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PEAKING CIRCUIT

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Fig. 1

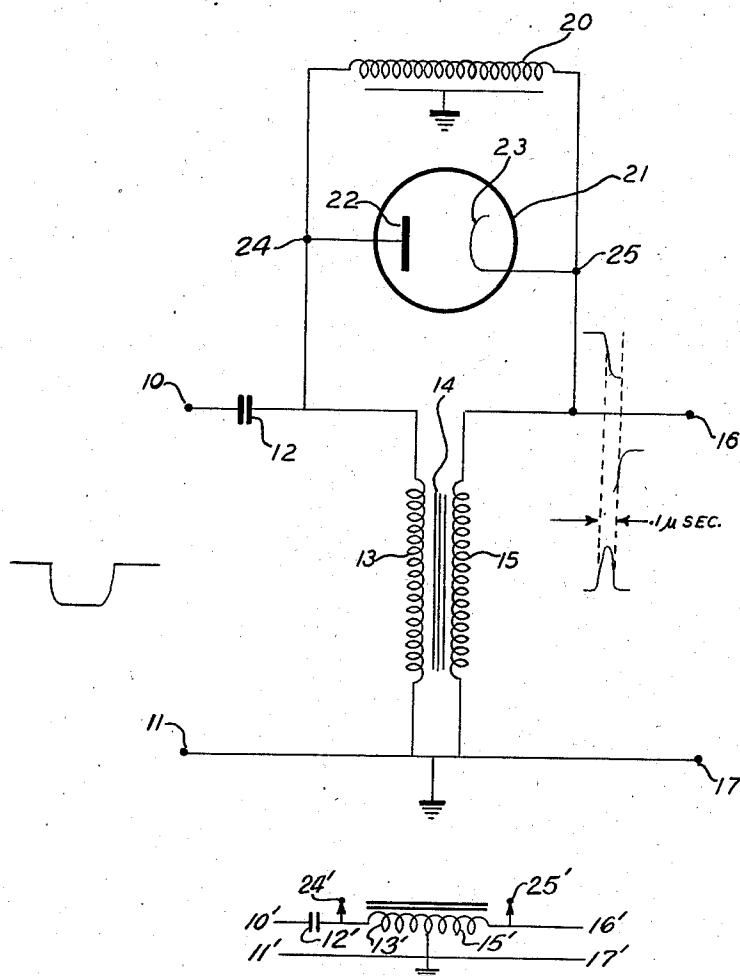


Fig. 2

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UNITED STATES PATENT OFFICE

2,443,790

PEAKING CIRCUIT

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4 Claims. (Cl. 178-44)

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This invention relates to a communication system and particularly to a system for the formation of sharp pulses. In radar and television systems, as well as in general applications, it frequently becomes necessary to generate a sharp pulse having a short time duration. Usually such pulses may be generated from a rectangular voltage wave by so-called peaking or differentiating circuits consisting of a combination of resistance and capacitance or resistance and inductance, having a time constant small in comparison to the shortest period of the component frequencies involved. However, in many practical instances, the voltage wave available for peaking may be far from rectangular due to frequency characteristics of the circuit, particularly characteristics caused by the presence of large amounts of distributed capacitance. Under such circumstances the usual peaker circuits will not provide desired peaker action. This invention provides a system wherein an effective peaker action is obtained over a wide range of input voltage wave forms.

A related circuit is disclosed in my co-pending application, Serial No. 518,154, filed Jan. 13, 1944.

The invention in general provides for a pulse transformer associated with a delay line and rectifier in such a fashion that the desired action takes place. In order that the invention may be more fully understood, reference will now be made to the figures diagrammatically showing the invention.

In Fig. 1, an input circuit 10 and 11 has a coupling condenser 12 and a primary 13 of a pulse transformer 14 connected therein as shown. Pulse transformer 14 is of the type well known in this art, comprising a transformer having comparatively small primary and secondary windings disposed over a laminated core of thin metal sheets. The transformer is characterized by very low distributed capacitance and low leakage reactance and may cover a band of frequencies whose upper limit may be of the order of 75,000 or even 100,000 cycles per second. The transformer ratio, as a rule, is quite low and in this instance may be unity. The secondary 15 is connected to terminal 16 and 17 of the output circuit. For convenience, terminals 11 and 17 may both be grounded.

