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DEVICE FOR SEPARATING AND TRANSFORMING TIME PHASE MODULATED PULSE TRAINS

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Fig.1

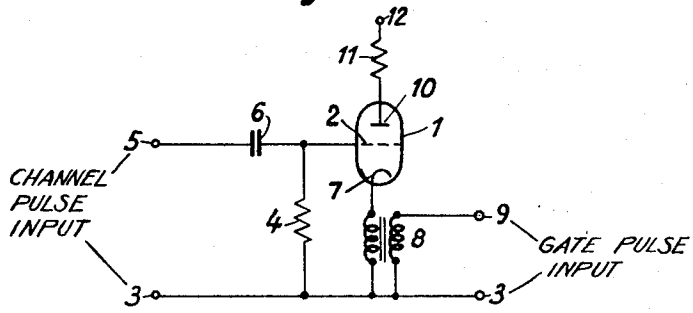
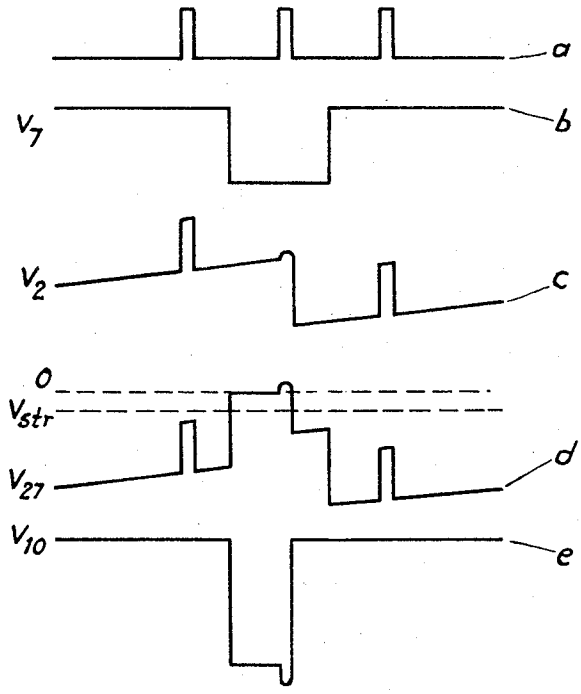


Fig.2



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DEVICE FOR SEPARATING AND TRANSFORMING TIME PHASE MODULATED PULSE TRAINS

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The present invention relates to a device for separating and transforming time phase modulated pulse trains.

A great number of devices for the same purpose are already known, but they usually have the disadvantage of being relatively complicated so that the total number of electron tubes in a single transmission system for time phase modulated pulses becomes rather large.

With this invention, however, a very simple and reliable device for separating and transforming time phase modulated pulse trains is obtained. The device of the invention affords the advantage that it is the trailing edge of the time phase modulated channel pulses and not their leading edge which determines the duration of the duration modulated pulses. When the time phase modulated pulse trains are transmitted from sender to receiver in the shape of high frequency voltage impulses, the trailing edges of the selected pulses are usually less influenced by noise than the leading edges of said pulses.

The device according to the invention comprises an electron tube the cathode current of which is normally suppressed, means to feed a gate pulse train to the cathode of the electron tube, the pulses of said train having such time phases that only those channel pulses which pertain to the channel pulse train to be selected, can arise during the times during which the respective gate pulses last, the gate pulses thereby having such a polarity and such an amplitude that they cause cathode current in the tube, and means for feeding over a condenser the time phase modulated pulse trains in the shape of pulses with positive polarity between the control grid and the cathode of said tubes and is chiefly characterized by the time phase modulated pulses having such an amplitude and the condenser such a small capacitance that during the duration of the channel pulse which arises when the tube is energized, said condenser is discharged by grid current to such a voltage that, when the channel pulse ceases, the cathode current of the tube is suppressed, the invention being further characterized by the time constant of the circuit being so great during the ensuing charging of the condenser that the cathode current of the tube is suppressed during the rest of the duration of the gate pulse as well.

The invention will be described more in detail with reference to the accompanying drawings.

Fig. 1 shows a device according to the invention. **1** is an electron tube, the control grid **2** of which is connected to ground **3** by means of a resistor **4**, and to an input terminal **5** through a condenser **6**. The cathode **7** of the tube is connected to ground through the secondary winding of a pulse transformer **8**. The primary winding is connected between a terminal **9** and ground. The anode **10** of the tube is connected through a resistor **11** to a source of anode voltage **12**.

The device operates in the following manner. All the channel pulse trains are fed to the input terminals **5**, **3**, of the device in the shape of pulses with positive polarity. Fig. 2*a* shows pulses pertaining to three different channels. Between the terminals **9** and **3** a gate pulse train

