April 21, 1959 M. C. BRANCH ET AL 2,883,469

STATIC ELECTRICAL CODE TRANSLATING APPARATUS

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FIG. 1.

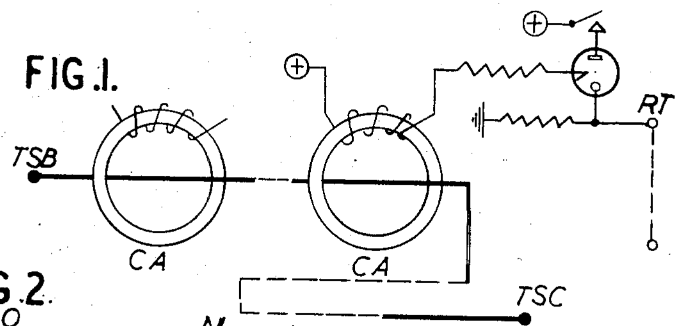

FIG. 2.

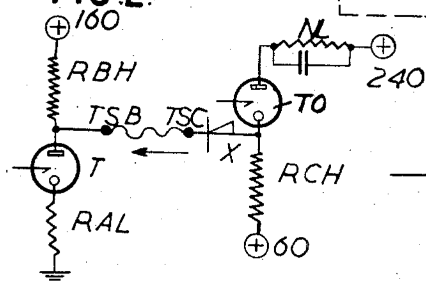

FIG. 3.

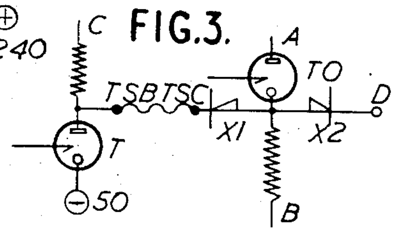

FIG. 4.

