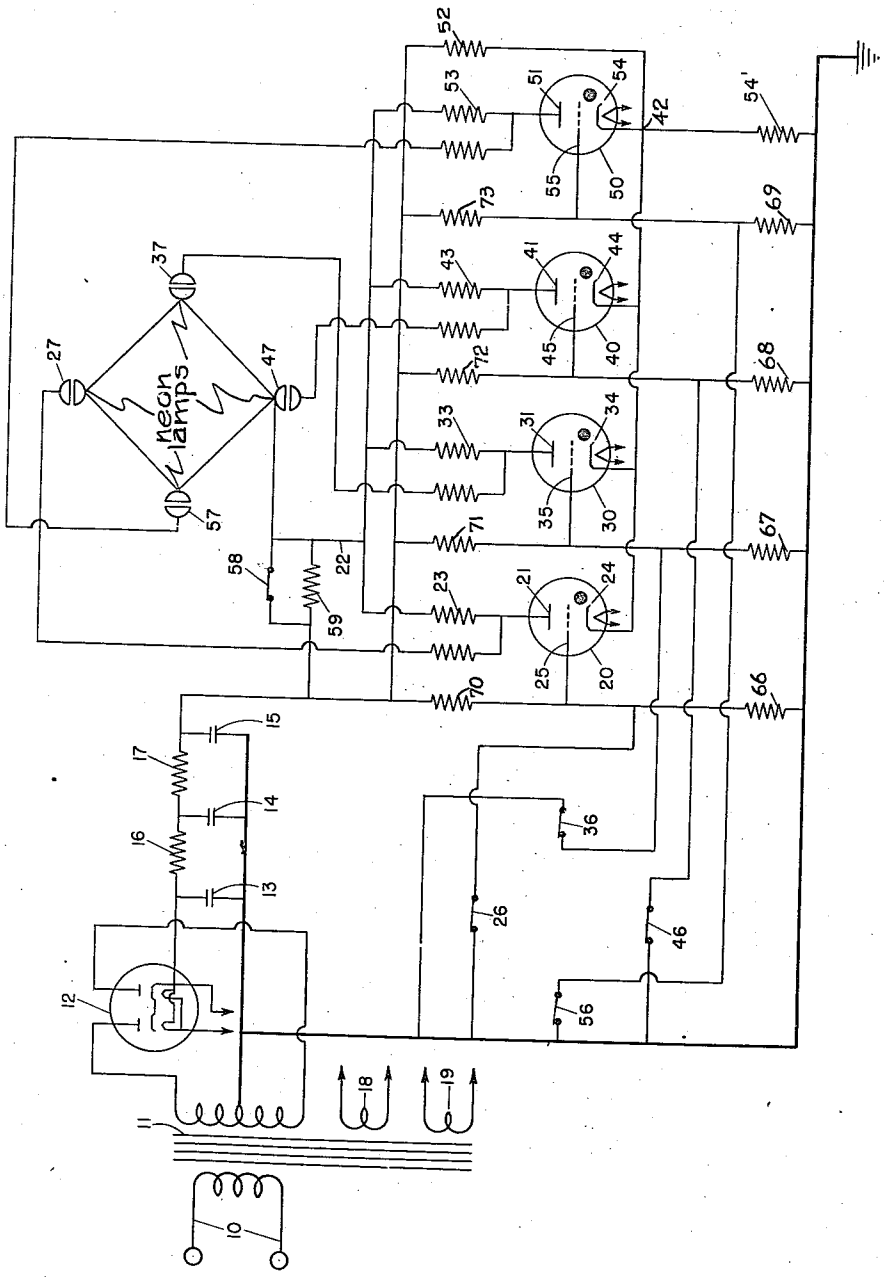
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ELECTRONIC CIRCUIT

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ELECTRONIC CIRCUIT

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2 Claims. (Cl. 177—352)

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This invention is in electronic circuits, and, specifically, it is a circuit the purpose of which is to determine which among a plurality of virtually simultaneous signals is actually the first received.

