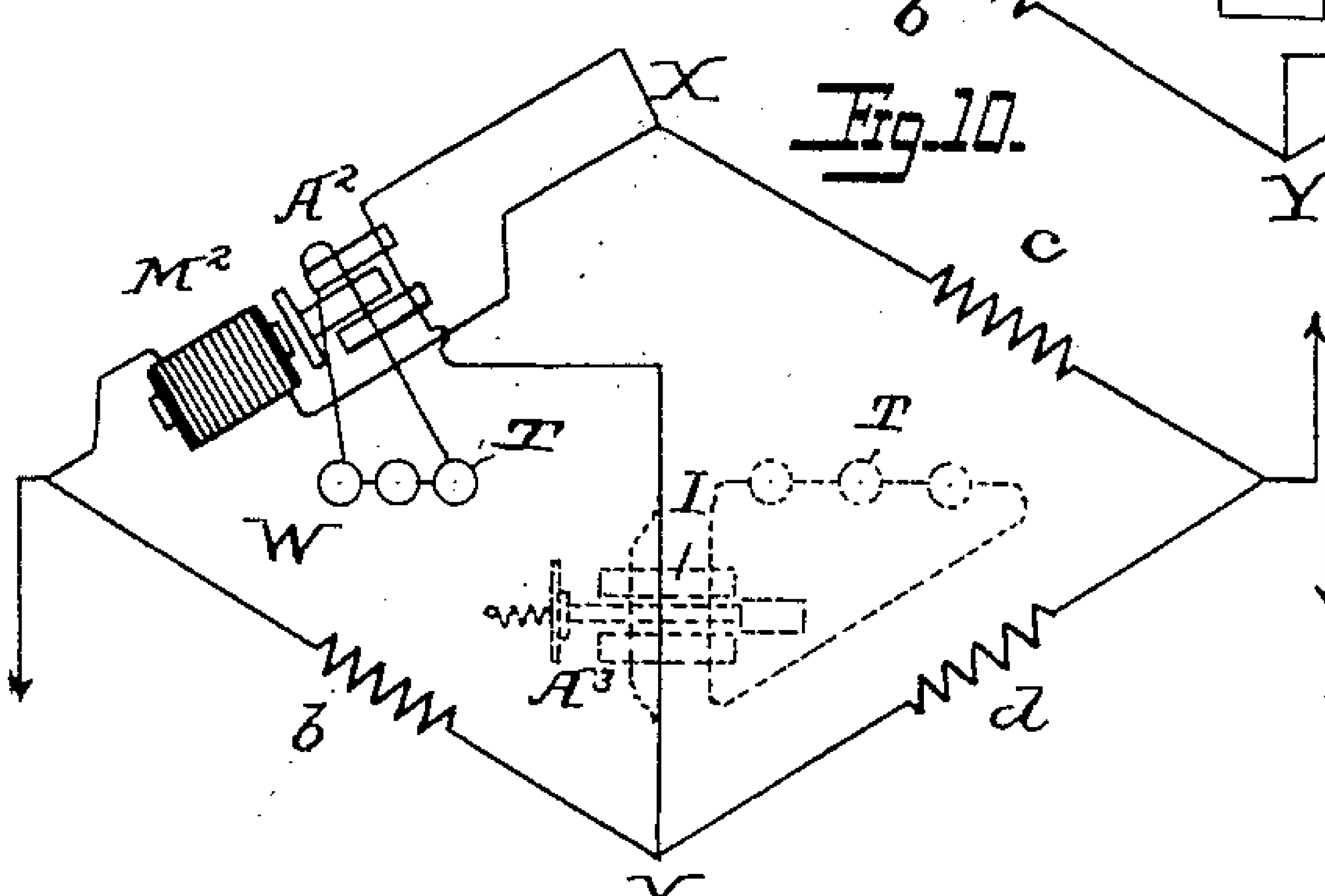
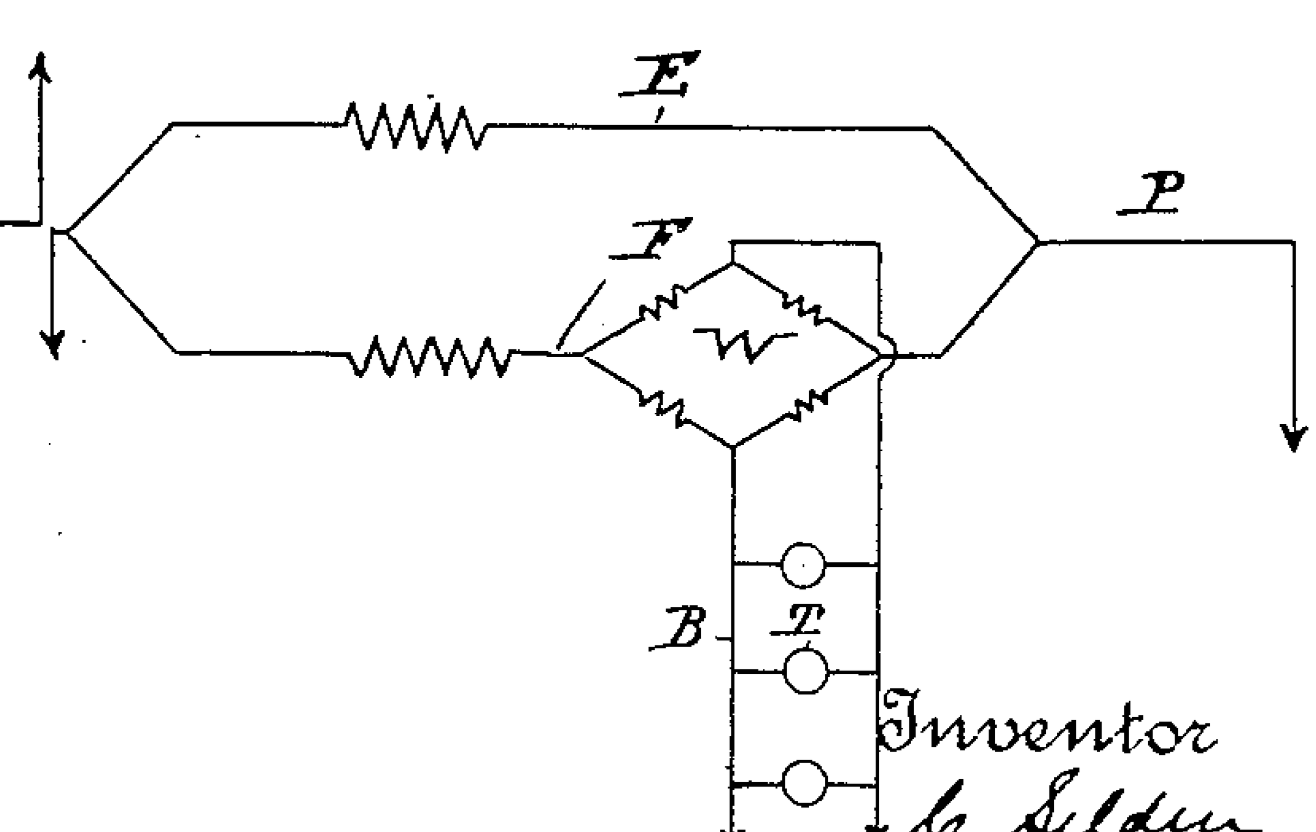