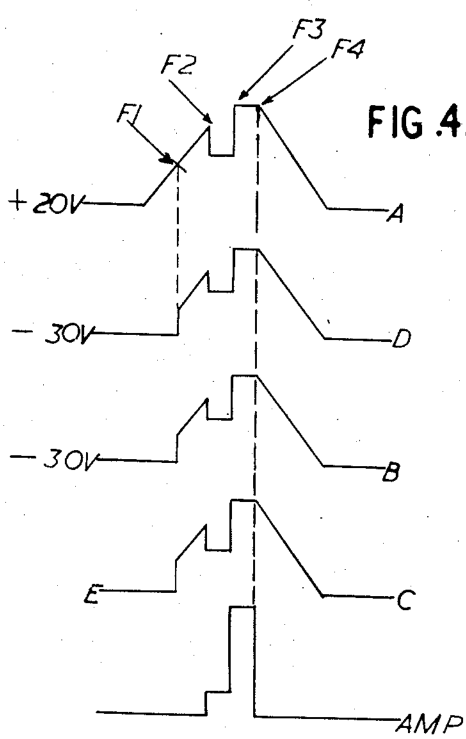

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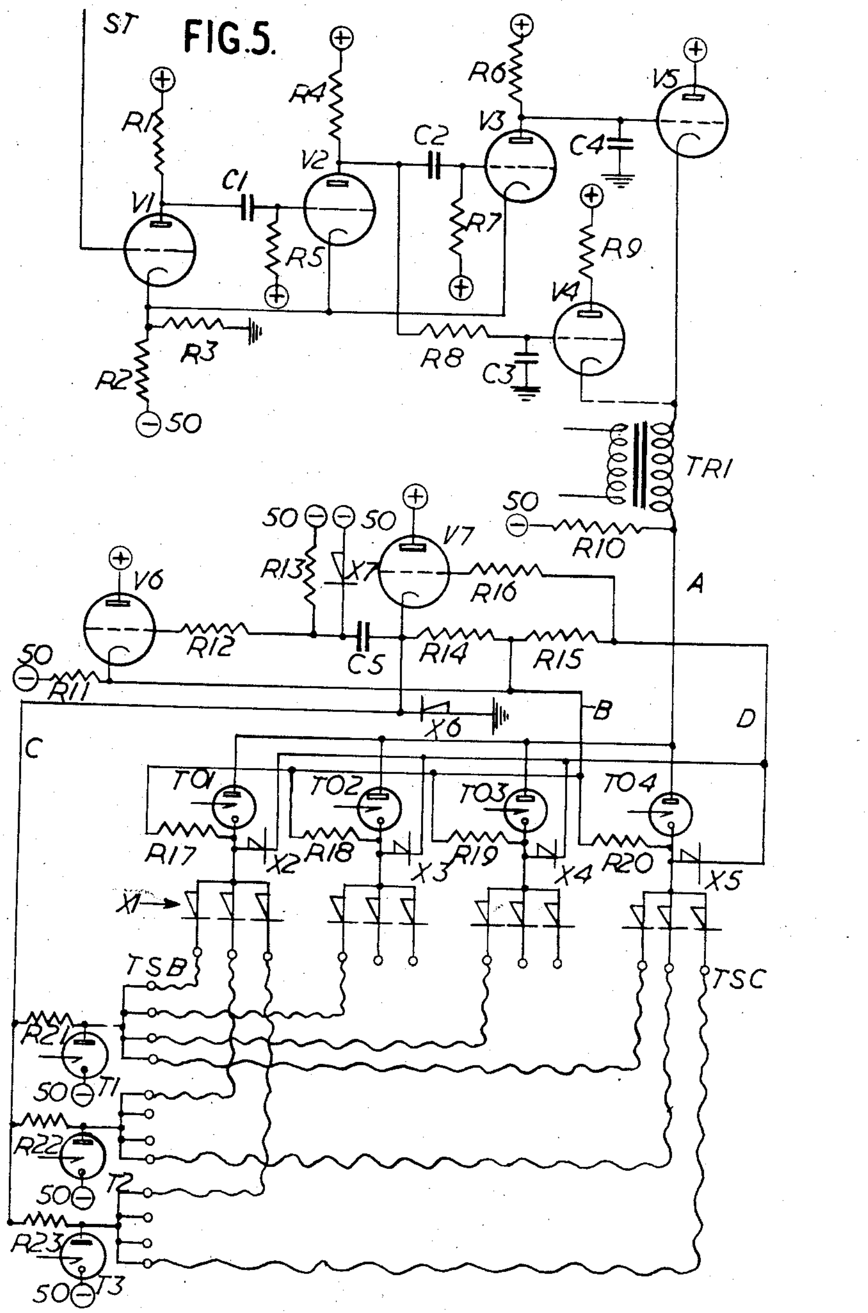
FIG.5.



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STATIC ELECTRICAL CODE TRANSLATING APPARATUS

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Application September 28, 1956, Serial No. 612,631

Claims priority, application Great Britain October 5, 1955

7 Claims. (Cl. 179—18)

This invention relates to electrical impulse code translators and particularly to translators in which wires, each unique to a translation to be effected are threaded through selected ones of a series of coils, whereby a pulse of current in a wire produces a corresponding pulse in each of the coils through which the wire passes but not in the remaining coils through which the wire does not pass.

Such arrangements are known, for instance, in the application of Hartley et al., Serial No. 480,965, filed January 10, 1955, now Patent No. 2,834,836, the present invention being an improvement over the arrangement disclosed in the application.

The present invention comprises static electrical code translating apparatus of the magnetic loop and threaded wire type in which a pulse of current through a selected wire is produced by the production of a voltage difference between the ends of the wire and in which a first voltage difference is produced for a predetermined interval of time to produce a relatively small current in a predetermined direction in the wire after which said first voltage difference is rapidly increased to a second voltage difference whereby said relatively small current is rapidly raised to a relatively high current and a pulse is produced in the outputs of the magnetic loops through which the wire is threaded.

The invention will now be described with reference to the accompanying drawings in which:

Fig. 1 shows how coils may be connected to produce pulses;

Fig. 2 is a circuit for applying voltage to a jumper wire;

Fig. 3 is another circuit for applying voltage to a jumper wire;

Fig. 4 shows graphically the voltages and current at certain points in the circuit of Fig. 3, and

Fig. 5 shows sufficient of a complete circuit for an understanding of the invention.

In translating apparatus of the threaded wire type, a wire, as shown in Fig. 1, is threaded through selected ones of a number of transformer rings CA, between two selected terminals TSB and TSC. The secondary windings of each of the rings CA is arranged to fire a cold cathode tube when a pulse of current is passed through the wire from TSC to TSB and thus to produce a voltage at predetermined ones of a number of terminals RT.

