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A. J. FINN ET AL

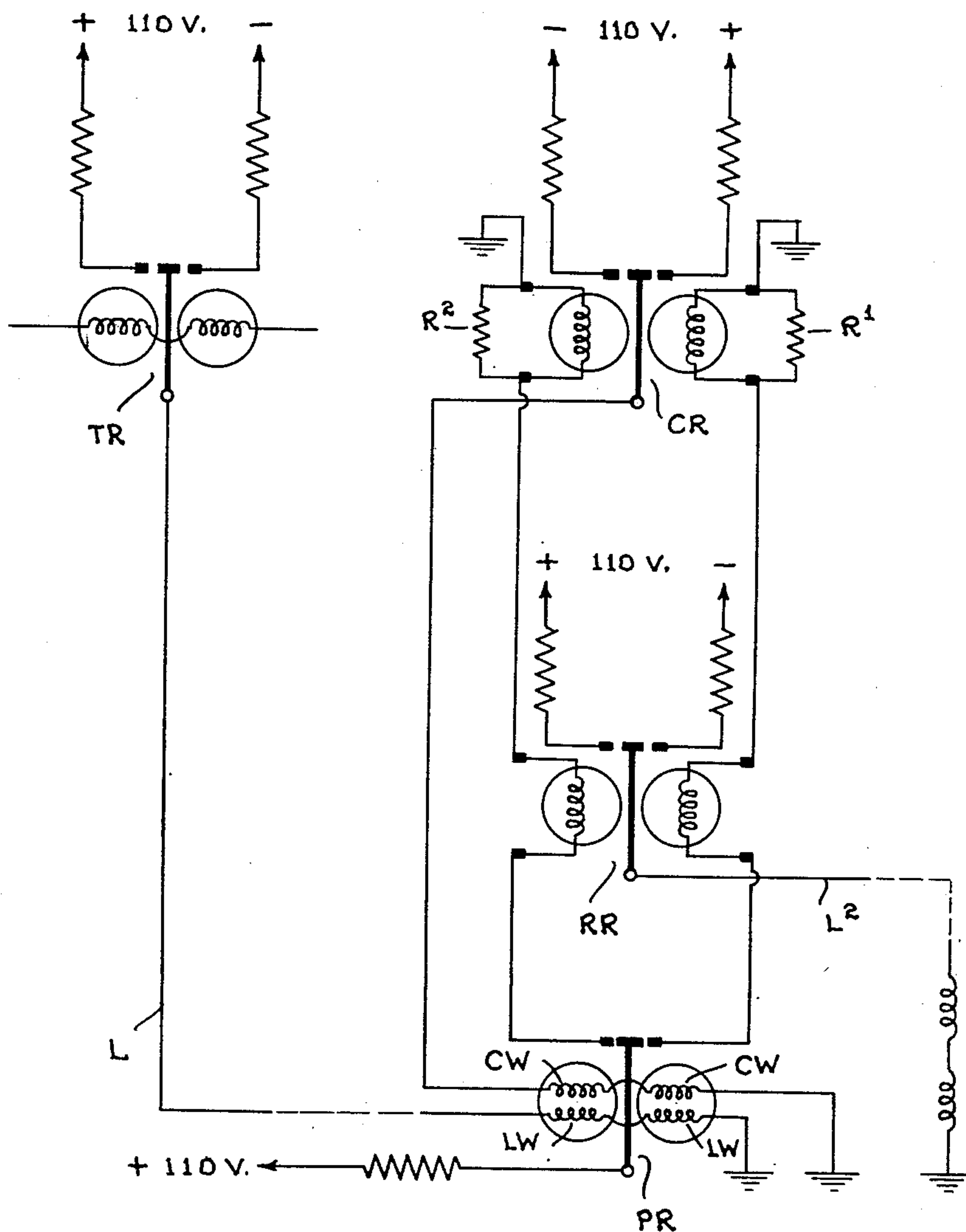
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AUTOMATIC STROKE CORRECTOR CIRCUIT

Filed Sept. 19, 1928

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Fig. 1.



Inventors:
and Alfred J. Finn
Percy L. Myer

By

Eugene C. Brown
Attorney

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Fig. 2.

