

April 22, 1947.

A. EASTON

2,419,340

PULSE WIDENING CIRCUITS

Filed Aug. 7, 1945

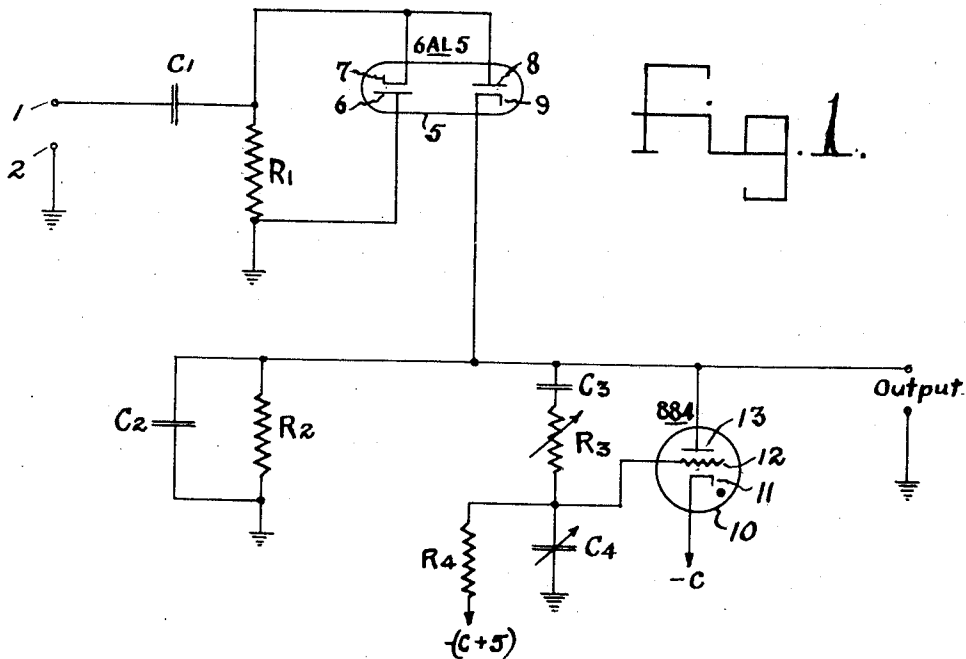


Fig. 1.

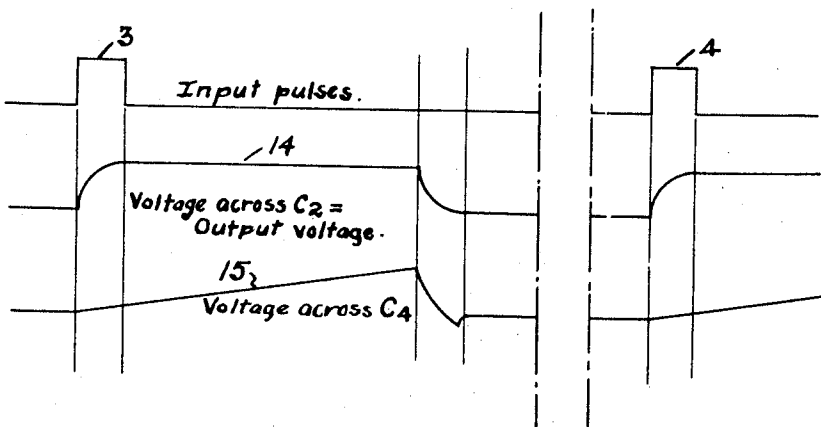


Fig. 2.

INVENTOR.
Allan Easton
BY *Darby & Darby*
Attorneys.

UNITED STATES PATENT OFFICE

2,419,340

PULSE WIDENING CIRCUITS

Allan Easton, Long Island City, N. Y., assignor
to Emerson Radio and Phonograph Corpora-
tion, New York, N. Y., a corporation of New
York

Application August 7, 1945, Serial No. 609,478

3 Claims. (Cl. 320-1)

1

For many purposes it is desirable to widen narrow pulses of electrical voltage as, for example, for integration purposes. In connection with such widening it is usually desirable, and frequently essential, that the amplitude of the widened pulse be unchanged, or at least continuously proportional to the input pulse amplitude.

The object of my invention is to provide an electrical circuit which will effect lengthening (widening) of a pulse without changing its amplitude or by making it of any desired amplitude, the extent of the widening being controllable in any desired relationship with respect to the amplitude of the input pulse.

In the drawings—

Figure 1 is a circuit diagram illustrating my invention; and

Figure 2 is a series of curves illustrating its operation.

In Figure 1 an incoming pulse may be received over the input terminals 1, 2. This pulse may, for example, be of one microsecond duration as illustrated by the pulses 3 and 4 of Figure 2. The arrangement of the circuit and the elements used are clear from the drawings, it being necessary to state only that the tube 5 is illustrated as a double diode tube which may be of the 6AL5 type having anodes 6, 8 and cathodes 7, 9, and the tube 10 is illustrated as a gas tube of the 884 type having a cathode 11, grid 12, and anode 13. A vacuum tube could be substituted for the tube 10 although the performance would not be as good.

