Sept. 7, 1943. E. W. HULLEGÅRD 2,329,048
COUNTING DEVICE WITH GASEOUS DISCHARGE VALVES
Filed Nov. 6, 1939

Inventor,
E. W. Hullegård

By: Glascock, Downing & Neubert
The present invention relates to apparatus for registering the sum of events or things occurring at different intervals and at different points.

When registering or counting events or things it is often necessary to combine the results in a single counting device in order to obtain the total of all events or things to be counted.

In carrying out the invention, electrical impulses are generated upon the occurrence of an event or the movement of a thing to be counted and such impulses taking place at various places are counted to provide an indication of the event or things to be counted. The invention includes an arrangement by which it is possible by the aid of relays and gaseous discharge tubes that a relay actuates a counting device indicating the total of all impulses. The arrangement is adapted to count every impulse even though several impulses are generated simultaneously. This feature of avoiding the dismissal of an impulse is obtained by an arrangement wherein a condenser is loaded by the aid of an impulse and the condenser then actuates the counting device common to all sources of impulses through a gaseous discharge tube.

The invention will be more thoroughly understood upon reference to the accompanying drawing and the following description wherein an exemplary embodiment of the invention is disclosed.

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

Referring to the drawing, there is shown at A a counting device for registering the total of a plurality of events or things to be counted. The apparatus includes a plurality of impulse generating means, two of which are shown generally at I and II. Each of the impulse generating means includes a switch 1 which is adapted to be moved into engagement with a contact 3 or 4 upon the occurrence of an event or the movement of a thing to be counted. The switch 1 is connected with a relay coil 2 which is passed by a current every time the switch 1 moves from one to the other of the contacts 3 or 4. The connection from the relay coil 2 is provided with a condenser 5, suitably connected to the midpoint of a direct current battery. One terminal of the battery is connected to the contact 3 and the other terminal to the contact 4. The relay is provided with a contact 6 connecting the positive terminal 9 of a direct current source and a condenser 8 and a resistance 7 the latter being connected to the negative terminal 10 of the battery. The terminal of condenser 8 in connection with the resistance 1 is also connected to the anode of a gaseous discharge valve 11. The cathode of this valve is connected to a resistance 12 common to all of the impulse generating means. The condenser 8 is loaded when one of the relays 2 is influenced at the discharge and charge of condenser 5, caused by the switch 1 shifting polarity. This loading of the condenser 8 takes place from the current source 9-10 via the resistance 7. When the voltage of the condenser 8 increases to a voltage corresponding to the glow tension of the gaseous discharge valve 11 a gaseous discharge takes place in the valve and the condenser 8 is discharged via the valve and the resistance 12 until the voltage of the condenser has dropped to an amount where the gaseous discharge ends.

A condenser 14 is connected to the wire 13 which extends between the cathodes of the gaseous discharge valves and the resistance 12 common to the impulse generating means. The other terminal of this condenser 14 is connected to the grid of a grid governed gaseous discharge valve, a thyatron or the like 15, in the anode circuit of which a relay coil 16 is arranged. An impulse to a condenser 8 and the discharge via the gaseous discharge valve 11 following this impulse, the tension of the wire 13 is increased to an amount corresponding to the voltage between the terminal of the condenser 8 minus the voltage drop in the gaseous discharge valve 11. Consequently the grid of the tube 15 obtains positive impulses via the condenser 14 causing the gaseous discharge to start and consequently the relay 16 connected in the anode circuit in the valve registers the impulse. The current source of the thyatron tube is connected between the cathode of this valve and one terminal of a contact 17 influenced by the relay and connected in series with the relay coil 16 with the effect that the current is interrupted when the relay is actuated. The discharge in the thyatron tube is interrupted by this contact in the same moment as the impulse is registered.