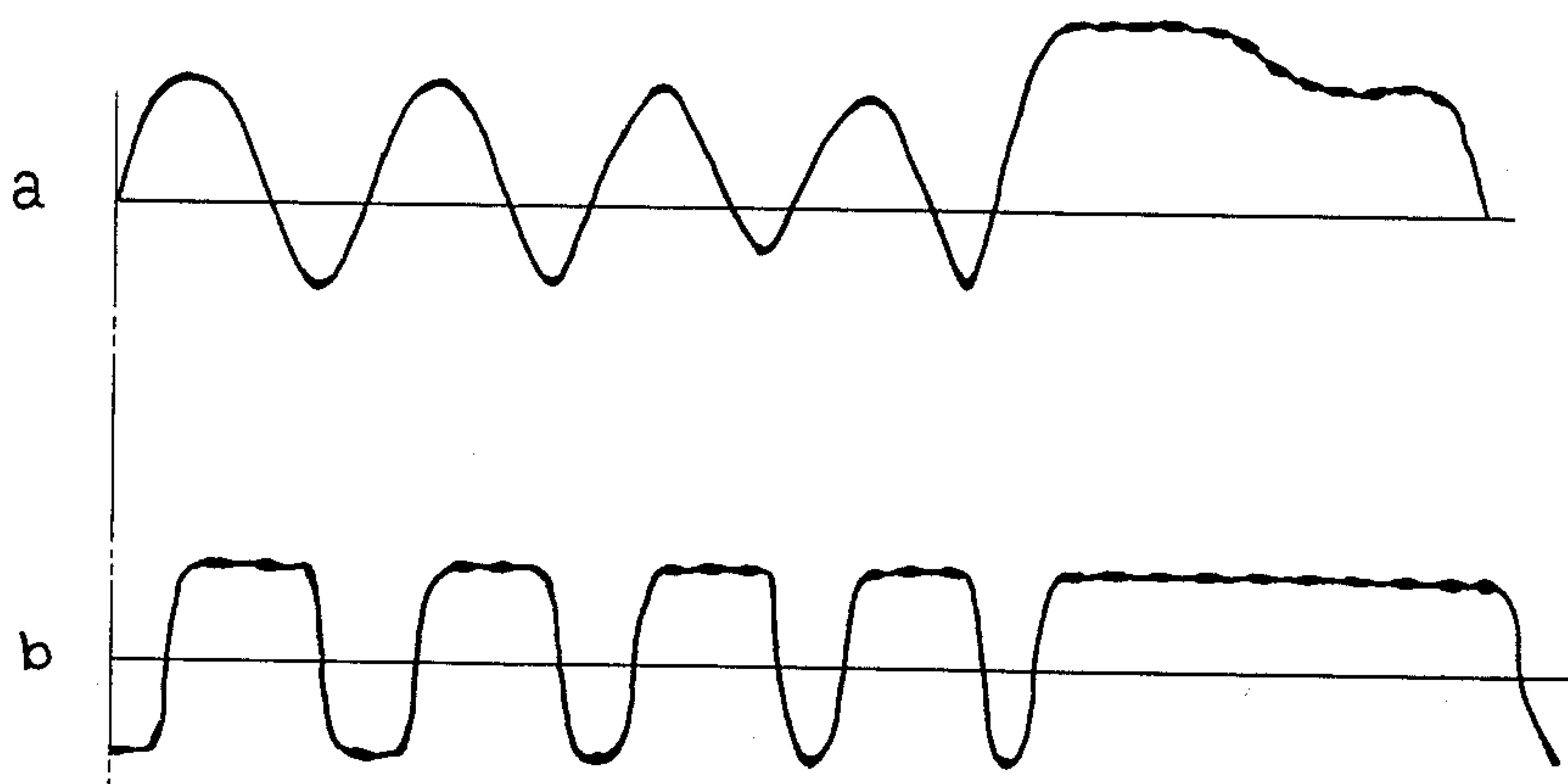
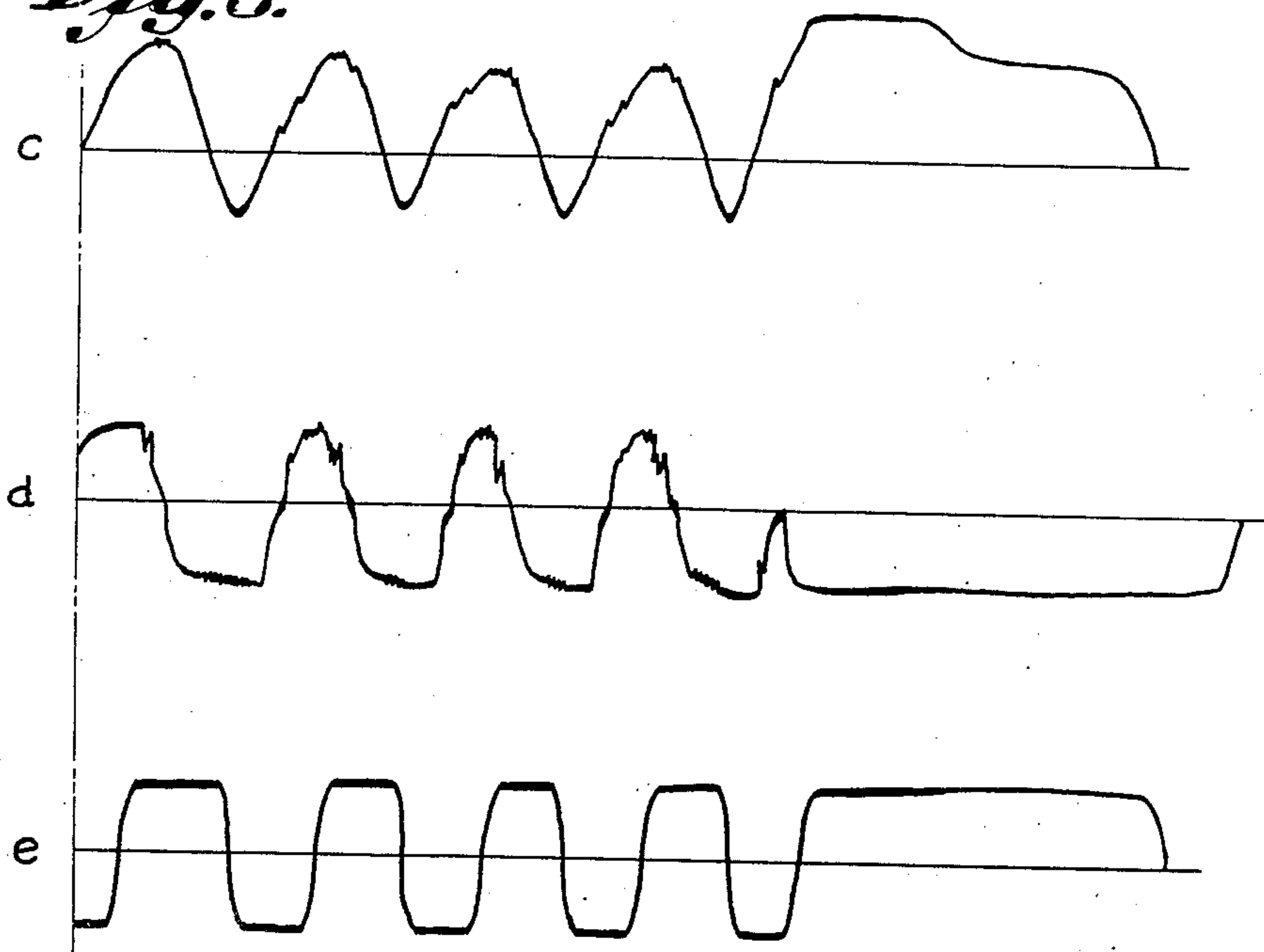


