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TIME MEASURING APPARATUS

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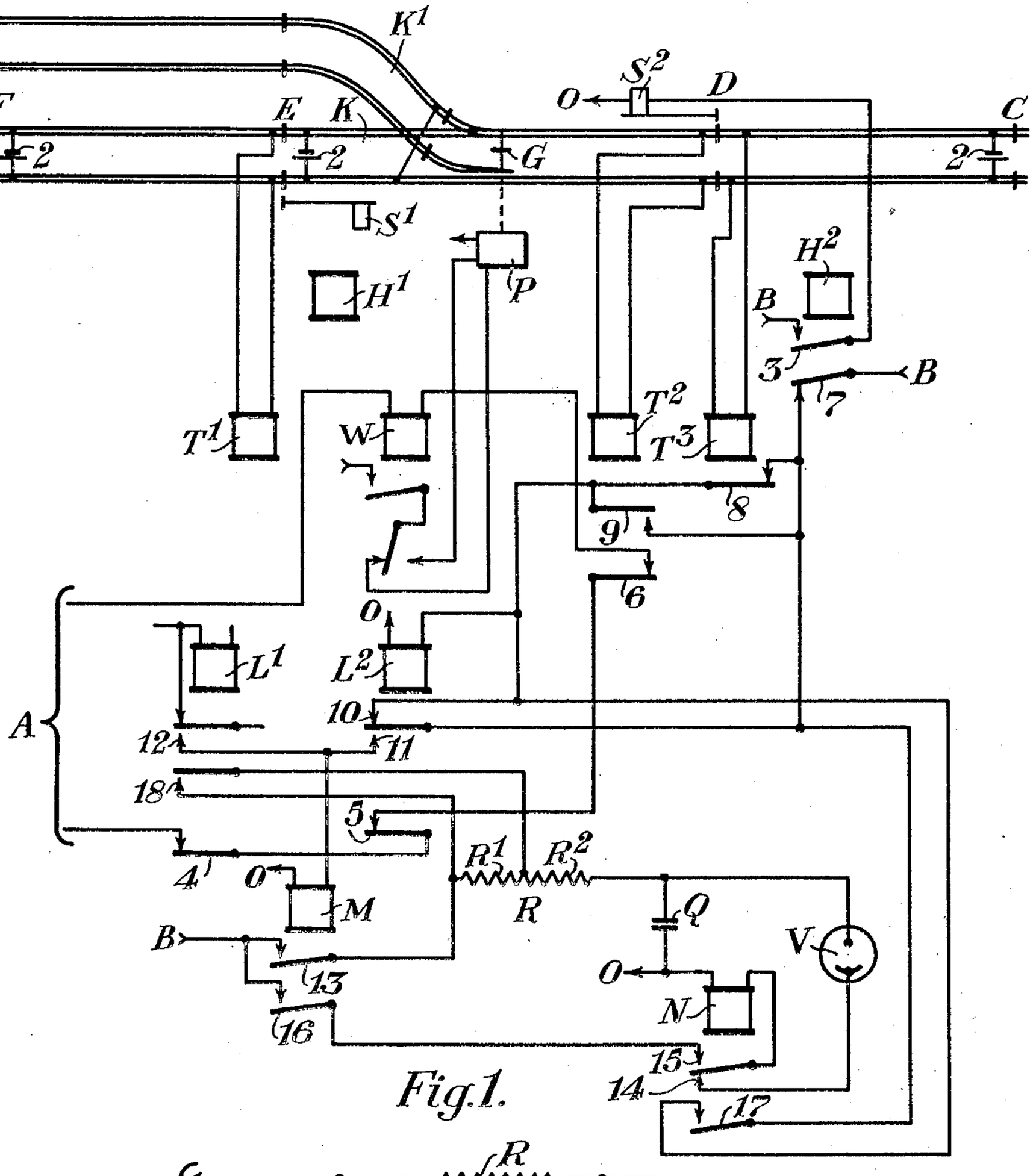

Fig. 1.

