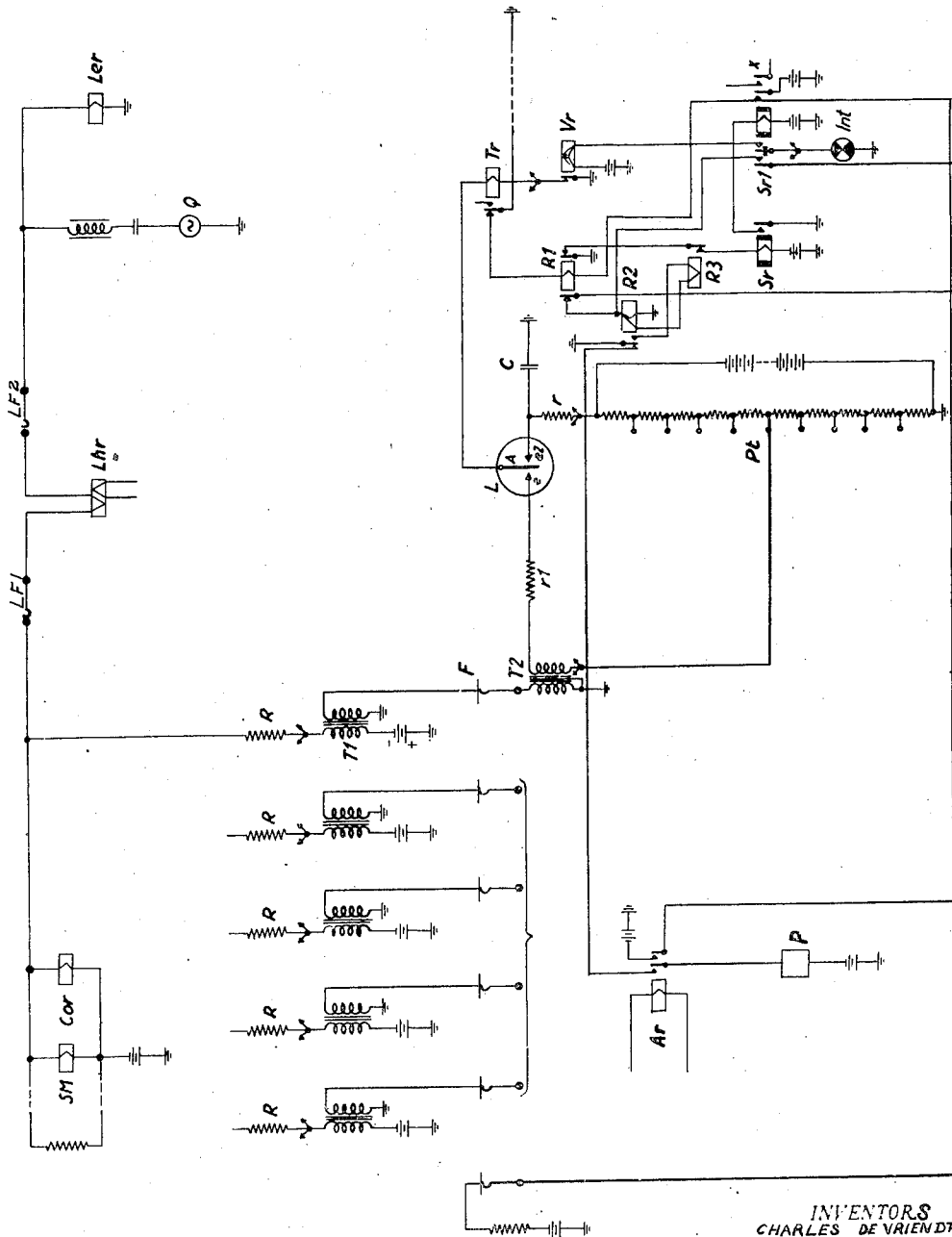


Dec. 6, 1949

C. DE VRIENDT ET AL
ELECTRICAL SIGNALING SYSTEM

2,490,038

Filed Jan. 22, 1943



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2,490,038

ELECTRICAL SIGNALING SYSTEM

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Application January 22, 1943, Serial No. 473,273
In the Netherlands June 26, 1941

Section 1, Public Law 690, August 8, 1946
Patent expires June 26, 1961

9 Claims. (Cl. 179—18)

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The invention relates to an electrical signalling system for use in automatic telephony using cold-cathode discharge tubes for the receipt of signals.

