

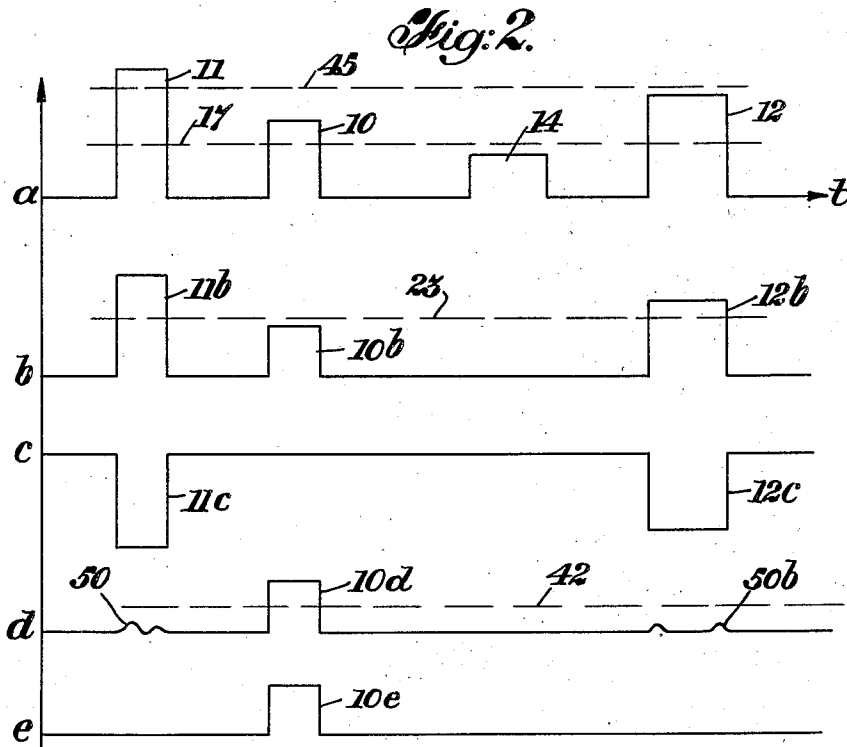
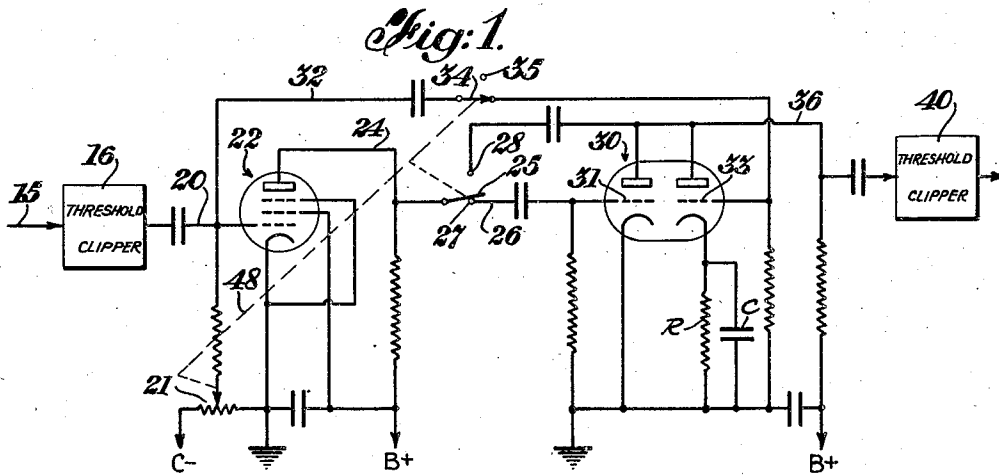
April 29, 1947.

D. D. GRIEG

2,419,548

DISCRIMINATOR CIRCUIT

Filed May 15, 1943



INVENTOR.
DONALD D. GRIEG
BY *Percy P. Lantzy*
ATTORNEY

UNITED STATES PATENT OFFICE

2,419,548

DISCRIMINATOR CIRCUIT

Donald D. Grieg, Forest Hills, N. Y., assignor to
Federal Telephone and Radio Corporation,
Newark, N. J., a corporation of Delaware

Application May 15, 1943, Serial No. 487,071

11 Claims. (Cl. 178-44)

1

This invention relates to radio impulse systems and more particularly a system for eliminating those pulses of a pulse modulated wave which differ in amplitude from a wanted pulse or pulses.

In my copending application Serial No. 467,516, filed December 1, 1942, methods and means are disclosed for selectively filtering a wave modulated with pulses differing in amplitude so as to eliminate from the pulse modulated wave those pulses of greater and/or lesser amplitude than a wanted pulse.

It is an object of my present invention to provide a simplified method and means in addition to those disclosed in my aforesaid copending application for selectively filtering a wave modulated with pulses differing in amplitude.

