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TRANSMISSION MEASURING SYSTEM

Filed Nov. 19, 1926

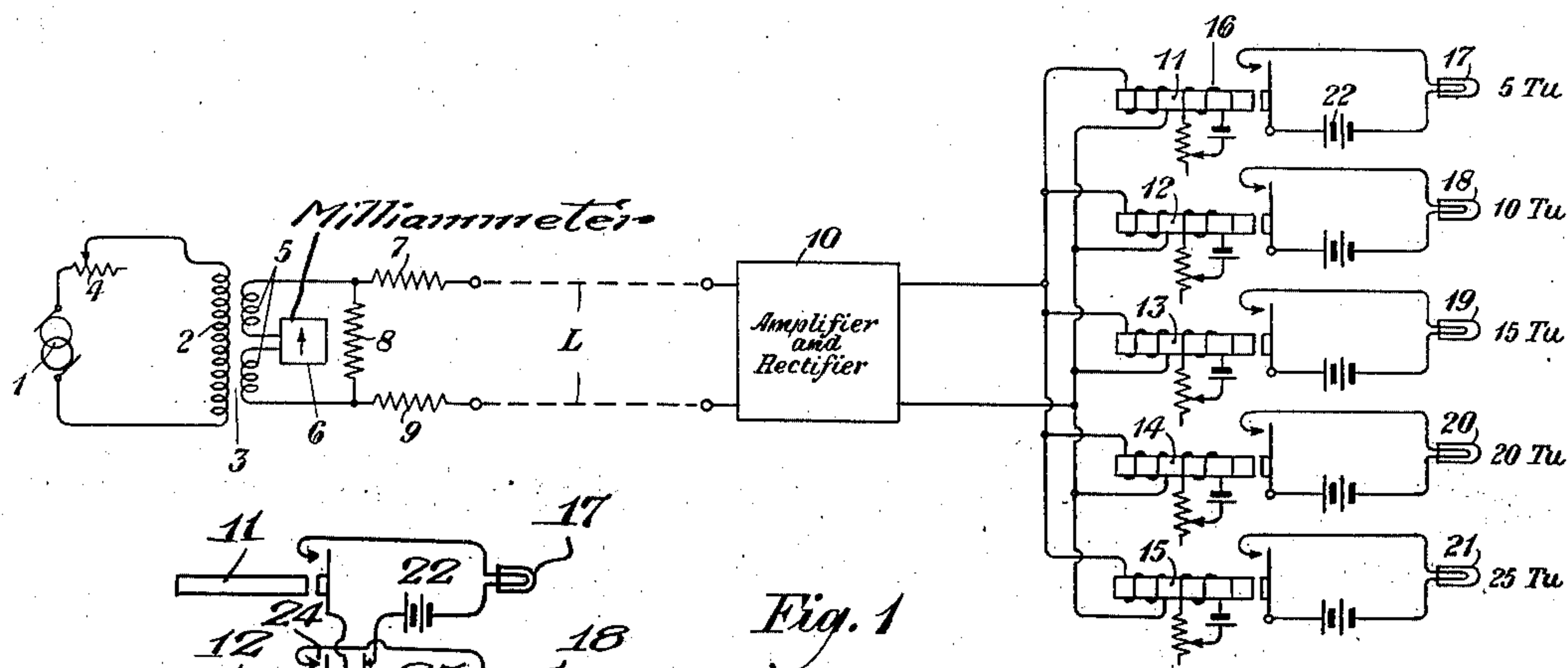


Fig. 1

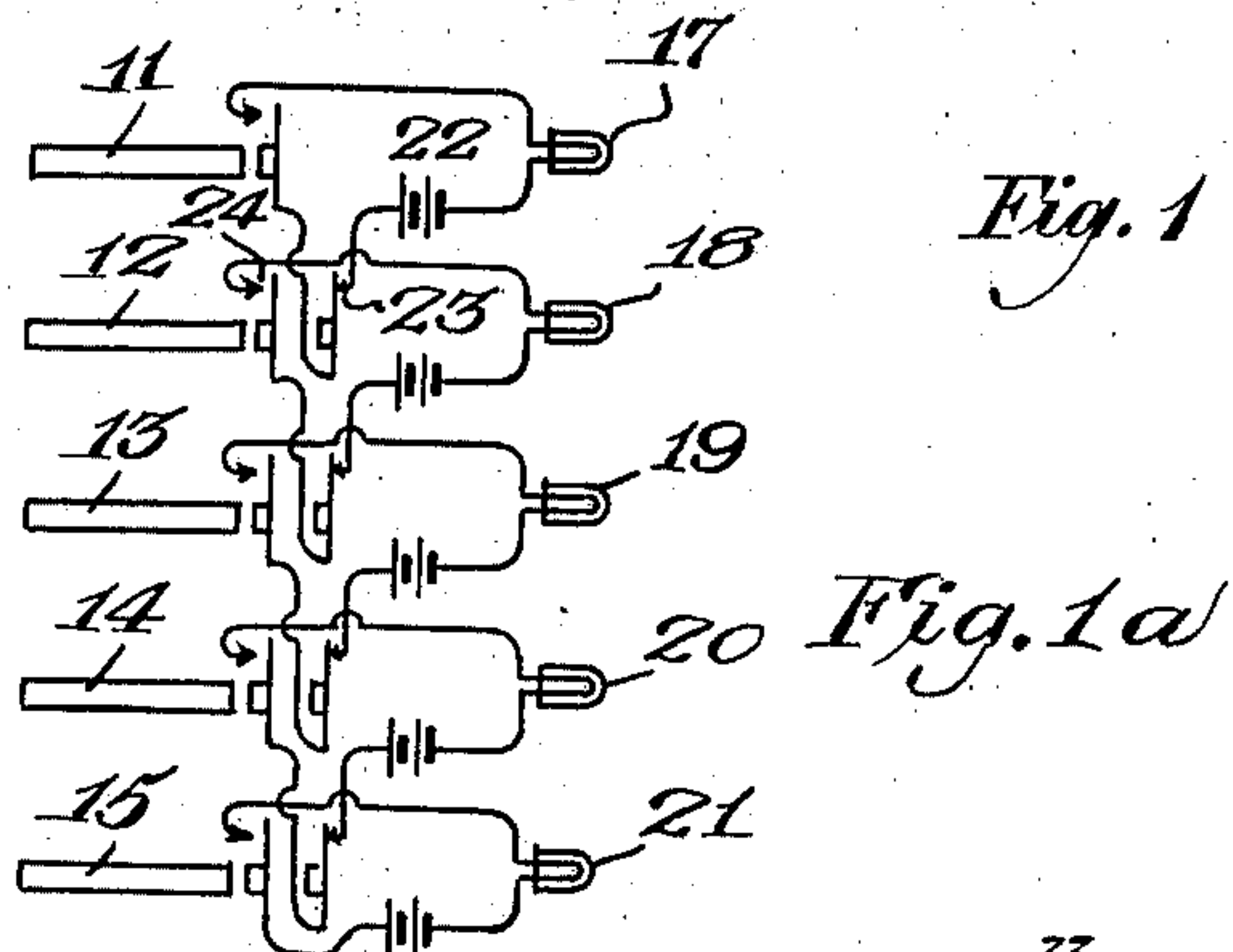


Fig. 1a

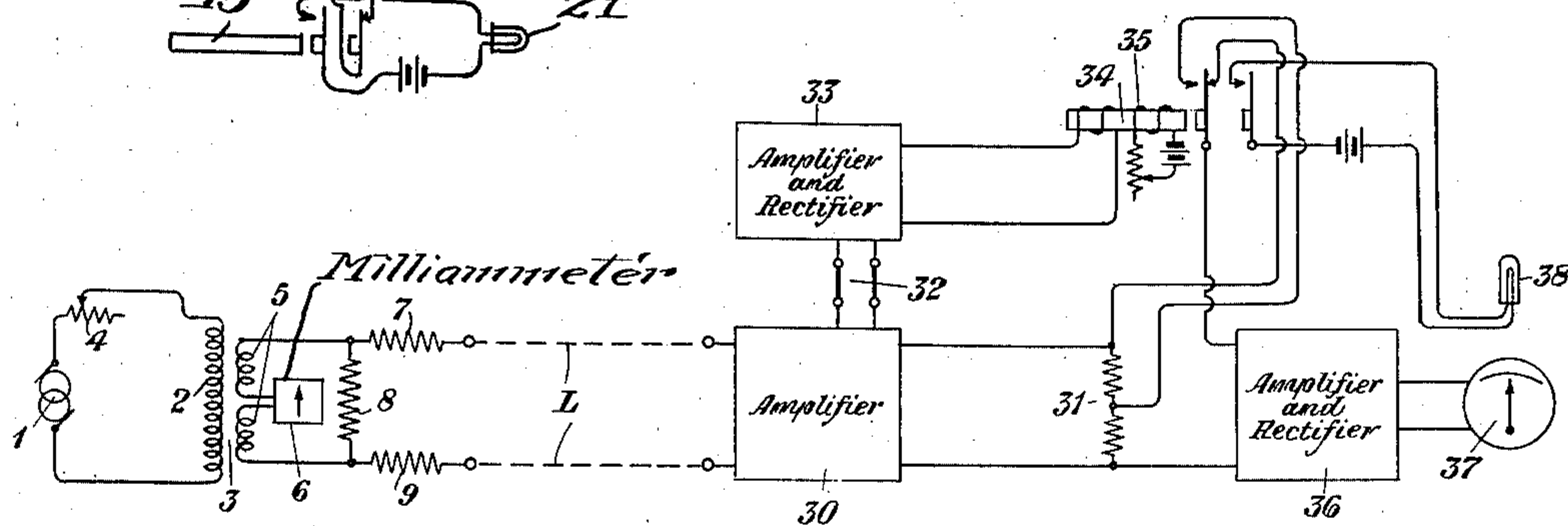


Fig. 2

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TRANSMISSION-MEASURING SYSTEM

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This invention relates to transmission measuring systems, and particularly to means for automatically indicating the transmission equivalent of a circuit over which signaling currents are transmitted.

In transmission measuring systems of the prior art, it requires a relatively long period of time for the operation of the apparatus at the receiving end of the transmission line to indicate or register the transmission equivalent of the line at the frequency of the signal being transmitted thereover. This time limitation is a matter of considerable importance, inasmuch as the circuit is out of commercial service while such measurements are being made. It is therefore highly desirable to be able to determine the transmission equivalent of a communication circuit substantially instantaneously.

This invention resides in a method and means for indicating or recording substantially instantaneously the transmission equivalent of a circuit.

Other objects of this invention will be apparent from the following description when read in connection with the attached drawing, of which Figure 1 shows schematically a form of the invention in which the transmission equivalent is indicated by means of signal lamps; Fig. 1^a is a modification of Fig. 1; and Fig. 2 shows a form employing a meter, the said figure also disclosing means whereby the range of the measuring device may be extended.