The circuit is intended especially for use in a submarine, to assist in locating the direction of the source of a shock such as that caused by the explosion of a depth charge. With information on the location of depth charge explosions, a submarine commander may, by proper selection of course, be enabled to avoid the destruction or damaging of his ship.

When the invention is used for this purpose, a plurality of spaced apart microphonic switches are employed with it. Ordinarily, all of the switches will be actuated by the same impulse. The circuit herein described and claimed determines which among the switches was first actuated and thus the direction of the source of the disturbing impulse, since obviously the switch nearest the source will be the first affected. This invention will separate signals received by successive microphones, where the time difference between the signals is no more than a millionth of a second.

It is contemplated that four switches, symmetrically arranged, be used, it being thus possible to determine the quadrant of the source of the shock. This is believed to be sufficient for submarine work. It will be apparent, however, that more microphonic switches may be used, if a closer determination is desired.

It will be obvious, also, that the usefulness of the invention is not limited to submarine work. Other military and commercial applications will suggest themselves. And, although the circuit will be herein described in connection with pressure-sensitive switches, for depth charge direction indicating purposes, for some other purposes within the scope of the invention, light-sensitive switches may be substituted, and for others, thermostatic switches.

One object of the invention is to provide a circuit to determine which among a plurality of signals received by it is first in point of time.

Another object is to provide a circuit with a plurality of switches and a similar number of indicating devices each to indicate the actuation of a particular switch, wherein the actuation of a switch and consequent energization of a portion of the circuit with an indicating device therein will disable the remainder of the circuit, and make it impossible for any other indicating device to register receipt of a signal by another switch.

Another object is to provide a circuit of the nature mentioned wherein after the actuation of a switch and resultant energization of a portion of the circuit, the actuation of any other switch can neither energize any other portion of the circuit nor disable the portion first energized.

A still further object of the invention is to provide a circuit including a plurality of electron tubes each initially capable of being ignited, wherein the ignition of one of said tubes causes the other tubes to become incapable of being ignited until the first-ignited tube is extinguished.

Other objects will appear from a reading of the following specification and claims.

The single figure of the drawing is a schematic diagram of the circuit of the invention.

Any convenient power supply may be used for the system. As shown in the drawing, an alternating current, carried by mains 10, is stepped up through a transformer 11, rectified in the vacuum tube 12, and smoothed out through the shunt capacitors 13, 14, 15, and series resistors 16 and 17.

A separate winding 18 on the transformer serves to heat the cathode of the rectifier tube 12, and a winding 19 is used to heat tubes 20, 30, 40 and 50. Neither heating circuit is shown as completed, since this would tend to confuse the diagram.

The tubes 20, 30, 40 and 50 are thyratrons, or gas-filled triodes. The properties of such tubes are well known.

The plates 21, 31, 41 and 51 of tubes 20, 30, 40 and 50, respectively, are connected to a common lead 22, through similar resistors 23, 33, 43 and 53, so that a similar positive potential may be initially applied to all plates. The exact magnitude of the applied potential will, of course, depend upon the characteristics of the tubes used.

The cathodes 24, 34, 44 and 54 of the tubes are connected to a point 42 between two resistors 52, 54' of a voltage divider in series with the direct current supply. As a result, current through any one thyratron will so increase the bias on the others as to inhibit or prevent ignition thereof.

Grids 25, 35, 45, and 55 are supplied with negative potential such as normally to prevent ignition of the tubes through normally closed switches 26, 36, 46 and 56, respectively connected across resistors 66, 67, 68 and 69 forming por-

tions of parallel voltage dividers 70, 71, 72 and 73 across the direct current supply.