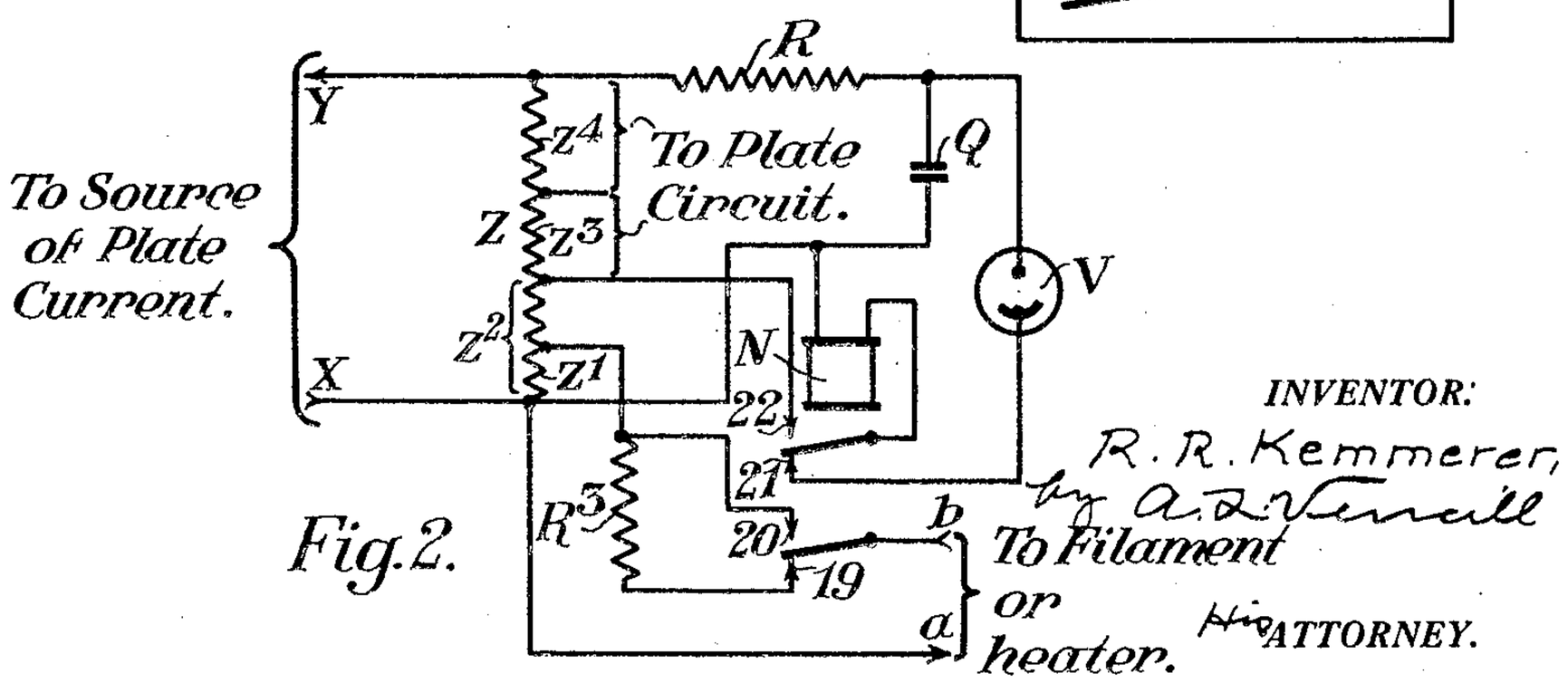

Fig. 2.

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UNITED STATES PATENT OFFICE

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TIME MEASURING APPARATUS

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My invention relates to time measuring apparatus, and particularly to apparatus of the type in which a condenser discharging through a glow tube of the neon type provides the time element.

One feature of my invention is the provision of means whereby the time element becomes effective automatically under certain conditions, as for example, in effecting the release of approach locking in railway signaling. Another feature of my invention is the provision of means whereby two or more time elements may be obtained with the same apparatus, when required.

I will describe two forms of apparatus embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawing, Fig. 1 is a diagrammatic view showing one form of apparatus embodying my invention applied to the time element release of approach locking in railway signaling. Fig. 2 is a diagrammatic view of another form of apparatus, also embodying my invention, for the time element control of energy supplied to the filament or heater of an ordinary vacuum tube and having application in radio or public address systems.