Fig. 3.



Inventors:
and Alfred J. Finn
Percy L. Myer

By

Eugene C. Brown
Attorney

UNITED STATES PATENT OFFICE

ALFRED J. FINN, OF BLOOMFIELD, NEW JERSEY, AND PERCY L. MYER, OF OZONE PARK, NEW YORK, ASSIGNORS TO THE WESTERN UNION TELEGRAPH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

AUTOMATIC STROKE-CORRECTOR CIRCUIT

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This invention relates to a method of and a circuit arrangement for correcting signal currents to eliminate the condition of bias, wandering zero, and other disturbing conditions. The invention relates particularly to systems employing alternating currents, or currents of uniform reversals of polarity.

Telegraph circuits using a ground return are subject to interference of various kinds which distort the signals transmitted over them, thereby decreasing the operating margin of the apparatus which they control. In systems employing signals which consist of uniform reversals of current (alternating current) such as is used in self winding ticker systems, this interference manifests itself either as a bias or in the form of a shaky or unsteady stroke of the ticker.

An object of this invention is to devise a circuit arrangement whereby the distorted signals received at the receiving station may be corrected to eliminate the bias or the unsteady conditions caused by the interference in the circuit.

A further object of my invention is to devise a method of and a system for automatically correcting the received signals of the condition of bias or unsteady operation.

In self winding ticker systems for long distance transmission, the signals consist of uniform reversals of current at approximately forty-cycle frequency, with long impulses of direct current of either polarity interspersed at non-uniform intervals. The uniform reversals of current at the forty cycle frequency serve to rotate the type wheel of the ticker to the desired position, and the long impulses of direct current are for printing the character. Disturbances picked up by the line, as by induction, earth potentials, or other abnormal conditions, distort the signals, and may cause impulses of one polarity to be much larger than the impulses of the opposite polarity. If the unbalance becomes very large, the signals will not operate the escapement on the ticker.