In Fig. 1, a source of oscillations 1 supplies the current to be transmitted over the line L for the determination of the equivalent of this line. This source is connected with the winding 2 of transformer 3 and also with a current limiting device 4, which may be of any desired form. The secondary 5 of this transformer has connected therewith a meter 6, by means of which the voltage applied to the network consisting of the resistances 7, 8 and 9, may be determined. The impedance of this network as viewed from the line is intended to substantially equal that of the line L which is bridged across the terminals of resistances 7 and 9. The distant end of the line is connected with an amplifier and

rectifier 10, the impedance of which as viewed from the line, being substantially equal to that of the line. The output of the rectifier is connected with the operating windings of a plurality of relays 11 to 15, inclusive. Each of these relays has a biasing winding, such as is indicated by 16 of relay 11. By means of the biasing windings, the relays may be made responsive to different values of line current. The armatures of the relays are connected with a source of potential and a signal lamp, such as 22 and 17, respectively, of relay 11.

The invention as disclosed in Fig. 1 will be clearly understood by a description of the manner in which the circuit, above described, operates. The oscillator 1 is set in operation, and the current limiting device 4 is varied until the voltage across the network 7—8—9, as indicated by the meter 6, is of a predetermined value. The voltage across the input of the amplifier 10 will, of course, depend upon the transmission characteristics of the