If more impulses enter into the relays 2 by actuation of the switches 1 each condenser 8 obtains a charge. During the discharge of a condenser 8 following a gaseous discharge in a valve 11 for instance in the impulse generating means I the voltage of the connection 13 common to the means I and II increases. The voltage drop between this connection 13 and condensers 8 in further impulse generating means the gaseous discharge valves of which have not been ignited, decreases in such a way that it is
not possible for the gaseous discharge to start in these means. Consequently the condensers are not discharged until the discharge via the ignited gaseous discharge valve has ceased followed by a decrease in voltage of the connection 13. Now the counting device has registered the first impulse and is ready to receive further impulses to be registered. When the voltage of the connection 13 is sufficiently decreased the voltage drop between the terminals of a second gaseous discharge valve 11 caused by the stored energy in a condenser 8 is getting high enough to start the gaseous discharge in the valve and a second discharge in the tube 15 is started by the voltage increase then taking place in the connection 13. Thus the stored impulse is registered by the counting device.

It is suitable to connect the condenser 8 to the current source only for a time necessary to charge the condenser to a voltage necessary to bring about the gaseous discharge in the gaseous discharge valve 11 or a voltage slightly above this. Therefore each condenser 8 is charged in the manner described from the current source 9 with the aid of relay 2 actuated by a switch 1, the relay being connected in series with a condenser 5. Should the condenser 8 be connected to the current source for a longer time it could happen that the condenser would be charged and discharged several times via the gaseous discharge valve 11 if certain values of the resistances 7 and 12 were used and consequently the device would register a plurality of impulses for one single primary impulse. This is avoided if the condenser is connected to the current source 9 during a time not being longer than necessary for the counting device to register an impulse. Of course it is possible to make this time longer by suitable dimension of the time constant partly for the system 7, 8 for the charging of the condenser partly for the circuit elements 7, 8, 11, 12 determining the discharging time for the circuit but the simplest rule to obtain a right impulse generation is given above. Naturally it is necessary to dimension the resistance 7 in such a way that the condenser 8 may be charged to the necessary voltage during the time the relay 2 is energized.

At a short loading impulse via the contact 6 the circuit elements 8, 11 and 12 are most important for the duration of the discharge through the gaseous discharge valve 11. As the condenser 14 receives a charge, also the circuit elements 14, 15 and 18 to a certain amount have an influence upon the duration of the discharge. The circuit constituted by last mentioned elements must have such a small time constant that when the condenser 14 is discharged the voltage of the grid of the valve 15 is decreased so rapidly to an amount below the voltage at which the discharge stops that it is not possible for a gaseous discharge to start once more when the contact 17 is closed after having actuated the counting device. Should this condition not be fulfilled the counting device may be actuated twice or more for one single primary impulse.

On the other hand it is necessary to choose so large a time constant that the counting device is allowed to continue a working period before the gaseous discharge in the valve 11 is stopped before the voltage of the connection 13 has decreased so far that a second impulse, stored in a condenser 8 of another impulse generating means may actuate the discharge valve of the counting device and this with such short a time interval that the relay 16 is only actuated once for two or more impulses.

I claim:

1. Apparatus for registering the sum of separate source of impulses comprising, a condenser for each source of impulses, means for charging each condenser upon the occurrence of an impulse, a gaseous discharge device connected to each condenser, a circuit extending from said gaseous discharge devices, a resistor in said circuit for discharging each condenser through the respective gaseous discharge devices whereby the discharge through one of said gaseous discharge devices lowers the voltage across the other gaseous discharge devices, a gaseous tube having a grid, a second condenser connected to said grid and said circuit, an anode circuit for said gaseous tube, a coil in said anode circuit, and a switch actuated by said coil for opening and closing said anode circuit.

2. Apparatus for registering the sum of separate sources of impulses comprising, a condenser for each source of impulses, means for charging each condenser upon the occurrence of an impulse, means for limiting the time of charging each condenser, a gaseous discharge device connected to each condenser, a circuit extending from said gaseous discharge devices, a resistor in said circuit for discharging each condenser through the respective gaseous discharge devices whereby the discharge through one of said gaseous discharge devices lowers the voltage across the other gaseous discharge devices, a gaseous tube having a grid, a second condenser connected to said grid and said circuit, between the resistor and the gaseous discharge devices, an anode circuit for said gaseous tube, a coil in said anode circuit, and a switch actuated by said coil for opening and closing said anode circuit.

ERIK WALDEMAR HULLEGARD.