A. GOLDSTEIN.

ELECTRICAL SIGNALING SYSTEM.

APPLICATION FILED APR. 13, 1910.

966,825. Patented Aug. 9, 1910.

2 SHEETS—SHEET 1.

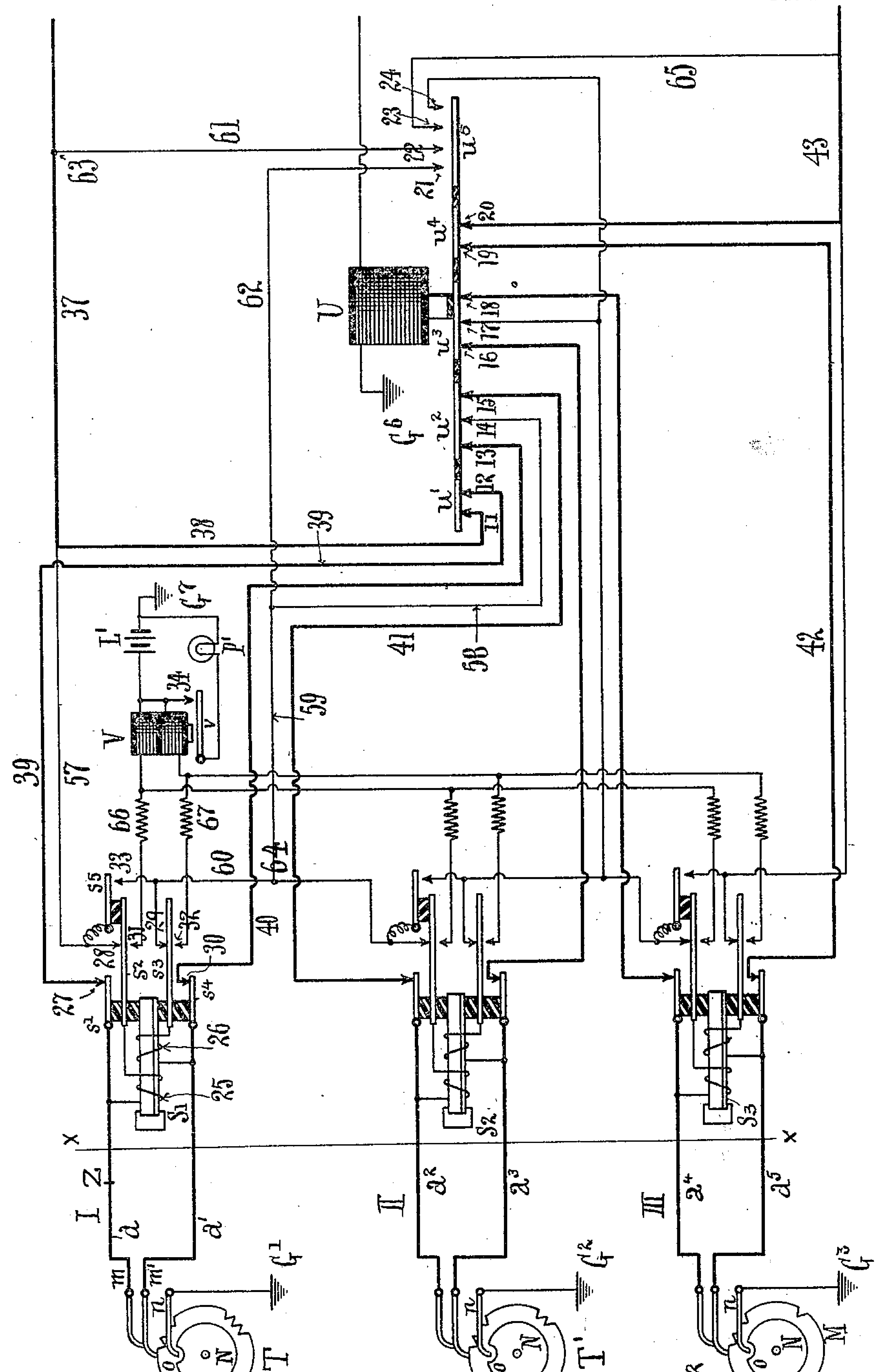

Fig. 1.