In the operation of my circuit, the positive input pulse 3 is received across the input terminals and charges the condenser C₂ to nearly the peak value of the pulse through the diode elements 8, 9. This charge is indicated by the curve 14 of Figure 2. When the pulse input decays to zero the capacitor C₂ begins to discharge through the resistance R₂. However, the time constant of the resistance-condenser combination R₂, C₂ is so great that for a relatively long period the charge on C₂ remains substantially constant, decaying very slowly.

The voltage across C₂ is also impressed simultaneously on the anode 13 of the tube 10 causing the anode to become positive. At the same time, the grid 12 becomes more positive slowly at a rate determined by the time constant of the circuit R₃, C₄. This rate may be controlled by varying the resistance R₃ or the condenser C₄ or both, and accordingly varying the duration or width of the output pulse. The condenser C₃ is made large as compared with condenser C₄ and is used to prevent the charge on condenser C₂ from leaking off through resistances R₃ and R₄.

2

The potential across C₄ is indicated by the curve 15 of Figure 2. When this potential reaches the critical firing potential the gas in the tube 10 ionizes and C₂ is completely discharged through the tube, thus reducing its potential, and the potential of the anode 13, to substantially zero as indicated by the curve 14. When this occurs the tube 10 deionizes and the circuit is ready for the next cycle.

The value of the negative bias -C and -(C+5) is selected to insure that the condenser C₂ will be discharged to ground potential and not above or below. If, however, the condenser C₂ should be discharged below ground potential so that the grounded plate is positive with respect to the other plate this potential will immediately leak off through the diode 5 through the path of anode 6 to cathode 7 and anode 8 to cathode 9.

As stated above, the amplitude of the output pulse may be controlled to have any desired value, for example, a value equal or smaller than the amplitude of the input pulse. It will be noted that the width of the output pulse may also be made to have a value such that

$$\text{Output pulse width} = \frac{k}{\text{input pulse amplitude}}$$

where k may be any desired constant, depending on the units used. If $k=1$ the output pulse width will of course be inversely proportional to the input pulse amplitude.

The tube 5 serves the function of providing a low resistance path of about 200 ohms in shunt to resistance R₁ through which the condenser C₂ may be quickly recharged to ground potential in the event it discharges to below ground potential, as has been described above. It also provides for direct current reinjections so that there will be no loss in peak pulse amplitude as the duty cycle is increased.

The delay network R₃, C₄ could be replaced with a delay network of a different type such as a delay multivibrator, or square wave generator. This would make the output pulse width completely independent of input pulse amplitude.

Approximate values for the various elements shown which may be used in the operation of my invention are as follows:

Condenser C ₁	-----microfarads	.1
Condenser C ₂	-----do	600 to .01
Condenser C ₃	-----do	.01
Condenser C ₄	-----micromicrofarads	1000 or 2000
Resistance R ₁	-----ohms	100,000
Resistance R ₂	-----megohms	10
Resistance R ₃	-----do	1
Resistance R ₄	-----do	1

It will be understood by those skilled in the art that my invention is capable of various modifications and I do not desire, therefore, to be restricted to the particular details shown and described but only within the scope of the appended claims.

What is claimed is:

1. A pulse widening circuit comprising a condenser which may be charged by an incoming pulse, a delay network connected to said condenser to be operative after a predetermined interval, and a radio tube connected to said delay network through which said condenser is discharged after said interval.

2. A pulse widening circuit comprising a condenser charged by an incoming pulse, a delay network connected across said condenser, a radio tube having an anode, grid and cathode with its anode-cathode circuit connected across said condenser and its grid connected to said delay network, whereby a potential is impressed upon said grid to discharge said condenser through said anode cathode circuit after a predetermined interval.

3. A pulse widening circuit comprising a condenser charged by an incoming pulse, a diode

through which said condenser is charged, a delay network connected across said condenser, a radio tube having an anode, cathode and control electrode with its anode-cathode circuit connected across said condenser and its control electrode connected to said delay network, whereby said condenser is discharged through said anode-cathode circuit after a predetermined interval, and a second diode connected in series with said first diode in a conductive direction across said condenser.

ALLAN EASTON.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
20 2,179,105	Sidney -----	Nov. 7, 1939
2,320,916	Dawson -----	June 1, 1943
2,188,970	Wilson -----	Feb. 6, 1940

FOREIGN PATENTS

Number	Country	Date
25 548,618	Brit. -----	Oct. 16, 1942

Disclaimer

2,419,340.—*Allan Easton*, Long Island City, N. Y. PULSE WIDENING CIRCUITS.
Patent dated Apr. 22, 1947. Disclaimer filed Mar. 18, 1949, by the assignee,
Emerson Radio & Phonograph Corporation.

Hereby enters this disclaimer to claims 1 and 2 of said patent.

[*Official Gazette April 19, 1949.*]