is fed, the pulses of which have such time phases, that only the channel pulses pertaining to the channel pulse train to be separated can arise during the time intervals, during which the said gate pulses last. The voltage wave form V_7 in Fig. 2*b* shows how the potential of the cathode **7** varies as a function of the time. The gate pulses on the cathode **7** thus have a negative potential. The intermediate channel pulse in Fig. 2*a* arises during the duration of the gate pulse in Fig. 2*b*, and it is thus said channel pulse which is to be selected. The cathode current of the electron tube is normally suppressed either by the grid leak **4** being connected to a source of bias voltage with negative polarity, or by the secondary winding of the pulse transformer **8** being connected not to ground but to a source of bias voltage with positive polarity, or else, as in the present device, by means of a bias voltage which operates automatically and will be described more in detail in the following. In the figure, the voltage wave form V_2 in Fig. 2*c* shows the voltage on the control grid **2** in relation to ground as a function of the time. The voltage wave form V_{27} in Fig. 2*d* shows how the difference of potential between the control grid **2** and the cathode **7** varies as a function of the time. The voltage wave form V_{10} in Fig. 2*e*, finally, shows how the voltage on the anode **10** varies as a function of the time. In Fig. 2*d*, the dotted line **0** shows the voltage zero between the control grid and the cathode whereas the dotted line V_{str} shows the cut-off voltage, i.e. the voltage for which the cathode current of the tube is cut off.

When the first of the channel pulses shown in Fig. 2*a* arises, the cathode current of the tube is thus cut off. The control grid bias voltage is chosen so that said channel pulse does not exceed the cut-off voltage, as is shown in Fig. 2*d*, and therefore the pulse cannot cause any cathode current in the tube. When the gate pulse reaches the cathode of the tube in the shape of a negative pulse, said pulse has an amplitude sufficient to produce cathode current. It may be advantageous to give the gate pulse such a great amplitude that it also causes a smaller grid current. A current is then obtained to the anode of the tube, as is shown in Fig. 2*e*. When the intermediate pulse of the channel pulses shown in Fig. 2*a* arises in the shape of a positive pulse on the control grid, said grid becomes positive in relation to the cathode, so that grid current is obtained. The condenser **6** the capacitance of which is relatively small, for example of the size 60 picofarad, is then discharged by the grid current. When the channel pulse ceases, the voltage at point **5** decreases and so does the voltage on the control grid as much as corresponds to the amplitude of the channel pulse. This voltage thereby becomes lower than the cut-off voltage so that the cathode current of the tube ceases. (See Fig. 2*d*.) During the rest of the duration of the gate pulse the condenser **6** is slowly charged through the resistor **4** the resistance of which is very high, for example 5 megohms. The charging takes place so slowly that the grid voltage has no time to rise to the cut-off voltage value during the rest of the duration of the gate pulse. When the gate pulse ceases, the potential on the cathode of the tube rises quickly so that the grid-cathode voltage is further substantially reduced. The condenser thereafter continues to be charged slowly, but the time constant for the charging circuit is so great that the cathode current of the tube is cut-off until the next gate pulse is fed to the terminals **9** and **3**. If the channel pulse trains fed to the terminals **5** and **3** are time phase modulated, a pulse train pertaining to a certain determined channel is obtained on the anode **10**, said train being duration modulated. If said pulse train is for example fed to a low pass filter the cut-off frequency of which is lower than half the repetition frequency of a separate channel pulse train, the signal obtained after the filter is the signal which

has originally time phase modulated the pulses pertaining to the actual channel.

A corresponding or equivalent device may be obtained if the electron tube is replaced by one or more transistors.

I claim:

1. A network for selecting a single pulse from a channel pulse train, said network comprising a first pair of input terminals for connection to a source of channel pulses and a second pair of input terminals for connection to a source of gate pulses, one terminal of each pair being connected to ground, an electron tube having an anode, a cathode and a control grid, an impedance means connected to the cathode of said electron tube and said gate pulse terminals, a network means including a capacitance means connected to the control grid of said electron tube and said channel pulse terminals, said network means having a long time constant in comparison with the repetition rate of the channel pulses whereby the presence of the first channel pulse during the application of a gate pulse to the tube charges said network means and the resultant grid current produced by said channel pulse removes a charge on said network means and causes the cathode current to cease upon termination of the channel pulse thus selected, said network means thereafter blocking said tube to prevent the production of cathode current during the remainder of the gate pulse, the selected pulse appearing between the anode and the ground.

2. A network according to claim 1 wherein said network means is a resistance-capacitance filter network.

3. A network according to claim 1 wherein said impedance means comprises a pulse transformer having a primary winding and a secondary winding, the primary winding being connected across the pair of gate pulse terminals and the secondary winding being connected to the cathode and ground.

4. A network according to claim 1 wherein said network means is a resistance-capacitance filter network having a time constant such that the tube is blocked at the arrival of the channel pulse next anterior of the selected one.

5. A network for selecting a single pulse from a channel pulse train, said network comprising a pair of input terminals for connection to a source of channel pulses and a pair of input terminals for connection to a source of gate pulses, one terminal of each pair being connected to ground, an electron tube having an anode, a cathode and a control grid, a pulse transformer having a primary winding and a secondary winding, the primary winding being connected across the pair of gate pulse terminals and the secondary winding being connected to the cathode and ground, and a network means including a capacitance means connected to the grid and the other terminal of the input terminals for the channel pulses and a resistance means connected across the terminals for the channel pulses, said network having a long time constant in comparison with the repetition rate of the channel pulses whereby the presence of the first channel pulse during the application of a gate pulse to the tube charges said network means and the resultant grid current produced by said channel pulse removes the charge on said network means and causes the cathode current to cease upon termination of the channel pulse thus selected, said network means thereafter blocking said tube to prevent the production of cathode current during the remainder of the gate pulse, the selected pulse appearing between the anode and ground.

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