WITNESSES:

Allan W. Moose.

May T. McGarry.

INVENTOR

Albert Goldstein

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Adolph Benjamin

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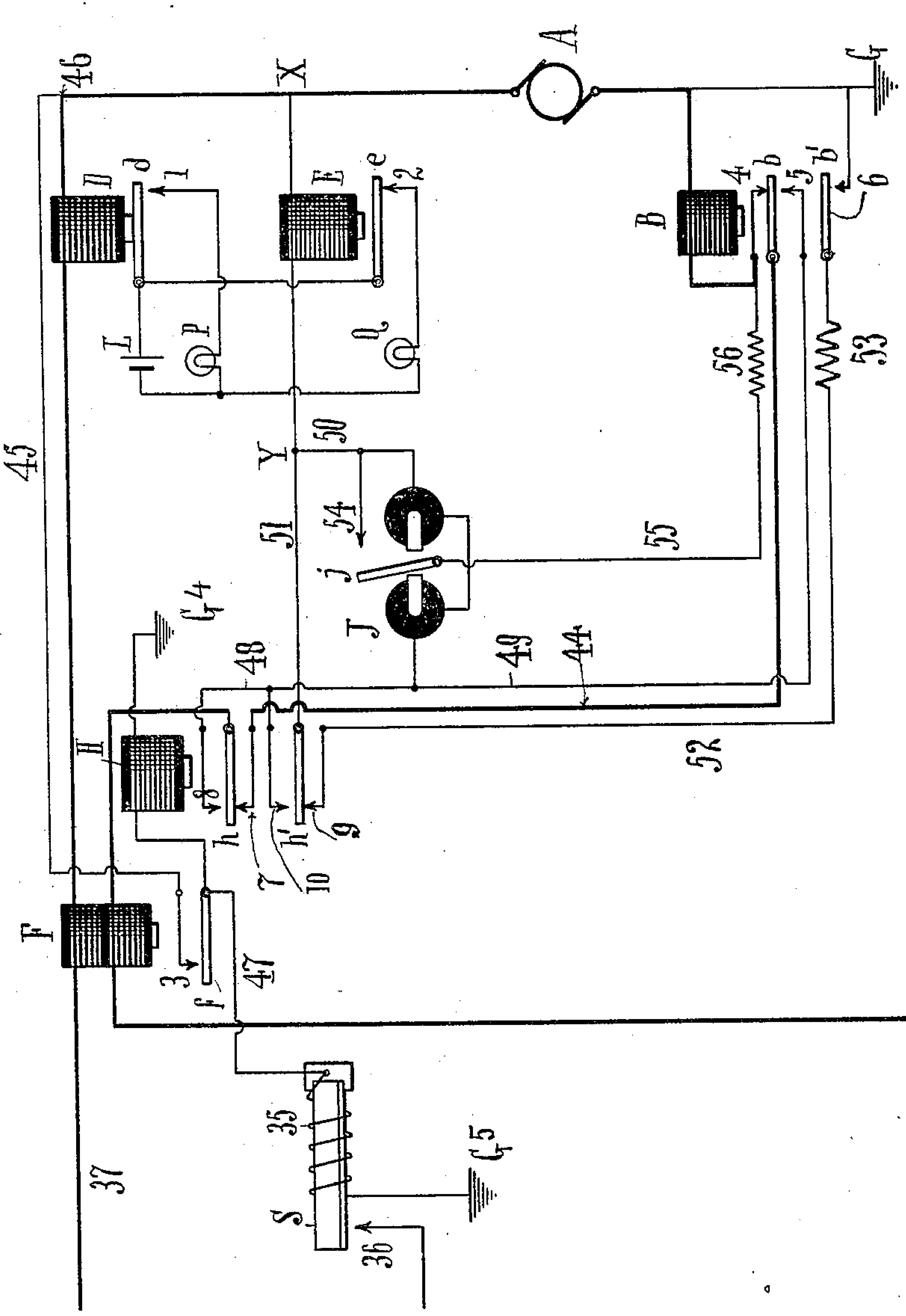

Fig. 2.