According to my invention, a wave modulated with pulses differing in amplitude is applied to a threshold clipper arranged to threshold clip the wave at an amplitude greater than the smaller amplitude pulses but less than the given amplitude of a wanted pulse. The wave is also applied to a second threshold clipper arranged to clip, amplify and invert in phase that portion of the wave above the amplitude of the wanted pulse. The outputs of these two threshold clippers are mixed together in a mixer tube whereby the inverted pulse energy of the second clipper subtracts from the pulse energy obtained from the first clipping operation whereby the output pulses of the mixer corresponding to the greater amplitude pulses are at least rendered less than the amplitude of the output pulse which corresponds to the wanted input pulse. Should there be more than one pulse in the input wave greater in amplitude than the wanted pulse and such greater pulses also differing from each other in amplitude, it will be desirable to again threshold clip the output of the mixer stage to eliminate those pulses which correspond to the greater pulses which now are less than the pulse corresponding to the wanted pulse of the input wave.

For a further understanding of the invention, reference may be had to the following detailed description to be read in connection with the accompanying drawing, in which:

Fig. 1 is a schematic wiring and block diagram of a pulse filtering system according to my invention; and

Fig. 2 is a graphical illustration of the operating steps thereof.

Referring to the figures of the drawing, curve *a* of Fig. 2 represents an input wave modulated with pulses of various amplitudes. Pulse 10 is a wanted pulse of a given amplitude while pulses

2

11 and 12 are two pulses of greater amplitude which in themselves differ in amplitude. The wave is also shown to be modulated with a pulse 14 which is of less amplitude than the wanted pulse 10. This wave is applied at the input 15 of a known threshold and amplifying clipper 16 which preferably is adjusted to clip the wave at an amplitude level 17. This amplitude level as shown on curve *a* is selected greater than the amplitude of pulse 14 but less than the amplitude of pulse 10. This clipping operation results in curve *b* having pulses 11*b*, 10*b* and 12*b*. The pulse 14 has been eliminated.

The wave according to curve *b* is applied through connection 20 to a second threshold and amplifying clipper 22 which preferably is adjusted by control resistor 21 to threshold clip the wave of curve *b* at a level 23. This level 23 is greater than the amplitude of pulse 10*b* but less than the amplitudes of the unwanted pulses 11*b* and 12*b*. The output of the clipper stage 22 is taken from the plate connection 24 so that the upper portion thus clipped is inverted in phase as indicated by the pulse energy 11*c* and 12*c* of curve *c*. This inverted energy is applied to an input connection 26 of a mixer stage 30 through the movable switch contact 25 in contact with a terminal 27 connected to a grid 31 of the mixer.

As shown in Fig. 1, the mixer stage 30 comprises a conventional double triode stage. The output energy of the threshold clipper 16 is also applied to the mixer stage 30 through a connection 32 to a second grid. The mixer stage is preferably provided with a threshold level by the voltage developed across the resistor-condenser network R-C which serves to eliminate lower amplitude fluctuation noise occurring between pulses. The output anode connection 36 of the mixer stage, however, is shown for purposes of illustration connected to a third threshold clipper 40, whereby a low threshold clipping level 42 operates to eliminate any pulse energy such as pulses 50 and 50*b* less in amplitude than wanted pulse 10*d*. The mixer stage, of course, may be provided with adjustable means to selectively vary the threshold level thereof to perform the clipping operation of clipper 40. Clipper 40 may then be omitted.

From the foregoing description, it will be clear that the pulse energy represented by curves *b* and *c* are mixed in the mixer stage 30. This mixing operation causes the inverted pulse energy of curve *c* to cancel a corresponding portion of the corresponding pulse energy of curve *b*. This results in an output wave for the mixer

stage corresponding to curve *d*. Although the unwanted pulses 11 and 12 are of different amplitudes, both of these pulses may be substantially eliminated by this mixing operation by making the threshold clipper 22 sufficiently sensitive. In order to eliminate the small pulses 50 and 50b, which result practically due to the finite build-up and decay time of the pulses, from the wanted pulse 10d, the threshold clipper 40 is arranged to clip the energy at the level 42 substantially equal to or greater than the amplitude of the unwanted pulses 50 and 50b. This, of course, will not only eliminate from the wave *d* these pulses but also any noise fluctuations that may be present thereby resulting in a final output pulse 10e amplified by the clipper 40 and corresponding to the wanted pulse 10 of curve *a*. As hereinbefore pointed out this last clipping may be performed by the mixer stage 30 thereby eliminating clipper 40.

Should it be desirable to select the greater pulse 11 from the curve *a*, this may be accomplished by adjusting the threshold clipper 22 to clip at a level 45 and by shifting the movable contacts 25 and 34 to contacts 23 and 35 respectively. This may be done by ganging the controls of contacts 25 and 34 with the adjustable contact of resistor 21 as indicated by the broken line 48. This eliminates all of the pulses with the exception of pulse 11 which by-passes the mixer 30. The threshold clipper 40 in this case may also be by-passed or the clipping function thereof eliminated.

While I have shown the wave *a* modulated with pulses having similar leading and trailing edges, the system will discriminate as to amplitude for pulses having different build-up and decay times. In the latter case, the cancellation operation of the mixer will, of course, result in a fluctuation more pronounced than the fluctuations 50 and 50b which result from cancellation of pulses 11 and 12.