Fig. 11.



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UNITED STATES PATENT OFFICE.

CHARLES SELDEN, OF BALTIMORE, MARYLAND.

ELECTRIC-LIGHTING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 480,375, dated August 9, 1892.

Application filed April 9, 1892. Serial No. 428,480. (No model.)

To all whom it may concern:

Be it known that I, CHARLES SELDEN, a citizen of the United States, residing in Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Systems of Distribution, of which the following is a specification.

My invention relates to systems of electrical distribution, and more especially to that class in which a current of relatively high potential or voltage may be distributed in such a manner as to furnish a current of a reduced potential or voltage at any point or points along the main-line circuit, in order that translating devices of different characters or quantities may be used at different points or places, and a current having the proper potential may be delivered to said various translating devices, while the main current may be utilized for many various purposes, being all divided up into various branch circuits or being used generally as a whole with a branch or branches derived therefrom.

My invention is applicable to systems of distribution of the so-called "continuous" or "alternating" currents, and may be applied to systems using either kinds.

I am aware that heretofore it has been proposed to employ the so-called "converters," "condensers," "secondary coils," or other induction devices for accomplishing the same general objects in connection with alternating currents. In the use of inductive devices the current traversing the main-line circuit ordinarily charges one branch of the inductor, as the converter or the condenser and the other branch of the inductor receiving its current by induction furnishes to the branch circuit a current of lower voltage than the original or main-line current.