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UNITED STATES PATENT OFFICE.

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ELECTRICAL SIGNALING SYSTEM.

966,825. Specification of Letters Patent. **Patented Aug. 9, 1910.**

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To all whom it may concern:

Be it known that I, Albert Goldstein, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented a certain new and useful Improvement in Electrical Signaling Systems, of which the following is a specification.

The invention is an electrical signaling system, and consists in the construction hereinafter set forth, whereby an accidental ground occurring in one or more loops of a plurality of loops connected in series in the circuit will not prevent signals being transmitted to a receiving station from any transmitter in any of said loops.

The accompanying drawing is an electrical diagram, showing the invention by conventional symbols. Figures 1 and 2 are to be read unitedly, Fig. 1 being placed on the left of Fig. 2.

Three loops I, II, III are here shown in series circuit with the source A of current which is grounded at G. In each loop is a transmitter T, T′, T^2, each comprising a code wheel M, on the shaft of which is a cam N, having a notch *o* in its rim. Bearing on the cam is a switch arm *n* which is connected to ground—as at G′, G^2 or G^3. When the code wheel M is at rest, the downwardly bent end of arm *n* enters notch *o* in cam N and so opens the ground connection. Each wheel M is rotated by any suitable means, released or otherwise controlled by the operator when a signal is to be sent, and, in rotating, said wheel makes and breaks circuit between the spring arms *m*, *m′*, in the usual way. The line conductors of the three loops I, II, III are shown at *a a′*, a^2 a^3 and a^4 a^5; so that all of the parts shown on the right of the line *x*, *x*, in the drawing are located at the receiving station, to which the signals are sent over the line conductors from the several transmitters T, T′, T^2. The magnets D and E respectively control their switches *d*, *e* to make and break local circuit at 1 and 2. In circuit with switches *d*, *e* and contacts 1, 2 are a local battery L and glow lamps P, Q, the whole located at the receiving station and constituting a translating device for signals coming over the line from transmitters T, T′, T^2. The magnet F has two coils, and when one over-balances the other, controls its switch *f* to make and break circuit at 3. The magnet B controls its switch *b* to make and break circuit at 4 and 5, and its switch *b′* to make and break circuit at 6. The magnet H controls its switches *h*, *h′* to make and break circuit at 7, 8, 9, 10. The magnet U has its switch lever formed of a number of mutually insulated sections *u′*, u^2, u^3, u^4, u^5. The section *u′* closes contacts at 11, 12: the section u^2, at 13, 14, 15: the section u^3, at 16, 17, 18: the section u^4 at 19, 20, and the section u^5, at 21, 22, 23, 24.

Associated with each loop I, II, III is a thermostatic circuit closer. Each of said circuit closers consists of a thermostatic bar S′, S^2, S^3, which may be made of two metals, as steel and brass, and supported at one end. On each bar are two heating coils 25 and 26. When one or the other or both of the coils on a bar are heated, the bar bends to close and open certain circuits. The switches controlled by each bar S′, S^2, S^3 are alike, so that the description of the set governed by bar S′ applies to all three. On the free end of bar S′ are mounted the switches *s′*, s^2, s^3, s^4, insulated from one another and from the bar. On switch s^2 is mounted a switch s^5 which is insulated from switch s^2. When the bar S′ is cool, no current then passing through the coils 25, 26, the switch *s′* closes circuit at 27; the switch s^2, at 28; the switch s^3, at 29, and the switch s^4 at 30. When the bar is heated by the passage of current through one or both of the coils 25, 26, as the case may be, then switch *s′* opens circuit at 27: s^2 opens circuit at 28 and closes circuit at 31: s^3 opens circuit at 29 and closes circuit at 32: s^4 opens circuit at 30, and s^5 closes circuit at 33. The magnet V, like the magnet F, has two coils, and when one overbalances the other, controls its switch *v* to close at 34, a local circuit including a battery L′ and lamp P′. A thermostatic bar S, similar to bars S′, S^2, S^3 but having one heating coil 35, when heated by the passage of current, closes contact at 36.