Connected across windings 13 and 15, these being in series for this purpose, is an inductance 20 having such a value and having such distributed capacitance as to constitute a delay line having an accurate predetermined delay, such as for example $\frac{1}{10}$ microsecond. Connected in shunt

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across delay line 20 is a diode 21. As shown here, the diode is connected with its anode 22 on the input side of the delay line and cathode 23 on the output side. This may be reversed, however, in which case the system will operate in a manner reverse to the system as shown.

Fig. 2 shows an alternative view of the transformer of Fig. 1. Similar points and connections have been similarly designated as prime numbers.

The system is adapted to be supplied with the voltage pulses available for peaking. Such pulses may have any desired duration and may represent the voltage pulses present in various portions of a radar system or may actually represent the envelope of the detected output of a large target echo. For convenience, the voltage pulse is shown as negative in character, although this is immaterial.

The operation is as follows. The initial drop in voltage passes through coupling condenser 12 which is preferably of a small value. The negative voltage front passes down through primary 13 of the pulse transformer to ground. This induces a voltage in secondary 15 of substantially the same value and about the same shape. However, the polarity of secondary 15 is such that terminal 16 is positive with respect to ground. At the same time, the negative voltage wave passing through delay line 20 (the polarity is such that diode 21 is non-conducting) also reaches output terminal 16. Thus, in output 16, there is generated first a positive voltage and then about $\frac{1}{10}$ microsecond later, the negative voltage from delay line 20 appears to complete a pulse having a time duration of about $\frac{1}{10}$ microsecond.

The tail of the rectangular voltage pulse applied to input 10 may, as far as diode 21 is concerned, be considered as a positive voltage. Thus diode 21 becomes conducting. This, in combination with the action of pulse transformer 14, serves to effectively suppress the operation of the system on a voltage rise in the positive direction. In fact, the rise of voltage in a positive sense will tend to be dissipated by going through windings 13 and 15, the magnetic fields tending to neutralize each other and thus providing a ground of low resistance and low impedance. As a rule, the ohmic resistance of pulse transformers is quite low so that where there is a tendency for magnetic fields to neutralize each other, dissipation in the system shown will occur readily.

By varying the amount of delay in line 20, the characteristics of the pulse in the output may be controlled. While the transformer ratio in pulse

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transformer 14 has been assumed to be unity, it may be desirable to depart from this somewhat to compensate for losses or suppress any tendency for oscillations. Thus, some pulse shaping may be obtained by controlling the amount of delay in line 20 together with the relative values of voltage peaks fed through delay line 20 and from secondary 15.

It is preferred to have coupling condenser 12 small since the time constant of the system for voltage variations in a positive sense is a function of the product of condenser 12 and resistance of diode 21. Naturally if the pulses follow each other rapidly, it is important that the entire system, as shown, becomes stabilized quickly after a voltage variation in a positive sense so that the next cycle may occur. Furthermore, a small capacitance will tend to prevent any floating action of the condenser with respect to ground.

It is clear that if diode 21 is reversed, the system will operate in the same manner except that potential variations in a positive sense will be peaked while potential variations in a negative sense will be suppressed.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent is:

1. In a system of the character described, a pulse transformer having a primary and secondary, an input circuit connected across the primary, an output connected across the secondary, said primary and secondary having one terminal of each in common, a delay line connected across the other input and output terminals and forming a shunt across the series-connected primary and secondary of the transformer, and a rectifier connected across said delay line, said system being adapted to be fed by recurring voltage pulses and yielding an output consisting of a voltage peak for one side of each input pulse.

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2. A peaking circuit including a transformer having a primary and secondary, an input circuit connected across said primary, an output circuit connected across said secondary, and a delay line connected between one end of said primary and one end of said secondary, said circuit being adapted to be fed by recurring voltage pulses and yielding an output of peaked voltage pulses.

3. In a system of the character described, a transformer having primary and secondary windings, one terminal of each winding being connected together, a delay line connected between the other terminals of the windings to transmit an impulse applied to said other terminal of said primary winding to said other terminal of said secondary winding, delayed and opposite in polarity to the impulse induced on said other terminal of said secondary winding by said applied impulse through said transformer, and rectifier means connected across said transformer to short circuit impulses of one polarity.

4. In a system of the character described, a delay line, and a transformer having a primary and a secondary winding, means to apply an impulse to said primary and said delay line to transmit to said secondary a delayed pulse opposite in polarity and closely following the impulse induced in said secondary, and rectifier means connected to said transformer to short circuit impulses of one polarity.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,224,134	Blumlein	Dec. 10, 1940