line L. If they are good, the voltage will be high, and, if poor, the voltage will be low. This voltage will be amplified and detected and applied to the operating windings of relays 11 to 15 in parallel. Assuming that the transmission equivalent of the line is equal to 15 TU, (transmission units), the voltage applied to the amplifier 10 will be such that relays 11, 12 and 13 will operate, thereby causing lamps 17, 18 and 19 to be lighted. If the equivalent were between 15 and 20 TU (but not including 20) the same lamps 17 to 19, inclusive, would be lighted. This would indicate to the operator or other attendant making these transmission measurements, that the equivalent of the line was at least as low as 15 TU. It is, of course, possible to adjust the relays so that smaller units, such as 1 TU or a fraction of a TU, could be measured, if desired. In like manner, it is possible to arrange the circuits of the armatures of the relays so that the lighting of one lamp will extinguish the preceding one, so that, at any instant, only one lamp would be lighted, namely, that closest in proximity to the transmission equivalent of the circuit. Such an

arrangement is shown in Fig. 1^a which represents the relays and lamp circuits of Fig. 1 modified to extinguish all lamps except that one that indicates the transmission equivalent. In Fig. 1, the lamp circuit of relay 11 is normally completed through the contact 23 of relay 12. When the transmitted current is sufficiently large to operate relay 12, it opens contact 23, extinguishing lamp 17 and simultaneously closes contact 24, thus lighting lamp 18. As will be seen, each lamp circuit, except that connected with relay 15 is completed through a contact of the succeeding relay.