The metallic circuit proceeds as follows: from non-grounded pole of source A, to magnet D, one coil of neutral magnet F, wire 37, wire 38, contact 11, switch *u′*, contact 12, wire 39, contact 27, switch *s′*, line member *a* of loop I, switch *m*, switch *m′*, line member *a′*, switch s^4, contact 30, wire 40, contact 13, switch u^2, contact 15, wire 41, through the similar parts controlled by the switches of thermostatic bars S^2 and S^3 in loops II and III, to wire 42, contact 19, switch u^4, contact 20, wire 43, other coil of magnet F, switch h, contact 7, wire 44, switch b, contact 4, magnet B and grounded pole of source A.

The normal operation of the system is as follows: When signals are sent, say from transmitter T, there is constant connection to ground G′, thus energizing the magnet F to close contact at 3, which point is connected by wire 45 and junction 46 to non-grounded pole of source A. Two branches are thus established from switch f, namely, (1) through magnet H to ground G^4; (2) by wire 47 through coil 35 of thermostatic bar S to ground G^5. Magnet H being energized, opens circuit at 7 and 9, and closes circuit at 8 and 10. Inasmuch as magnet F is not retarded in its response to the taps of the signal from transmitter T, the coil of bar S is not traversed by a current for a sufficient period of time to cause said bar to close circuit at 36. On the other hand, magnet H should be made with sufficient lag so as not to respond to the signal taps. By reason of the opening of the circuit at 7, magnet B which is normally energized is caused to fail, so that its switches b, b' open circuit at contact 4 and close circuit at contacts 5 and 6. Two leads from the non-grounded pole of source A now exist as follows: (1) from source A, to magnet D, one coil of magnet F, wire 37, wire 38, contact 11, switch u', contact 12, wire 39, contact 27, switch s', and line member a of loop I through transmitter T to ground G′. (2) from source A, to junction X, magnet E, switch h', contact 10, wire 48, contact 8, switch h, other coil of magnet F, wire 43, contact 20, switch u^4, contact 19, wire 42, through the switches controlled by thermostatic bars S^3 and S^2 in loops III and II to wire 41, contact 15, switch u^2, contact 13, wire 40, contact 30, switch s^4, to member a' of loop I, transmitter T and ground G′. Consequently both magnets D and E are actuated by the current impulses sent by transmitter T, and both lamps P, Q translate the signals visually. As soon as the transmitter T stops—say having completed its rotation—the ground G′ is removed from the system and magnet F becomes deënergized, opening circuit at 3, and causing magnet H to fail, thus opening circuit at 8 and 10 and closing circuit at 7 and 9. Two circuits are now established from junction X: (1) by magnet E, to junction Y, (2) by magnet D, one coil of magnet F, through loops I, II, III successively, by wire 43, to other coil of magnet F, switch h, contact 7, wire 44, switch b, contact 5, wire 49, polarized magnet J, wire 50, to junction Y. Then, from junction Y, by wire 51, to switch h', contact 9, wire 52, resistance 53, switch b', contact 6, to grounded pole of source A. Magnet J now being energized by a reverse current swings its switch j to close circuit at contact 54, when the circuit is established from source A, to junction X, magnet E, junction Y, wire 50, contact 54, switch j, wire 55, resistance 56, magnet B, to grounded pole of source A: thus energizing magnet B and restoring the metallic circuit as originally described. Magnet B is given sufficient lag so that it will not be caused to fail by the momentary interruptions due to the operation of the transmitters; nor until after its circuit has been opened for some predetermined period of time.