In carrying out my system of distribution I make use of the well-known principle of the Wheatstone bridge, by means of which, having a given potential in the main line, I can by proper adjustment of the various arms of the bridge deliver to a branch circuit, practically constituting the bridge-wire, just such a voltage as may be desired by creating a proper difference of potential in the branches of the bridge at the point of junction therewith of the bridge-wire, and I connect to this bridge-wire the translating devices in which the reduced current is utilized and arrange them in various ways, either in series or in multiple or combinations thereof.

By the use of my improved system of distribution I am enabled to avoid some of the well-known objections and difficulties arising from the ordinary systems, in that I avoid the counter action or disturbances due to self-induction generally observed in the use of converter or other inductive systems, and at the same time I use the current more economically. Moreover, in the ordinary converter system it is usual in practice to construct the converters so that they shall have a given and arbitrary capacity; but by the use of my invention one construction is all that is necessary, and by varying the resistance of the various arms of the bridge I can adjust the distributer for all desired purposes within the limits of the initial power.

Without attempting to recite all the advantages due to my improved system nor to describe all its various applications in detail, I will now proceed to set forth the general principles of my invention in such full, clear, and exact language as to enable those skilled in the art to understand and to be able to apply the same, and this without limiting myself to the details of the various forms and arrangements herein set forth, as it is evident that they can be varied to suit the requirements of any particular case without departing from the general principles of my invention.

Referring to the accompanying drawings, in which my invention is illustrated diagrammatically, Figure 1 shows a main circuit and a branch wherein the translating devices are placed in series and are operated by means of an inductive bridge-wire. Fig. 2 shows a similar arrangement with the translating devices in multiple. Fig. 3 shows a similar arrangement of translating devices in multiple with a non-inductive bridge-wire. Fig. 4 shows translating devices arranged in series with a similar bridge-wire. Figs. 5 and 6 show the translating devices, respectively, in series and multiple arc with an induction device in the bridge-wire. Fig. 7 shows an arrangement of circuits wherein the bridge-wire and one arm of the bridge are arranged in peculiar relation to each other. Fig. 8 represents an extension of my invention into what I term the "compound bridge." Figs. 9 and 10 show arrangements with inductive devices in the circuits, and Fig. 11 shows a divided circuit with the bridge arranged in one of the divisions of the circuit.

In the drawings, G represents an electric generating or distributing station, and P N the main-line wires or conductors leading therefrom, and L represents translating devices included in the main circuit—such, for instance, as arc-lamps, motors, or the like—two being shown in the present instance to illustrate my invention. These translating devices in the main circuit are shown as arranged in series, while also arranged in the main circuit is a Wheatstone bridge W. This bridge, as is usual, of course is composed of four arms *a b c d* and a bridge-wire B.