Where I refer in the description and the appended claims to "pulse modulated wave," I use this expression in a generic sense to include trains of pulses formed by either pulse modulation of radio frequency carriers or by pulse modulation of electrical currents, such, for example, as direct current. It will therefore be clear that my invention is applicable to radio systems and also to systems using line transmission such, for example, as telegraph systems.

While I have described the principles of my invention in connection with a specific system, it will be clearly understood that the system herein illustrated and described is given only by way of example and not as limiting the scope of my invention as set forth in the object and the appended claims.

I claim:

1. A method of eliminating from a pulse modulated wave those pulses of greater and lesser amplitude than a given amplitude comprising threshold clipping the wave at an amplitude greater than the smaller amplitude pulses but less than said given amplitude, threshold clipping and inverting in phase that portion of the wave clipped above said given amplitude, and mixing the inverted pulse energy with the pulse energy obtained by the first-mentioned clipping operation, whereby the output pulses corresponding to the greater amplitude pulses are substantially eliminated giving a pulse output corresponding to those pulses of said given amplitude.

2. A method of eliminating from a pulse modu-

lated wave those pulses of greater and lesser amplitude than a given amplitude comprising threshold clipping the wave at an amplitude greater than the smaller amplitude pulses but less than said given amplitude, threshold clipping and inverting in phase that portion of the wave clipped above said given amplitude, mixing the inverted pulse energy with the pulse energy obtained by the first-mentioned clipping operation, whereby the output pulses corresponding to the greater amplitude pulses are less than said given amplitude, and threshold clipping said output pulses to eliminate those output pulses less than said given amplitude.

3. A method of eliminating from a pulse modulated wave those pulses larger than a given amplitude comprising threshold clipping and inverting in phase the portion of the wave above said given amplitude, and mixing the inverted pulse energy with energy of said modulated wave whereby the output pulses corresponding to greater amplitude pulses are substantially eliminated thereby giving a final pulse output corresponding to those pulses of said given amplitude.

4. A method of eliminating from a pulse modulated wave those pulses larger than a given amplitude comprising threshold clipping and inverting in phase the portion of the wave above said given amplitude, mixing the inverted pulse energy with energy of said modulated wave whereby the output pulses corresponding to the greater amplitude pulses are at least less than said given amplitude, and threshold clipping the output of said mixing operation to eliminate those pulses less than said given amplitude.

5. A system for eliminating from a pulse modulated wave those pulses of greater and lesser amplitude than a given amplitude comprising means to threshold clip the wave at an amplitude above the smaller amplitude pulses but less than said given amplitude, means to threshold clip and invert in phase that portion of the wave above said given amplitude, means to mix the inverted pulse energy with the output pulse energy of said first-mentioned clipping means, whereby the pulse output corresponding to the greater amplitude pulses is at least less than said given energy amplitude, and means to threshold clip the output of said mixing means to eliminate those pulses less than said given amplitude.

6. A system for eliminating from a wave modulated with pulses of different amplitudes those pulses larger than a given amplitude comprising means to threshold clip and invert in phase that portion of the wave above said given amplitude, and means for mixing the inverted pulse energy with the wave energy whereby the pulse output corresponding to the greater amplitude pulses is substantially eliminated.

7. The system defined in claim 6, wherein the energy mixing means includes means biasing it to a given threshold level to eliminate low amplitude fluctuations between pulses of said given amplitude.

8. A system for eliminating from a wave modulated with pulses of different amplitudes those pulses larger than a given amplitude comprising means to threshold clip and invert in phase that portion of the wave above said given amplitude, means for mixing the inverted pulse energy with the wave energy whereby the output pulses corresponding to the greater amplitude pulses are less than said given amplitude, and means to threshold clip the output of said mixing means

5

to eliminate those output pulses less than the pulses corresponding to said given amplitude.

9. A system for selectively filtering a wave modulated with pulses differing in amplitude comprising a threshold clipper means to adjust said threshold clipper to clip and invert in phase that part of the wave greater than a given amplitude, means to mix the modulated wave and the inverted energy to obtain a pulse output corresponding to the pulses of said given amplitude, a circuit by-passing said mixer means, means for selectively applying the output of said clipper means to said mixer means and to said by-pass means, and means ganging the selective means with the clipper adjusting means, whereby the pulses of said given amplitude and pulses of amplitude greater than said given amplitude are selectively isolatable from said wave.

10. A method of eliminating from a pulse modulated wave those pulses larger than a given amplitude comprising threshold clipping and am-

6

plifying a portion of the larger unwanted pulses to obtain pulse energy of the unwanted pulses in inverted form, and mixing the inverted pulse energy with energy of said modulated wave whereby the output pulses corresponding to greater amplitude pulses are substantially eliminated thereby giving a final pulse output corresponding to those pulses of said given amplitude.

11. A system for selecting wanted pulses of a given amplitude from a train of pulses including pulses of amplitude greater than said given amplitude comprising means to threshold clip and invert in phase a portion of the pulses of greater amplitude, means for mixing the inverted pulse energy with the wave energy whereby the larger pulses are reduced below said given amplitude, and means to threshold clip peak portions of the wanted pulses at a level above the reduced pulses.

DONALD D. GRIEG.