I will now describe the operation of the system under abnormal condition of a ground occurring in any one of the loops—say, for example, at Z in member a of loop I. The immediate effect of the ground is to unbalance magnet F, which closes circuit at 3. This energizes magnet H, with the results already described. Because now the ground is kept on, the current can heat coil 35 of bar S, causing the free end of said bar to close contact at 36, thus establishing the following circuit: from non-grounded pole of source A, to junction 46, wire 45, contact 3, switch f, wire 47, bar S, contact 36, magnet U to ground G^6. Magnet U thus becomes energized, opening contacts 11, 12, 13, 14, 15, 16, 17, 18, 19 and 20, and closing contacts 21, 22, 23, 24. It is now to be especially noted that the thermostatic bars S', S^2, S^3 are normally cold, and that their heating coils are then short-circuited by the switches u', u^2, etc., controlled by magnet U. Thus in the case of bar S, for example, coil 25 is short-circuited as follows: from coil 25, to switch s', contact 27, wire 39, contact 12, switch u', contact 11, wire 38, wire 57, contact 28, switch s^2, to other terminal of said coil. Coil 26 on the same bar is short-circuited as follows: from coil 26, to switch s^4, contact 30, wire 40, contact 13, switch u^2, contact 14, wire 58, wire 59, wire 60, contact 29, switch s^3 to other terminal of said coil. It will be evident, therefore, that when magnet U opens the above-named contacts 11 to 20, all of these short circuits will be opened. Besides doing this, the magnet U through switch u^5 closes, as stated, the contacts 21, 22, 23, 24. These contacts short-circuit the three loops I, II, III individually, the lead in each loop being the same as now to be described in connection with loop I. The short circuit of loop I proceeds from junction point 63 on one side of loop I, by wire 61, to contact 22, switch u^5, contact 21, wire 62, wire 59, to junction 64 on the other side of loop I. Two leads are thus established from non-grounded pole of source A, to the ground at Z, as follows: (1) from source A, to magnet D, one coil of magnet F, wire 37, wire 57, contact 28, switch s^2, heat coil 25, line member a of loop I to Z. (2) From source A, to junction X, magnet E, wire 51, switch h', contact 10, wire 48, contact 8, switch h, other coil of magnet F, wire 43, wire 65, contact 23, switch u^5, contact 21, wire 62, wire 59, wire 60, contact 29, switch s^3, heat coil 26, line member a' of loop I, switches m' and m of transmitter T and line member a of loop I to Z. These two leads are tied together by the crossing from junction 63 by wire 61 to contact 22 and switch u^5. In this case both heat coils 25 and 26 will become heated, causing the bar S′, as already described, to open circuit at 27, 28, 29 and 30, and close circuit at 31, 32, 33. The result then is (1) to cut loop I and the transmitter T therein out of the system and connect it with magnet V and battery L′, one pole of which battery is grounded at G^7. Magnet V is then balanced, but when the transmitter T operates, it responds to the tap signals which are translated at the receiving station by the lamp P′, battery L′ then maintaining sufficient current through coils 25 and 26 to keep them heated, so that bar S′ remains in its operated position. Another result is (2) to make a short circuit from junction point 63 on wire 37 to point 64 on wire 60, which proceeds as follows: from junction point 63, by wire 37, wire 57, switch s^5, contact 33, wire 60 to point 64. The purpose of this short circuit is to make the metallic circuit continuous after loop I has been removed therefrom. Of course, the removal of the ground at point Z in loop I from the system causes magnet F again to become balanced, opening circuit at 3, which causes magnets H and U to fail. The failure of magnet U acts to break all the loop short circuits and to establish the short circuits around the heating coils—except the short circuits around the coils of bar S′ in loop I which are open because of the open contacts at 27 and 30. Magnet H, by means of magnet J and magnet B, as already described, reëstablishes the original metallic circuit. The net result of the whole then is, that transmitter T in grounded loop I sends its signals to lamp P′, while transmitters T′ and T^2 continue to send their signals over the metallic circuit to lamps P and Q as before. The effect, therefore, of an accidental ground on any loop is to cut that loop out of the system and to connect its transmitter to the special receiving apparatus operating lamp P′, and to close the gap in the metallic circuit due to this removal of the grounded loop, so that the transmitters in the remaining unimpaired loops can continue sending their signals over the metallic circuit, as before, to operate lamps P and Q. If only one loop is grounded, that loop is cut out: if two loops are individually grounded, both are cut out, and so for any number of loops, the grounded loops being automatically removed, and the metallic circuit reëstablished for whatever loops may remain.