In the corrector circuit of this invention, the signals are received and re-formed, so that the bias and shaky effects will be practically eliminated, and are then repeated to the

apparatus to be operated. The transmitted signals are received by a polar relay having two separate windings, only one of which is connected in the receiving circuit. The polar relay controls a corrector relay which in turn supplies a correcting signal to the second winding for correcting the operation of the polar relay. The polar relay is operated by the conjoint action of the received signals and the correcting currents supplied from the corrector relay.

The invention is illustrated in the accompanying drawing in which:

Figure 1 is a diagram of the circuit arrangement employed;

Figure 2 shows curves illustrating the operation of the receiving apparatus when the corrector relay is not functioning; and

Figure 3 shows curves illustrating the operation of the system when the corrector relay is operating.

Referring to Figure 1, TR indicates a transmitting relay at a transmitting station, which is employed for transmitting over line L the signal currents which consist of uniform reversals of current interspersed with long impulses of current of either polarity. At the receiving station PR indicates a polar relay having two operating windings LW and CW, the line L being connected to the line winding LW. The armature of polar relay PR is connected to a positive source of operating current, and the left and right contacts of this relay are connected in circuit with the operating coils of one or more polar relays, such as a repeating relay RR, and the corrector relay CR. The armature of the repeating relay RR is connected to a line L² into which the corrected signals are to be repeated, and in which is connected the apparatus to be operated, such as the ticker. The right and left contacts of repeating relays RR are connected, respectively, to negative and positive battery. The right and left contacts of corrector relay CR are connected, respectively, to positive and negative battery, and the armature of the corrector relay is connected in circuit with the corrector winding CW on polar relay PR. The operating windings of corrector relay CR are shunted by

resistances R' and R^2 , respectively, for a purpose which will appear hereinafter.

Operation of the system is as follows:

Signals received from line L by the polar relay PR will be repeated to the repeating relay RR and the corrector relay CR in the same condition in which they are received, the positive impulse from the line causing the armature of the polar relay to move to the left and the negative impulse causing it to move to the right. The connection of the contacts of the corrector relay CR to battery is opposite to that of the transmitting relay, the positive battery being connected to the right contact and the negative battery to the left. Thus, when positive battery is being applied to the main line by the transmitting relay, the armature of the polar relay PR is moved to the left and causes the armature of the corrector relay to also move to the left, thereby causing negative battery to be applied to the corrector winding of the polar relay PR. This negative battery applied to the corrector winding would decrease the effect of the positive battery coming in from the transmitting station, however, the resistances connected in shunt to the coils of the corrector relay are adjusted to such value as to cause the corrector relay to lag a full impulse behind the operation of the polar relay when vibrating at its normal frequency, for example, forty cycles per second. Accordingly, the negative impulse supplied to the corrector winding will be delayed in its application until the next negative impulse is supplied from the line by the transmitting station. Also, when the positive impulse is being supplied to the polar relay PR from the line, the corrector relay, which is nearly a full impulse behind the polar relay, is supplying the lagging positive impulse corresponding with the previous negative line impulse. Thus the polar relay is operated by the conjoint action of impulses of like polarity from both the line and the corrector relay.

If the incoming signals are distorted by a momentary bias on the line such that the previous negative impulse was heavy or longer than the present positive impulse, the corrector relay will be repeating a corresponding heavy or long positive impulse through the corrector coil at the time the relatively short or weak positive impulse is being received. And vice versa, when the line relay is receiving a heavy or long impulse, the corrector relay is just supplying an impulse corresponding to the previous short or weak impulse, but of the same polarity as the line impulse being received. A positive bias in the line signals is repeated back through the corrector coil of the line polar relay PR as a negative bias, and the long negative impulses from the corrector relay are supplied to the line relay at exactly the correct time to aid the weak or short negative impulses supplied

from the line. The result is an equalized process which is ready to function on every signal, thereby strengthening the line signals and practically eliminating the effects of line interference. The combination of the current from the line and from the corrector is such as to eliminate substantially 85% of the bias which may come in over the line due to any cause.

Referring to Figure 2, the curve shown at (a) is an oscillogram of four cycles of the steady reversal current followed by a long positive impulse. It will be noted that the positive portions of the alternating current are greater than the negative portions of the current, and the alternating current zero line appears to shift. The curve shown at (b) in Figure 2 shows the repeated signal when no corrector current is applied. The inequality of the positive and negative impulses of the uniform reversal current is quite evident from this curve.