Referring to Fig. 1 of the drawing, the reference character K designates a stretch of railway track which is divided by insulated joints to form a section D—E. Located in this section is a railway switch G leading into a siding K^1. Extending from one end of this section D—E is an approach section C—D, and extending from the other end of the section D—E is a second approach section E—F. Each of the track sections is provided with a track circuit comprising a battery 2 and a track relay designated by the reference character T with a distinguishing exponent.

Traffic over the switch G is governed by a group of signals of which only S^1 and S^2 are shown, these being controlled by the signal relays H^1 and H^2, respectively. As shown in the drawing, signal S^2 is provided with a circuit which passes from terminal B of a suitable source of current, through the front contact 3 of relay H^2, and the operating mechanism of the signal S^2 to terminal O of the same source of current. The controlling circuit for signal S^1 is similar to the circuit for signal S^2, but is omitted from the drawing to simplify the disclosure. The signal relays H^1 and H^2 are controlled from a remote point, such as an interlocking tower, and also by the track relay T^2 as usual, but the controlling circuits for these relays are omitted from the drawing because they form no part of my present invention.

The switch G is provided with an operating mechanism P, which is controlled by suitable switch governing apparatus, this apparatus in the form here shown comprising a polarized relay W. The control of the switch G is such that the switch will be moved to its normal or its reverse position according as relay W is energized with current of one polarity or the other. The relay W is controlled from the same remote point as relays H^1 and H^2 over a circuit of which only a portion, terminating in the reference character A, is shown, this portion including the front contacts 4 and 5 of approach locking relays L^1 and L^2 and the front contact 6 of track relay T^2.

The approach locking relay L^2 becomes energized over either of two pick-up circuits, one of which includes back contact 7 of relay H^2 and front contact 8 of relay T^3, and the other of which includes back contact 7 of relay H^2 and back contact 9 of relay T^2. Once relay L^2 becomes energized, it will remain energized over a stick circuit which includes back contact 7 of relay H^2 and front contact 10 of relay L^2. The control circuits for approach locking relay L^1 are not shown, but it will be understood that relay L^1 is controlled in a manner similar to that just described for relay L^2.

The purpose of relay M is to initiate operation of relay N preparatory to an automatic release of the approach locking. The pick-up circuit for relay M includes back contact 7 of relay H^2 and back contact 11 of relay L^2. In similar manner, relay M may be picked up over back contact 12 of relay L^1. When relay M is picked up, a source of direct current of suitable magnitude is applied across the

condenser Q over front contact 13 of relay M and resistor R in series. The condenser Q is arranged to discharge through the tube V of the neon, or similar type, and the winding of the approach locking release relay N, in series. The tube V is of such character that it becomes conducting above a critical value of potential across its terminals, and ceases to conduct when the potential is reduced to the critical cut-off point for the tube. The condenser Q and resistor R are so proportioned that a predetermined time interval will elapse before the potential across condenser Q will reach the critical value required to start a discharge through tube V.

When tube V becomes conducting, the accumulated charge on condenser Q is released through the winding of relay N so that relay N picks up, opening back contact 14 and closing front contact 15. The relay N is so designed that the discharge impulse from condenser Q is sufficient to cause front contact 15 to close. Once relay N is picked up, it will remain energized over a circuit starting at terminal B, front contact 16 of relay M, front contact 15 of relay N, and winding of relay N to the other terminal O of the source. The picking up of relay N interrupts the discharge circuit for condenser Q at back contact 14 of relay N, and closes front contact 17 of this relay. The closing of contact 17 completes an auxiliary pick-up circuit for relay L^2 which can be traced from terminal B of the source, back contact 7 of relay H^2, front contact 17 of relay N, and winding of relay L^2 to the other terminal O of the source.

When relay L^2 picks up, the circuit for relay M is interrupted at back contact 11 of relay L^2, so that relay M will release, opening contact 16 which deenergizes relay N, and contact 13 which removes the source of potential from condenser Q. The release of relay N will close contact 14, reestablishing the discharge path for condenser Q through the tube V so that the charge on condenser Q will be drained to the level determined by the cut-off point of tube V, preparatory to a subsequent automatic release of the approach locking.