It is well understood that on the interposition of a Wheatstone bridge in an electric current a portion of the current passes through two arms of the bridge, as *a c*, and the other portion through the two arms, as *b* and *d*, and the current passing through these arms depends upon the relative resistance of the two branches. If the resistance of the two branches of the bridge is equal, of course the current is divided equally between the branches; but if the resistance of the two branches varies more or less, current will flow through the branches in accordance with well-known laws, and at the points X Y of the bridge there will be a difference of potential, depending upon the relative relations of the resistance in the two branches of the bridge, This fact is taken advantage of in the ordinary use of the Wheatstone bridge in measuring resistances, and a galvanometer or other indicating device is usually placed in the bridge-wire B. I take advantage of this well-known condition and use the bridge-wire as my derived circuit, in which I include the translating devices, which are to be operated under a current of less potential than that in the main circuit. Thus, for instance, assuming that the main circuit P and N carries a current of two thousand volts and it is desired to utilize in the branch circuit a current of one hundred volts, it is evident that by properly proportioning the resistance in the branches of the bridge a difference of potential is established at the point X and Y of one hundred volts, and by connecting the bridge-wire to these points and including the translating devices in the bridge-wire these translating devices will receive the proper and desired amount of current. It is not necessary for me to explain in detail the exact amount of resistance necessary to place in any one or more of the arms of the bridge in order to produce this desired effect. I find, also, in practice that by the interposition of comparatively small resistances it can be used so that there is little or no practical waste of current passing through the bridge, and by using small resistances I avoid not only the waste of current, but the danger of the resistances becoming heated and other well-known defects. In some instances, however, I find it advantageous to use a comparatively high resistance in the various branches of the bridge—as, for instance, when there is liability to be considerable variation in the potential of the main-line system. For instance, if there the but slight difference in the resistance of was branches a variation of ten per cent. in the current flowing through the branches of the bridge would make a considerable change in the current flowing through the bridge-wire B, causing the lamps or other translating devices included in the bridge-wire to vary, and if, for instance, these translating devices were incandescent lamps, the light would flicker or waver or be unpleasant to the eye. This can be better illustrated in assuming that the resistance in the arms *a* and *b* were respectively 1 and 2 and the bridge-wire was receiving a current, say, of one hundred volts, and there should be a considerable variation in the main-line current, this would be more apparent in its effects in a bridge-wire than if the resistance in the arms *a b*, for instance, were respectively one hundred and two hundred. This, however, would result in employing a comparatively high resistance in the branches of the bridge, which, as before stated, is objectionable; and in order to avoid these difficulties, as well as for other reasons, I make what I term a "double bridge," (shown more particularly in Fig. 8,) in which a bridge W′ is interposed in the bridge-wire B of the bridge W, which is in the main-line wire of the system. In this arrangement I can use comparatively small resistances in the main bridge W and produce the desired difference of potential at the points X and Y, and even if these points should be subject to a considerable change the second bridge W′ would compensate largely therefor, and the translating devices arranged in the bridge-wire B′ of this bridge would be but slightly affected by this change, and especially would this be so when, for instance, I use a comparatively high resistance in the arms *a′ b′ c′ d′* of the second bridge. Moreover, it will be seen that this comparatively high resistance in the second bridge does not in any way interfere with the current of the main circuit, and the resistance is not subject to the danger of heating, as when placed in the main bridge.

Referring again to Fig. 1, I have shown the bridge-wire B as including inducting devices in the form of a condenser C, which may be used with an alternating current, while the translating devices T T are represented as incandescent lamps arranged in series in the bridge-wire. It will thus be seen that with this arrangement there is no direct electrical connection between the translating devices and the main circuit.

In Fig. 2 I have shown substantially the same arrangement, except that the translating devices T T are arranged in multiple arc in the bridge-wire B, the translating devices being between the condensers C C on one side, while the terminals of the bridge-wire are connected at the points X and Y of the bridge W, as before.

In Figs. 3 and 4 I have shown substantially the same arrangement of circuits, except that instead of interposing the inductive devices, as before, the translating devices are connected, respectively, in multiple arc and in series in the non-inductive bridge-wire B, which may be used with a direct current.

In Figs. 5 and 6, respectively, I have shown the translating devices arranged in the bridge-wire B in series and multiple arc, together with an induction device in the form of a coil I, also connected to the bridge-wire. This arrangement involves no new principle of operation, but simply is another way of carrying out my invention, it being understood that the other circuits are substantially as before described.

In Fig. 7 I have illustrated another modified arrangement of the bridge-wire, in which one of the arms, as a, of the bridge, together with the bridge-wire B, are brought together and wound to form the coils of the magnet M, which may be used as the resistance device in the bridge-arm, and the potential may be increased or decreased by cutting out or shunting a portion of the bridge-wire, or by so adjusting the resistances in the two branches of the bridge as to change the direction of the current through the bridge-wire, so that I can partially neutralize the current flowing through the arm a, or, on the other hand, may tend to increase the current flowing therethrough.

In Figs. 9 and 10 I have illustrated, diagrammatically, an extension of my invention in which, for instance in Fig. 9, a magnet M′ is arranged in the main circuit, the armature A of which is provided with an extension A′, bearing upon the resistance device a in one of the arms of the bridge, and it will be seen that by this arrangement the resistance in the branch of the bridge, including this arm, may be varied automatically according to the variations of the current in the main line through the medium of the magnet, its armature and connecting-arm, this arm and armature forming, as it were, a short circuit between the main-line wire and a portion of the resistance a. Thus if, for instance, there was a current of two thousand volts in the main line and a difference of potential between the points X and Y of the bridge of one hundred volts, and for some reason or other the potential of the main current should decrease considerably, the armature of the magnet M′ would operate to change the resistance of the arm a of the bridge, so as to practically maintain the proper difference of potential between the points X and Y.

In Fig. 10 I have shown still another application of my system of distribution, in which the translating devices of the branch circuit are arranged in a secondary circuit of an inductive device, the bridge-wire B forming the primary circuit of the transformer.