A method of producing the pulse of current in the jumper wire will now be explained in connection with Fig. 2. A number of cold cathode gas discharge tubes T0 and T are arranged in coordinate array and the several jumper wires are connected between the respective terminals TSC and TSB, there being an individual rectifier X in series with each wire. The appropriate tube T0 and tube T are selected in known manner and fired. With low resistance network NL connected to the anode of tube T0 and low resistance RAL connected to the cathode of tube T, the values of high resistances RBH and RCH and of the various voltages are such that current flows from terminal TSC to terminal TSB.

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It is found however, that certain problems arise in practice due to limitations imposed by the components used. For example, the type of rectifier used at X has a high forward voltage drop at high current density and although very small rectifiers are used, the self capacity is high so that they will not block short pulses of current in the reverse direction. Again, the life of such rectifiers can be considerably increased by continuous biassing in the reverse direction. The cold cathode tubes also give rise to difficulties in that the maintaining voltage varies from tube to tube over a wide range as also does the output and the life when used for high currents.

The principles of a circuit which overcomes these difficulties will be explained with reference to Fig. 3. The normal potentials at points C and B are such that a reverse voltage is always present on the rectifiers X1. When a tube T0 and a tube T have been selected and fired, the voltages at C and A are sufficient to maintain the tubes and cause a small current to flow in the one wire between the selected tubes from TSC to TSB. The voltage at A is caused to rise gradually for a given time and the voltage at D, taken through a rectifier X2 from the cathode of the fired T0 tube is used to control the difference in voltages at B and C of all the tubes. The voltage at A is then caused to rise rapidly and after a short time to fall away and extinguish the tube T0. The fall of voltage at D causes sufficient fall at C to extinguish the T tube.

A circuit for controlling the voltages at C and B from that at D is shown in Fig. 5. In this figure, four T0 tubes and three T tubes are shown, but it will be appreciated that the coordinate array of T0 and T tubes may comprise any required number, say 30×30, for which there could be up to 900 rectifiers X1 and 900 jumper wires any one of which could be selected by selecting the appropriate T0 and T tubes.

Normally the X1 rectifiers have a reverse voltage impressed upon them from earth via rectifier X6, C wire, resistances R21, terminals TSB, jumper wires, terminals TSC, rectifiers X1, resistances R17, B wire to −30 volts at the junction between resistance R11 and tube V6. When a selection is to be effected the appropriate T0 and T tubes are selected and primed in known manner. Also a pulse is applied to the start wire ST to the grid of valve V1. Valves V1–V7 are of the thermionic type having an anode voltage of say +400 volts.

Valves V1, V2, V3, constitute a timing chain and control the waveform of outputs valves V4 and V5 which supply current on the A wire to the selected jumper wire over the fired T0 tube. Valve V1 controls valve V2 with a time lag of say 17 ms. determined by the network C1, R5, during which time valve V2 controls valve V4 to supply low voltage on the lead A. Valve V2 controls valve V3 with a time lag of say ½ ms. determined by the network C2, R7, during which time valve V3 controls valve V5 to supply high voltage on the lead A. Curve A, Fig. 4 represents the voltage on lead A during these operations.

Valves V2 and V3 are normally passing full current so that valves V4 and V5 are nearly biased off and the effective voltage on lead A is about 20 v. When valve V1 conducts the current in valve V2 dies away controlled by C1 and R5, its anode voltage rises and valve V4, switches on, controlled by R8 and C3. The voltage on lead A therefore rises and when it reaches a point F1, the primed T0 tube, say T01, fires and its cathode voltage jumps up. This jump is transmitted to lead D through the appropriate X2 rectifier. Normally the rectifier X6 supplies earth potential on lead C and the cathode follower valve V6 supplies about −30 volts on lead B. Any voltage rise on lead D is passed on by valve V7 and condenser C5 so that the 30 volt difference between leads C and B is maintained. Thus when tube T01 fires and its cathode voltage rises, the voltages of D, B and C also rise as shown in Fig. 4. As the voltage on lead A continues to rise, so does that of D, B and C until at F2, the voltage of lead C is sufficient for the primed T tube, say T1, to fire. There is now a current path through tubes T01 and T1, via the selected jumper wire and rectifier but not through other jumper wires. This current is limited by R9. This causes a fall in voltage on lead A and similarly in D, B and C. When the point F3 is reached valve V5 becomes fully conducting and the voltage on lead A jumps up, followed by that on D, B and C. Likewise the current through tubes T01 and T1 and the selected jumper wire also jumps up. In order to prevent this rise being too great and causing damage to a valve or tube, a transformer TR1 is inserted in the lead A, the secondary of which is taken to any suitable current limiting device. The output of the valve V5 is controlled by the valve V3 and condenser C2 and resistor R7. When the point F4 is reached valve V5 cuts off causing the voltages on the leads A, D, B and C to return to normal. The tubes T01 and T1 extinguish, their priming having been removed during the period when they were fired.