The object of the resistances 66, 67 connected with magnet V is approximately to equalize the flow of current over the members a, a' to the ground at Z, so as to insure the neutralization of magnet V when the transmitter is not operating.

I claim:

1. The combination of a source of current, a ground connection at one pole thereof, a metallic circuit including a plurality of loops in series, a ground connection from each of said loops, a transmitter in each of said loop ground connections, translating means in said circuit operated by each of said transmitters, means operating upon the occurrence of an abnormal ground in any one of said loops for cutting said loop out of circuit, and means for closing the gap in the metallic circuit due to the removal therefrom of the grounded loop.

2. The combination of a source of current, a ground connection at one pole thereof, a metallic circuit including a plurality of loops in series, a ground connection from each of said loops, a transmitter in each of said loop ground connections, translating means in said circuit operated by each of said transmitters, means operating upon the occurrence of an abnormal ground in any fractional number of said loops for cutting said loops out of circuit, and means for closing the gaps in the metallic circuit due to the removal therefrom of said grounded loops.

3. The combination of a source of current, a ground connection at one pole thereof, a metallic circuit including a plurality of loops in series, a ground connection from each of said loops, a transmitter on each of said loop ground connections, translating means in said circuit operated by each of said transmitters, a separate translating means in local circuit, means operating upon the occurrence of an abnormal ground in any one of said loops for cutting said loop out of circuit, and means for connecting said cut out loop to said separate translating means.

4. The combination of a source of current, a ground connection at one pole thereof, a metallic circuit including a plurality of loops in series, a ground connection from each of said loops, a transmitter in each of said loop ground connections, translating means in said circuit operated by each of said transmitters, a separate translating means in local circuit, means operating upon the occurrence of an abnormal ground in any fractional number of said loops for cutting said loops out of circuit, and means for connecting said cut out loops to said separate translating means.

5. The combination of a source of current, a ground connection at one pole thereof, a metallic circuit including a plurality of loops in series, a ground connection from each of said loops, a transmitter in each of said loop ground connections, translating means in said circuit operated by each of said transmitters, a separate translating means in local circuit, means operating upon the occurrence of an abnormal ground in any one of said loops for cutting said loop out of the circuit, means for connecting said cut out loop in local circuit with said separate translating means, and means for closing the gap in the metallic circuit due to the removal therefrom of the grounded loop.

6. The combination of a source of current, a ground connection at one pole thereof, a metallic circuit including a plurality of loops in series, a ground connection from each of said loops, a transmitter in each of said loop ground connections, translating means in said circuit operated by each of said transmitters, a separate translating means in local circuit, means operating upon the occurrence of an abnormal ground in any fractional number of said loops for cutting said loops out of circuit, means for connecting said loops in local circuit with said separate translating means, and means for closing the gaps in the metallic circuit due to the removal therefrom of the grounded loops.

7. The combination of a source of current, a ground connection at one pole thereof, a metallic circuit including a plurality of loops in series, a ground connection from each of said loops, a transmitter in each of said loop ground connections, translating means in said circuit operated by each of said transmitters, a separate translating means in local circuit, means operating upon the occurrence of an abnormal ground in any one of said loops for cutting said loop out of the circuit, means for connecting said cut out loop in local circuit with said separate translating means, means for closing the gap in the metallic circuit due to the removal therefrom of the grounded loop, and means operating upon the removal of said abnormal ground for restoring the original metallic circuit.

8. The combination of a source of current, a ground connection at one pole thereof, a metallic circuit including a plurality of loops in series, a ground connection from each of said loops, a transmitter in each of said loop ground connections, translating means in said circuit operated by each of said transmitters, a separate translating means in local circuit, means operating upon the occurrence of an abnormal ground in any fractional number of said loops for cutting said loops out of circuit, means for connecting said loops in local circuit with said separate translating means, means for closing the gaps in the metallic circuit due to the removal therefrom of the grounded loops, and means operating upon the removal of said abnormal grounds for restoring the original metallic circuit.

In testimony whereof I have affixed my signature in presence of two witnesses.

ALBERT GOLDSTEIN.

Witnesses:
GERTRUDE T. PORTER,
MAY T. MCGARRY.