The discharge of condenser Q under this condition may not be continuous, but may occur in several steps because each discharge pulse will pick up relay N, interrupting the discharge path momentarily, until relay N releases again, caused by the holding circuit for relay N being open at contact 16 of relay M. Should this cyclical operation of relay N, following a release of the approach locking, be deemed undesirable, it can be overcome by connecting a resistor of suitable value across the condenser Q through an additional front contact on relay N, so that condenser Q may be completely discharged after relay N has become energized. It will be apparent from the above that relay N provides an automatic means for effecting the release of approach locking after the lapse of a predetermined time interval.

I shall now describe the manner in which the apparatus functions to effect an automatic release of the approach locking after a train has accepted a route set up by the operator. Assuming that a train has entered section C—D and the operator has caused relay H^2 to become energized for clearing signal S^2, the presence of a train on track section C—D will cause track relay T^3 to release, opening its front contact 8 which is in the pick-up circuit for approach locking relay L^2. Since the stick circuit for relay L^2 is also open at back contact 7 of relay H^2, relay L^2 will release and will open the circuit for switch control relay W at front contact 5, so that the switch position can not now be changed. If the operator now decides to change the route, he will release relay H^2, causing signal S^2 to assume its stop position and causing back contact 7 of relay H^2 to close, but relay L^2 cannot be picked up because front contact 8 of relay T^3, and also back contact 9 of relay T^2 are both open. However, the release of relay L^2 closes back contact 11 which causes relay M to pick up over contacts 7 and 11 in series, starting the time interval which results in the energization of relay N and the release of the approach locking, as described hereinbefore.

If a train should enter the approach section F—E in the other direction of travel, the sequence of operation of the corresponding apparatus for an automatic release of the approach locking would be similar to that just described in connection with a train on section C—D. It should be noted that I have provided an additional back contact 18 on relay L^1 which is effective in short circuiting a portion R^1 of the resistor R with relay L^1 released, so that, in the practice of my invention, it becomes possible with the same release apparatus to obtain a different time interval for each direction of traffic, suited to the speed of traffic in that direction. This result is obtained because, among other factors, the amount of resistance in the charging circuit for condenser Q determines the time interval required for the potential across condenser Q to build up to the critical discharge value. It will be understood that back contact 18 of relay L^1 can be used to control the time interval in any other suitable manner, as for example by changing the value of the potential applied to condenser Q, or changing the effective capacity of this condenser, so that my invention is not limited to the short-circuiting of a portion of resistor R as a means for varying the time element.

Referring to Fig. 2, which shows a means for obtaining the time element control of energy to the filament or heater of a vacuum tube, the reference character Z designates a

resistor connected in the usual manner across the source of plate current supply for obtaining plate voltages and a low voltage suitable for energizing the filament or heater of a vacuum tube or tubes, which are not shown, for simplicity. The resistor R, condenser Q and glow tube V are connected in a similar manner and serve the same purpose, as already described in connection with Fig. 1, namely, to introduce a predetermined time lag in the operation of relay N. Assuming that a source of direct current has been applied to the terminals X—Y, a potential will build up across condenser Q until the resistance of glow tube V is broken down, and a discharge takes place. The discharge from condenser Q will pick up relay N, opening the discharge path at contact 21 and closing contact 22 to complete a stick circuit for relay N, which relay now becomes constantly energized from the potential across portion Z^2 of resistor Z.