With signal receiving devices employing cold-cathode tubes it is usual for a signal to which the tube must respond to cause the receiving device to function even if the duration of the signal is very short. Such arrangements do not take into account the continuation of the original signal but only its first appearance. In many cases, however, it is necessary to make the operation of the signal receiving device dependent upon the continuation of the presence of the original signal. As an example may be mentioned the desirability in automatic telephone exchange systems of causing the apparatus to perform a required function in the case of premature release. In this case, for example, the condition exists that a subscriber has made a call thereby sending a predetermined signal to the automatic apparatus but has, thereafter, before dialing the complete number, prematurely released the connection causing the calling signal to cease. If use is made of a cold-cathode gaseous discharge tube it will, therefore, be necessary that the device in addition to responding immediately to the predetermined signal will also take account of the continuation thereof.

Other circumstances may also occur in which this provision is necessary. The discharge tube employed in such a signal receiving device will respond immediately on arbitrary short impulses which may originate in a disturbing manner due to accidentally appearing condenser discharges, induction phenomena and the like. In this case the receiving device will react as if a normal signal were received. Means have, therefore, to be provided to test whether the signal is a proper one or whether the signal is due to an accidental impulse which may cause the receiving device to function incorrectly.

According to the invention a signal receiver comprises one or more cold-cathode tubes which are maintained in working condition only during the time the signal continues, each cold-cathode tube being returned to the starting condition and thereby being again and again in a condition to respond to the signal during the time the signal continues and as a result thereafter maintaining the receiving device as a whole in the working condition.

According to another feature of the invention the signal receiver only performs its function completely after the cold-cathode tube has re-

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turned at least once to its starting condition. If, thereafter, the signal is still present the tube will again respond and only then will the signal receiver, which at the first response performs only a partial introductory function, complete its operation. By this last mentioned means the detrimental disturbing operation due to sudden spurious impulses will be avoided.

One embodiment of the invention is illustrated by the accompanying drawing in which is shown an identification circuit, subscribers lines being identified by line finders and provision being made for the possibility of premature release of a connection by a calling subscriber.

A subscriber's line provided with a service meter SM and a cut-off relay Cor is diagrammatically illustrated. LF1 and LF2 are first and second line finders provided with holding relays Lhr and Ler. A source of alternating current Q of a predetermined frequency, for example 450 cycles per second, is connected to the c-wire of a line at the second line finder. The c-wire of subscriber's line is connected to the primary winding of a transformer T1 which is common to a plurality of similar resistances R.

In the embodiment illustrated, 19 further resistances of equal value are presumed to be connected to the transformer T1 in parallel with resistance R. Similarly, 20 other subscribers' lines and resistances R are connected to each of the other four transformers similar to T1. In the secondary winding of transformer T1 a low potential only is induced. This secondary winding is connected over the terminals and brush of a finder switch F to the primary winding of a secondary transformer T2. This transformer steps up the potential taken from the brushes of line finder F to such an extent that the cold-cathode tube L is thereby fired. The tube L may be adjusted by means of a potentiometer Pt in such manner that the desired operation is obtained when the predetermined low potential is induced in the secondary winding of transformer T2. A very high resistance r1 of, for example, 500,000 ohms in the lead to the control electrode e1 insures that only very little energy will be consumed by the device.

After the tube L has fired in response to a signal, a circuit is completed for a test relay Tr. The purpose of the condenser C is to give a short pulse of a predetermined magnitude whereby a very rapid operation of the test relay Tr is obtained.