In Figure 2, the curve shown at (c) is an oscillogram of substantially the same received signal shown at (a) in Fig. 2. The curve shown at (d) is an oscillographic record of the corrector current supplied to the corrector winding of the polar relay by the corrector relay, and the curve shown at (e) illustrates the corrected signal repeated by the polar relay by the conjoint action of the received signal and the corrector signal. By comparing curve (e) of Fig. 3 and curve (b) of Fig. 2, it is quite apparent that substantially all bias and inequality in the signal is eliminated by the corrector arrangement.

It will be understood that more than one repeating relay corresponding to RR may be connected in series in the circuit of polar relay PR. It is also apparent that various changes may be made in the arrangement shown and described without departing from the spirit of this invention. Thus the winding CW of relay PR may be omitted, the lead from the armature of relay CR being then connected directly to the line terminal of the winding LW.

We claim:

1. In a signaling system employing alternating current of a definite periodicity and subject to disturbing currents, the method of correcting the received signal for bias and other disturbing conditions, which consists in, receiving the transmitted signals, repeating the received signals to a repeating device, retarding the operation of the repeating device by substantially one-half the period of the alternating current, and supplying the signal from said repeating device to the receiving relay, whereby said relay is operated by the conjoint action of the received signal and the repeated delayed signal.

2. In a signaling system employing alternating current of a definite periodicity and subject to disturbing currents, the method of

correcting the received signal for bias and other disturbing conditions, which consists in, receiving the transmitted signals, repeating the received signals to a repeating device, 5 retarding the operation of the repeating device by substantially one-half the period of the alternating current, and supplying the signal from said repeating device to the receiving relay in reversed phase relation, 10 whereby said relay is operated by the conjoint action of the received signal and the repeated signal.

3. In a signaling system, a line subject to disturbing currents, means for transmitting 15 an alternating current signal of definite periodicity over said line, a receiving relay operated by current from the line, a relay controlled by said receiving relay, means for repeating signals back to said receiving relay 20 from said second relay, and means to retard the operation of the second relay.

4. In a signaling system, a line subject to disturbing currents, means for transmitting 25 an alternating current signal of definite periodicity over said line, a receiving relay operated by the current from the line, means for producing an alternating current corresponding in period to the received current, but reversed in phase, means for retarding said 30 produced current by substantially one-half cycle, and means for supplying said produced current to said receiving relay whereby said relay is operated by the conjoint action of the received current and the produced current. 35

5. In a signaling system, an alternating current signaling circuit, a receiving relay operated by the signaling current, a repeater operated by the receiving relay to produce 40 currents opposite in phase to the received signal, means for retarding the operation of said repeater by substantially one-half cycle of the signaling current, and means for supplying the signal from said repeater to the receiving 45 relay, whereby said relay is operated by the conjoint action of the received signal and the repeated signal.

6. In a signaling system, a line subject to disturbing currents, means for transmitting 50 over said line successive impulses of opposite polarity and definite periodicity, means for receiving the distorted impulses, means controlled by said receiving means for producing impulses of opposite polarity to the received impulses, means for delaying the operation of said impulse producing means, and 55 means for supplying the delayed impulses to the receiving means, whereby said receiving means is operated by the conjoint action of the received impulses and the delayed impulses. 60

7. In a signaling system, a line conductor supplying alternating current signals, a polar 65 relay operated by said signals, a second polar relay controlled by the first relay to produce

an alternating current reversed in phase with respect to the received signal, means for retarding the operation of said second relay by substantially one-half cycle of the signaling current, means for supplying the current produced by the second relay to the first relay, 70 whereby the first relay is operated by the conjoint action of the received signal and the repeated signal.

8. In a signaling system, a line conductor 75 supplying distorted alternating current signals, a receiving polar relay having two operating windings, one of said windings being connected to said line whereby said relay is operated by said signals, a second polar relay 80 controlled by said first relay, said second relay comprising an armature in circuit with the second winding of said first relay and cooperating with opposed contacts of opposite polarity, said contacts being of such polarity 85 that a negative impulse supplied from the line causes a positive impulse to flow through the second winding of said first relay and vice versa, resistance elements connected in shunt 90 to the operating windings of said second relay and having such value that the operation of said relay is delayed by substantially one-half period of the signaling current, a third relay controlled by said first relay, and a signal 95 operating circuit controlled by said third relay.

In testimony whereof we affix our signatures.

ALFRED J. FINN.
PERCY L. MYER.

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