It will be seen that, since the voltage relationship between leads C and B was maintained throughout, the voltages across the jumper wires other than the selected one, were mainly unaffected by the operation. If, as previously suggested, there were 30 T0 and 30 T tubes, then the voltage across 841 of the jumper wires would be entirely unaffected. Of the remainder, the other 29 jumpers connected to the cathode of tube T01 would have a higher effective B voltage and the other 29 connected to tube T1 would have a lower effective C voltage, so that the normal difference between C and B is reduced. Without the above described control of the relationship between the voltages on leads C and B, it is possible, and in fact probable, that the effective voltage on lead B would rise above that of C and a number of the jumper wires, other than the selected one, would pass forward current or at any rate pass less reverse current. The simultaneous effect of so many changes could cause coils other than the ones through which the selected jumper passes to produce an operable pulse in their secondary windings.

While the principles of the invention have been described above in connection with specific embodiments, and particular modifications thereof, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of the invention.

What we claim is:

1. Static electrical code translating apparatus of the magnetic loop and threaded wire type comprising a plurality of magnetic loops, a plurality of wires threaded through different ones of said loops, means for producing a first voltage difference between ends of a selected wire, whereby a pulse of current is sent through said wire for a predetermined interval of time to produce a relatively small current in a predetermined direction in the wire, means responsive to said pulse of current for rapidly increasing said first voltage difference to a second voltage difference, whereby said relatively small current is rapidly raised to a relatively high current, and means responsive to said high current for producing a pulse in the outputs of the magnetic loops through which the selected wire is threaded.

2. Static electrical code translating apparatus of the magnetic loop and threaded wire type comprising a plurality of magnetic loops, a plurality of wires threaded through predetermined ones of said loops, a plurality of static electrical switches arranged in coordinate array and having terminals, said threaded wires being connected between the terminals of said switches so that a predetermined wire is selected by the selection of a switch in each coordinate, means for normally applying a voltage in a predetermined sense between the terminals of the respective coordinates, means responsive to the operation of a selected switch in one coordinate for raising the voltages of the terminals of the other coordinate to a level at which the selected switch in said other coordinate operates and means responsive to the voltage rise for causing reversal of the sense of the voltage applied by said voltage applying means to the wire connected between said selected switches.

3. Static electrical code translating apparatus, as claimed in claim 1, further comprising an individual rectifier in series with each threaded wire, means for normally applying and maintaining a voltage difference in the reverse direction to said rectifiers to bias said rectifiers in a non-conductive state, said bias with respect to the rectifier in series with a selected wire being overcome by the means for producing the first and second voltage differences between ends of said selected wire during the periods when said first and second voltage differences are applied to said selected wire.

4. Static electrical code translating apparatus, as claimed in claim 1, in which the means for applying the first and second voltages for producing relatively small and relatively high currents are static electrical devices.

5. Static electrical code translating apparatus, as claimed in claim 2, in which the means for applying the voltage and for raising the voltage are static electrical devices.

6. Static electrical code translating apparatus of the magnetic loop and threaded wire type comprising a plurality of magnetic loops, a plurality of wires threaded through different ones of said loops, first and second sets of terminals, each terminal of said first set being connected to the respective ends of a plurality of said threaded wires the opposite ends of which are connected respectively to a terminal of different sets of terminals of said second set, means for producing a voltage difference between a selected terminal in said first set and a selected terminal in said second set, thereby causing current to flow in the wire connecting said selected terminals, means responsive to said flow of current for substantially simultaneously raising the voltages on both said selected terminals, and means at a predetermined time thereafter for increasing the voltage difference between said selected terminals, whereby a pulse of increased current is caused to flow in the wire connecting said selected terminals which is sufficient to affect the magnetic loops threaded by said line.

7. Static electrical code translating apparatus, as claimed in claim 6, in which the means for producing a voltage difference between a selected terminal in the first set and selected terminal in the second set comprises a static electric switch connected to each of said terminals and means for operating one of said switches a predetermined interval of time after the operation of the other, and in which the means for increasing the voltage difference between the selected terminals comprises electronic timing means for increasing the operating potential of one of said switches.

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