The drop across portion Z^1 of resistor Z is used for energizing the filament or heater of a vacuum tube, and when energy is first applied across the terminals X—Y, and before relay N has been picked up, resistor R^3 provides a means for limiting the current flowing in the filament or heater circuit due to excess potential across Z^1 until such time as the plate current load for the tubes of the system, supplied from the potential across portions Z^3 and Z^4 of resistor Z, increases to its normal value, thereby increasing the drop across Z^3 and Z^4 and decreasing the drop across Z^1. This condition is especially important if the tubes which draw plate current from across Z^3 and Z^4 are of the heater type, requiring an appreciable time for reaching their normal operating condition. The apparatus is so proportioned that condenser Q will discharge when the requisite time has elapsed, and the picking up of relay N which follows, results in disconnecting of the resistor R^3 at back contact 19 of relay N, and the closing of a direct connection through front contact 20 from the terminals of resistor Z^1 to the filament or heater circuit *a*—*b*. Contacts 19 and 20 can be of the continuity transfer type, in which case no interruption in the flow of current in the circuit *a*—*b* will result. When the energy is removed from the terminals X—Y, condenser Q will become discharged through the resistor Z and resistor R in series, so that the apparatus will be restored to the proper condition for a subsequent application of energy to the terminals X—Y. As will be apparent from the above description of Fig. 2, the apparatus therein disclosed provides a means for preventing excess voltage from being applied to the filament or other element of a vacuum tube, resulting from a transient load condition on that tube or other tubes of the system.

The tube V has been illustrated as a two-element glow tube, but it will be readily understood that other devices such for example as the grid glow tube or any suitable discharge device having a critical breakdown potential could be used to accomplish the desired result, so that my invention is not limited thereby.

Although I have herein shown and described but two applications and arrangements of time measuring apparatus embodying my invention, it is understood that the combination of resistor R, condenser Q, discharge device V and relay N may be used in any other suitable manner to interpose automatically a predetermined time interval in the operation of any desired function, various changes and modifications being possible within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In combination, a railway switch, a signal for controlling traffic over said switch, means for operating said switch, an approach locking relay for governing said means, a resistor, a condenser, a source of direct current, means for connecting said source across said condenser and resistor in series when said approach locking relay and said signal are both deenergized, an approach locking release relay, a discharge device connected across said condenser in series with the winding and a back contact of said approach locking release relay and effective to operate the relay with energy from said condenser only when the potential across the condenser exceeds a predetermined value, and means for energizing said approach locking relay when said approach locking release relay is operated.

2. In combination, a railway switch, a signal for controlling traffic over said switch, means for operating said switch, an approach locking relay for governing said means, a control relay, means for energizing said control relay when said approach locking relay and said signal are both deenergized, a resistor, a condenser, a source of direct current, means for connecting said source across said condenser and resistor in series when said control relay is energized, an approach locking release relay, a discharge device connected across said condenser in series with the winding and a back contact of said approach locking release relay and effective to operate the relay with energy from said condenser only when the potential across the condenser exceeds a predetermined value, and means for energizing said approach locking relay when said approach locking release relay is operated.

3. In combination, a main section of railway track containing a switch; two signals, one for each direction of traffic over said

switch; an approach section adjoining each end of said main section, means for operating said switch, approach locking comprising an approach locking relay associated with each of said approach sections for governing said means, a resistor, a condenser, a source of direct current, means for connecting said source across said condenser and resistor in series effective when either of said approach locking relays and the corresponding signal are both deenergized, other means governed by one of said approach locking relays for short-circuiting a portion of said resistor when said one approach locking relay is deenergized, an approach locking release relay, a discharge device connected across said condenser in series with the winding and a back contact of said approach locking release relay and effective to operate the relay with energy from said condenser only when the potential across the condenser exceeds a predetermined value, and means effective when said approach locking release relay is operated for releasing said approach locking.

4. In combination, a main section of railway track containing a switch; two signals, one for each direction of traffic over said switch; an approach section adjoining each end of said main section, means for operating said switch, approach locking comprising an approach locking relay associated with each of said approach sections for governing said means, a source of direct current, a resistor, a condenser connected across said source through said resistor when either of said approach locking relays and the corresponding signal are both deenergized and requiring a definite time interval to receive a predetermined charge, means effective when one of said approach locking relays is deenergized for changing said time interval, an approach locking release relay, means including a discharge device having a critical breakdown potential for operating said approach locking release relay with energy from said condenser when the condenser has received said predetermined charge, and means effective when said approach locking release relay is operated for releasing said approach locking.

In testimony whereof I affix my signature.

RALPH R. KEMMERER.