In the arrangement shown, five brushes of the automatic finder switch F hunt for a subscriber's line in, for example, an exchange of 10,000 lines,

to the c-wire of which an alternating current of 450 cycles per second is connected over the line finders LF2, LF1. A cold-cathode tube such as L is connected together with a test relay Tr to each of the five brushes, whereas that part of the circuit comprising relays R1, R2, R3, Sr, Srl, Vr and the potentiometer Pt is common to all the tubes L and the test relays Tr. As soon as the device for the identification of a call becomes operative, a starting relay Ar is energized and a circuit is closed for the power magnet P of the switch F over a front contact of Ar and back contact of relay R2. At the same time battery is connected via the outer front contact of relay Ar to the winding of relay R1 causing this relay to operate, since the circuit is closed over the back contact of test relay Tr. If, during this hunting movement which is performed by the finder brushes, a c-wire is found to which an alternating potential of 450 cycles per second is connected, the cold-cathode tube L will fire and the test relay Tr will be energized, as already described. The attraction of the armature of relay Tr opens the circuit of relay R1 which relay releases very quickly connecting the relay R2 to the sixth or test brush of the finder F for the purpose of making a direct current test.

If the line is free, the potential on the test brush will be sufficiently high to energize relay R2 which opens the circuit of the power magnet P and arrests the finder F. Over a front contact of relay R2, relay R3 is connected in series with a second low resistance winding of R2 whereby the potential on the test brush is reduced to such an extent that another finder will not react when testing this potential; thus only one identification finder will stop in the required position. Relay R3 closes a circuit over its front contact and the right hand back contact of relay R1 for a sensitive and slow release relay Sr which operates and in turn closes a circuit for another slow release relay Srl which now performs the following functions:

1. It connects the direct current test relay R2 to the sixth or test brush of the line finder independently of the contacts of relay R1.

2. It connects battery to the winding of relay R1 which thereby becomes independent of the starting relay Ar.

3. It closes a circuit for relay Vr including a common interrupter Int.

4. It closes a contact X by which further functions of the identification circuit of which the finder F forms part, are initiated.

Relay Vr opens and closes the circuit of the test relay Tr at the periodicity of the interrupter Int. In consequence the main gap of the cold-cathode tube L is periodically extinguished and this tube is, therefore, periodically restored to the condition in which it may respond repeatedly to the original signal so long as this signal appears to be present on the c-wire.

In the arrangement illustrated in the drawing, the main gap of the cold-cathode tube is extinguished by interrupting the anode-cathode circuit. It will be evident, however, that other arrangements are possible by which the gap may be extinguished, for example, by reducing the potential between the electrodes A and e2 of the main gap below the limiting potential at which discharge is still possible.

When the test relay Tr releases its armature, relay R1 again energizes. Due to the slow release operation of relays Sr and Srl, relay Srl will, however, not release if the interruption takes

place for a period of time as determined by the interrupter Int. In case, however, the time of interruption is longer because, for example, the original signal is no longer present on the c-wire and the tube L and the test relay Tr are no longer energized, then the relay Srl will release causing the circuit to be restored entirely to its original condition. If the first response of the tube L is caused by a disturbing impulse "kick" it will not again react after the first interruption of the circuit of test relay Tr which will, therefore, remain in a deenergized condition. Relay R1 is operated and relay Sr is deenergized; thereafter, relay Srl releases and is followed by the release of relays R1, R2 and R3. If the starting relay Ar is still operated, then relay R1 will remain energized and the brushes of the finder F will again start their rotation. If the starting relay Ar is not energized the finder F will remain at rest. In the case of a premature release, relay Srl will remain operated until the moment at which the alternating current of 450 cycles per second is removed from the c-wire.

One embodiment only of the invention has been illustrated and described in detail but it is to be understood that the invention is not limited to the specific embodiment described in detail. For example, in well known manner the signal receiver may be so arranged that it does not perform its complete operation upon the first response or firing of the cold-cathode tube L but only after this tube has been restored at least once to its starting condition by means of the interrupter Int. In this manner a sudden impulse "kick" will not cause the response of the signal receiving apparatus since when the second test is made the condition which initiated the operation will no longer be present.

What is claimed is:

1. In a signalling system, a signalling line, a gas discharge tube including a discharge gap, a current responsive device in circuit with said discharge gap, a control device, means under the control of said current responsive device and connecting said current responsive device to said control device for actuating said control device, means for applying a signal received over said line to said gas discharge tube to strike said discharge gap and energize said current responsive device, and means under control of said control device for periodically extinguishing said gap and restoring the current thereof to normal during the period that said signal is applied to said line.