In the arrangement shown in Fig. 2, in which the same numbers have been used to represent parts similar to those shown in Fig. 1, the oscillator 1 supplies current for transmission over the line L, the transmission equivalent of which is to be determined. This line is connected with an amplifier 30; the output of which is connected across the potentiometer 31 and also by means of the branch circuit 32 with an amplifier and rectifier 33. The output of the amplifier-rectifier 33 is connected with the winding of the relay 34 which is biased by means of the winding 35. This relay controls the connection of the potentiometer 31 with the amplifier and rectifier 36, the output of which is connected with an indicating or recording device 37. The relay 34 also controls the operation of the signal lamp 38, the purpose of which will be clear from subsequent description.

The function of the amplifier and rectifier 33, together with the switching apparatus connected therewith, is to extend the range of the scale of the device 37. Let it be assumed that this scale has a range capable of indicating clearly ten transmission units. For reasons which will be clear from subsequent description, the scale will be marked and subdivided between 10 and 20 TU. When a predetermined voltage is impressed across the network 7—8—9, a voltage will be applied to the amplifier 30, whose value depends upon the transmission equivalent of the line L. This voltage, when amplified, will be applied across the potentiometer 31 and also by means of the branch circuit 32, to the amplifier-rectifier 33. Assuming that the transmission equivalent is relatively low, for example, of the order of 5 to 10 TU, the voltage applied to the amplifier 30, and also to the amplifier-rectifier 33, will be fairly large, that is to say, sufficient to operate the relay 34. This relay will attract its armatures, and through its left-hand armature, it will connect the input of the amplifier-rectifier 36 with the midpoint or a predetermined point other than the extremities of the potentiometer 31, which will reduce to a predetermined degree the voltage applied by the amplifier 30 to the amplifier-rectifier 36. This

reduction will be sufficient to bring the current in the output of 36 within the limitations of the scale of the indicating device 37 which, as stated, covers the range between 10 and 20 TU. The right-hand armature of relay 34 will close the circuit through the lamp 38 and cause it to light, thus indicating to the operator or other attendant who is making these measurements, that the transmission equivalent indicated by the scale reading of the indicating device is higher by the predetermined amount, 10 TU, than the equivalent actually is. If, on the other hand, the transmission equivalent of the line L is between 10 and 20 TU, the voltage across the amplifier 30 will be relatively low, so that when amplified and impressed upon the circuit 32 and substantially modified therein, it will not be sufficiently large to operate relay 34. Consequently, the output of amplifier 30 will be applied directly to the input of the amplifier-rectifier 36. The output of this amplifier will be within the limits of the scale, that is, between 10 and 20 TU, and the reading of the scale of the device 37 will be a direct indication of the transmission equivalent of the line L.

While the invention has been disclosed as embodied in the particular form shown, it is obviously capable of embodiment in other forms, without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a transmission measuring system, the combination with a source of alternating current of fixed magnitude, of a transmission circuit connected with said source capable of attenuating the voltage applied to the circuit by the said source, means connected with the said circuit to indicate substantially instantaneously the equivalent of the circuit in transmission units of a predetermined standard, and means automatically responsive to the received voltage to effectively extend the range of the said indicating device.

2. In a transmission equivalent indicating system the combination with a transmission circuit over which a voltage wave of predetermined magnitude is transmitted of an indicating circuit connected with the said transmission circuit and having an indicating device, and means automatically responsive to the received voltage to cut down the voltage applied to the said device whenever the transmission equivalent of the said transmission circuit is greater than a predetermined amount.

3. In a transmission equivalent indicating system the combination with a transmission circuit over which a voltage wave of predetermined magnitude is transmitted of an indicating circuit connected with the said transmission circuit and having means to amplify to a known degree the received voltage, means to indicate directly the voltage as amplified when the said voltage does not exceed a fixed

limit, and means automatically responsive to the received voltage to cut down to a known extent the voltage applied to the said indicating means when the amplified voltage exceeds the limit of direct measurement of the
5 indicating means.

4. In a transmission equivalent indicating system the combination with a transmission circuit over which a voltage wave of predetermined magnitude is transmitted of an indicating circuit connected with the said transmission circuit and having an amplifier to amplify the received voltage, a rectifier connected with the said amplifier, an indicating
10 device connected with the said rectifier, a potentiometer connected between the said amplifier and rectifier, normally adjusted to apply the full voltage of the amplifier to the rectifier, and means connected with the said
15 amplifier and said potentiometer and automatically responsive to the received voltage to reduce to a known extent the voltage applied to the said rectifier whenever the input voltage of the said amplifier exceeds a predetermined limit.
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In testimony whereof, I have signed my name to this specification this 17th day of November, 1926.

FRED H. BEST.

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