Neon lamps 27, 37, 47 and 57 are provided in the plate circuits of the tubes. These are preferably to be mounted on a control panel which may be located at a distance from the principal elements of the invention, and are intended to give visual indication of the lighting of a thyratron. For some purposes, other types of indicators may, of course, be used; and, in some applications of the invention, it may be entirely feasible to note the ignition of a tube by mere inspection.

It will be seen that all of the thyratrons are initially susceptible of being ignited by the opening of the proper switch 26, 36, 46, or 56. As soon as one begins to conduct, however, the potential of its cathode and of the other cathodes rises, while the common anode potential falls, the result being that the opening of another switch will be ineffective to ignite any other tube. And, since the grid of the conducting tube can no longer control that tube, subsequent closing of its switch will not exinguish the ignited tube.

In practice, in submarine work, four microphonic switches are arranged at the corners of a square. The square may be as little as three feet on a side, but it may be larger to advantage, if convenient. The plane of the four switches is horizontal. It will be understood that these switches are located outside of the pressure hull of the submarine, and the electrical leads from the switches are brought to the interior of the vessel through water-tight fittings in the hull.

The switches may be oriented in any desired manner with respect to the submarine. One suitable manner is with two switches to port and two to starboard. Whatever the arrangement, the actuation of a switch (which will be identified by a neon lamp on the control panel) will indicate that the source of the shock was within the quadrant including the bearing of that switch, plus or minus 45°. As already stated, more switches may be employed if a closer bearing on the source of the shock is desired.

After operation of a switch and energization of a portion of the circuit, as described, no further signal will be able to ignite another tube.

By means of a switch 58, the plate circuit may be effectively opened to extinguish the ignited thyratron and the neon indicating lamp. Resistor 59, which is of the order of one megohm, prevents arcing at the switch, and adds to the accuracy of the circuit. It will be understood that the switch 58 is, like switches 26, 36, 46 and 56, normally closed.

The procedure in using the circuit for depth charge direction indicating purposes is for an operator to station himself at the switch 58, which can best be located on the control panel with the neon indicating lamps. Immediately upon observation of the ignition of a lamp, the switch, which may be a push-button, should be opened momentarily and again closed. The directions of the sources of further shocks can then be determined in the same manner.

This invention may be manufactured and/or used by or for the Government of the United States without the payment to me of any royalties thereon or therefor.

I do not intend to limit myself to the exact form of circuit above described, since it is obvious that many changes can be made therein within the spirit of the invention. I claim as my invention:

1. In apparatus of the character described, a plurality of gas-filled tubes each including a plate, a cathode and a control electrode, a direct current source, each of said tubes being provided with means normally maintaining its control electrode at a potential below that required for ignition of the tube comprising a normally closed switch connecting the control electrode to the negative side of said direct current source, and with means operable upon opening of said switch to elevate the control electrode to the potential required for ignition of the tube comprising a voltage divider in series with said direct current source and including a resistor shunting said switch, and means operable upon the ignition of any given one of said tubes to elevate the cathode potentials of the remainder of said tubes to prevent ignition of more than said one given tube comprising two resistors serially connected to said direct current source and means connecting the cathodes of all of said tubes to a point between said resistors.

2. In apparatus of the character described, a plurality of gas-filled tubes each including a plate, a cathode and a control electrode, a direct current source, each of said tubes being provided with means normally maintaining its control electrode at a potential below that required for ignition of the tube comprising a normally closed switch connecting the control electrode to the negative side of said direct current source, and with means operable upon opening of said switch to elevate the control electrode to the potential required for ignition of the tube comprising a voltage divider in series with said direct current source and including a resistor shunting said switch, means operable upon the ignition of any given one of said tubes to elevate the cathode potentials of the remainder of said tubes to prevent ignition of more than said one given tube comprising two resistors serially connected to said direct current source and means connecting the cathodes of all of said tubes to a point between said resistors, individual resistors connecting the plates of said tubes to the positive side of said current source, and means shunted across said plate resistors to indicate the passage of plate current in any one of said tubes.

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