2. In a signalling system, a gas discharge tube comprising a plurality of electrodes including a pair of electrodes forming a discharge gap, a first electric relay in the circuit of said discharge gap, a second slow-release electric relay in a circuit controlled by said first electric relay, means for applying a signal voltage to an electrode of said tube to strike said discharge gap and actuate said first relay, and means under the control of said second relay and operated during the operation thereof for periodically extinguishing said gap and restoring the circuit thereof to normal during the period that said signal voltage is applied to said tube.

3. In a signalling system, a gas discharge tube comprising a main discharge gap and an auxiliary discharge gap, a first electric relay in the circuit of said main gap, a second electric relay in a circuit controlled by said first relay, means for applying a signal voltage to said auxiliary gap to strike the said main gap and energize said first relay, and means under the control of said second relay

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and operated during the operation thereof for periodically extinguishing said main gap and restoring the circuit thereof to normal during the period that said signal voltage is applied to said auxiliary gap.

4. In a signalling system, a gas discharge tube comprising a main discharge gap and an auxiliary discharge gap, a first electric relay in the circuit of said main gap, a second electric relay in a circuit controlled by said first relay, means for applying a signal voltage to said auxiliary gap to strike the said main gap and energize said first relay, and means under the control of said second relay and operated during the operation thereof for periodically interrupting and restoring the circuit of said main gap during the period that said signal voltage is applied to said auxiliary gap.

5. In an electric signalling system a gas discharge tube comprising a main discharge gap and an auxiliary discharge gap, a first electric relay in the circuit of said main gap, a second slow-to-release relay in a circuit controlled by said first relay, means for applying a signal voltage to said auxiliary gap to strike said main gap and energize said first relay, and means under the control of said second relay and operated during the operation thereof for periodically interrupting the circuit of said first relay.

6. In an electric signalling system, a gas discharge tube comprising a plurality of electrodes including a pair of electrodes forming a discharge gap, means for applying a predetermined potential across said discharge gap, a first electric relay in the circuit of said discharge gap, a second electric relay controlled by said first relay, means for applying a signal voltage to an electrode of said tube to strike said discharge gap and energize said first relay, and means under the control of said second relay and operated during the operation thereof for extinguishing said gap and after a predetermined interval for reapplying said predetermined potential across said gap.

7. In a telecommunication system a plurality of lines, a line identifying switch comprising contacts connected to said lines and a movable wiper, a gas discharge tube having a main gap and an auxiliary gap, means for applying a predetermined potential across said main gap, an electrical coupling between said wiper and said auxiliary gap, means for applying an identifying potential to a predetermined one of said lines, means for closing a driving circuit for said switch, an electric relay in the circuit of said main discharge gap which is energized when said wiper engages said last-mentioned line and said main gap strikes, a second relay under the control of said first relay for controlling the opening of said driving circuit, and means under the control of said second relay for extinguishing said main gap and after a predetermined interval for reapplying said predetermined potential across said main gap.

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8. In a telecommunication system a plurality of lines, a line identifying switch comprising contacts connected to said lines and a movable wiper, a gas discharge tube having a main gap and an auxiliary gap, means for applying a predetermined potential across said main gap, an electrical coupling between said wiper and said auxiliary gap, means for applying an identifying potential to a predetermined one of said lines, means for closing a driving circuit for said switch, an electric relay in the circuit of said main discharge gap which is energized when said wiper engages said last-mentioned line and said main gap strikes, a second relay under the control of said first relay for controlling the opening of said driving circuit, and means under the control of said second relay for periodically extinguishing said main gap and restoring the circuit thereof to normal during the period that said identifying potential is applied to said line.

9. In a telecommunication system a plurality of lines, a line identifying switch comprising contacts connected to said lines and a movable wiper, a gas discharge tube having a main gap and an auxiliary gap, means for applying a predetermined potential across said main gap, an electrical coupling between said wiper and said auxiliary gap, means for applying an identifying potential to a predetermined one of said lines, means for closing a driving circuit for said switch, an electric relay in the circuit of said main discharge gap which is energized when said wiper engages said last-mentioned line and said main gap strikes, a second relay under the control of said first relay a test wiper for said switch, a connection from said test wiper to a winding of a test relay said connection extending over contacts of said second relay, a slow-release relay under the control of said second relay, and means under the control of said slow-release relay for periodically interrupting the circuit of said first relay.

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