I have further shown a magnet M^2, arranged in one of the arms of the bridge, which may form the resistance therein, and an armature A^2 is arranged to be operated by this magnet and to automatically vary the inductive relation of the two branches of the converters or transformers, so as to maintain a substantially even current in the translating devices in the secondary thereof. In the same figure in dotted lines I have shown another embodiment of this idea, in which the bridge-wire B forms a primary of the inductorium I and the translating devices are in the secondary thereof, while the armature A^3 is connected with a core, which is automatically varied by the current of the bridge-wire to regulate the inductive capacity of the inductorium and to maintain the current in the translating device T substantially uniform. This same general principle of regulation can readily be applied to the compound bridge shown in Fig. 8, in which the magnet M^4 is arranged in the bridge-wire, while the armature A^4 is shown as pivoted and having an extended arm which will move over the resistance $a' b'$ of the secondary bridge and automatically vary the current flowing through the two branches of the secondary bridge, so as to maintain the desired difference of potential between the points X′ Y′ to supply the translating devices T with a uniform current and to compensate for variations of potential in the main line and the bridge-wire B, connecting the points X and Y thereof.

In Fig. 11 I have shown another application of my invention, in which the main line is divided into two branches E and F, in one branch of which, as in F, is interposed the Wheatstone bridge W, and connected to the bridge-wire B thereof are the translating devices T, (shown in the present instance as arranged in multiple arc;) but it will be evident that any other modification of my invention may be readily applied to the main circuit in this way, and, if desired, there may be a bridge in both branches of the main circuit and the resistances so proportioned as to supply currents of different strength to the different translating devices.

From the above description it will be evident to those skilled in the art that my invention is capable of many and varied uses and applications all involving the same general principles, broadly considered, and I do not deem it necessary to further explain or illustrate them, as it is evident that my invention is not limited to the details of construction and arrangement above set forth.

What I claim is—

1. In a system of electrical distribution, the combination, with the main-line wire, of a

Wheatstone bridge interposed in said main-line wire arranged to supply a definite current to the translating devices connected in the bridge-wire thereof, substantially as described.

2. In a system of electrical distribution, the combination, with the main-line wire, of a Wheatstone bridge interposed therein and translating devices connected in the bridge-wire, the resistances of the various arms of the bridge being so proportioned as to furnish the desired current to the translating devices in the bridge-wire, substantially as described.

3. In a system of electrical distribution, the combination, with the main-line wire, of a Wheatstone bridge connected thereto arranged to supply a definite current to the bridge-wire, translating devices arranged in said bridge-wire, and inductive devices interposed between the translating devices and the terminals of the bridge-wire, substantially as described.

4. In a system of electrical distribution, the combination, with the main-line wire carrying currents of high potential and translating devices connected to said main-line wire, of a Wheatstone bridge connected to said main wire and arranged to supply the bridge-wire thereof with an inductive current of lower potential and translating devices arranged in said bridge-wire, substantially as described.

5. In a system of electrical distribution, the combination, with the main-line wire, of a Wheatstone bridge interposed in said main-line wire arranged to supply current to the bridge-wire thereof, and a second bridge connected in said first bridge-wire, and translating devices connected to the second bridge-wire, substantially as described.

6. In a system of electrical distribution, the combination, with the main-line wire, of a Wheatstone bridge interposed therein and arranged to supply current to the translating devices in the bridge-wire, and automatic means controlled by the current arranged to vary the relative resistances of the bridge to compensate for changes of potential in the main-line circuit, substantially as described.

7. In a system of electrical distribution, the combination, with the main-line wire, of a Wheatstone bridge interposed in said main-line wire and arranged to supply current in the bridge-wire containing the translating devices, of an electro-magnet connected in the circuit and arranged to automatically compensate for variations of changes of potential in said circuit, substantially as described.

8. In a system of electrical distribution, the combination, with the main-line wire, of a Wheatstone bridge interposed therein, a second bridge interposed in the bridge-wire of the first bridge, and electro-magnetic devices arranged to automatically vary the resistances of the branches of said second bridge to compensate for variations in the potential of the current, substantially as described.

9. In a system of electrical distribution, the combination, with the main-line wire divided into branches, of a Wheatstone bridge interposed in one of said branches and arranged to supply current to the bridge-wire containing the translating devices, substantially as described.

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

CHARLES SELDEN.

Witnesses:
CHARLES SELDEN, Jr.,
F. L. FREEMAN.