

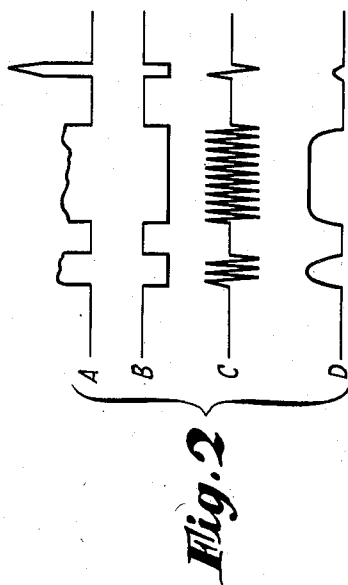
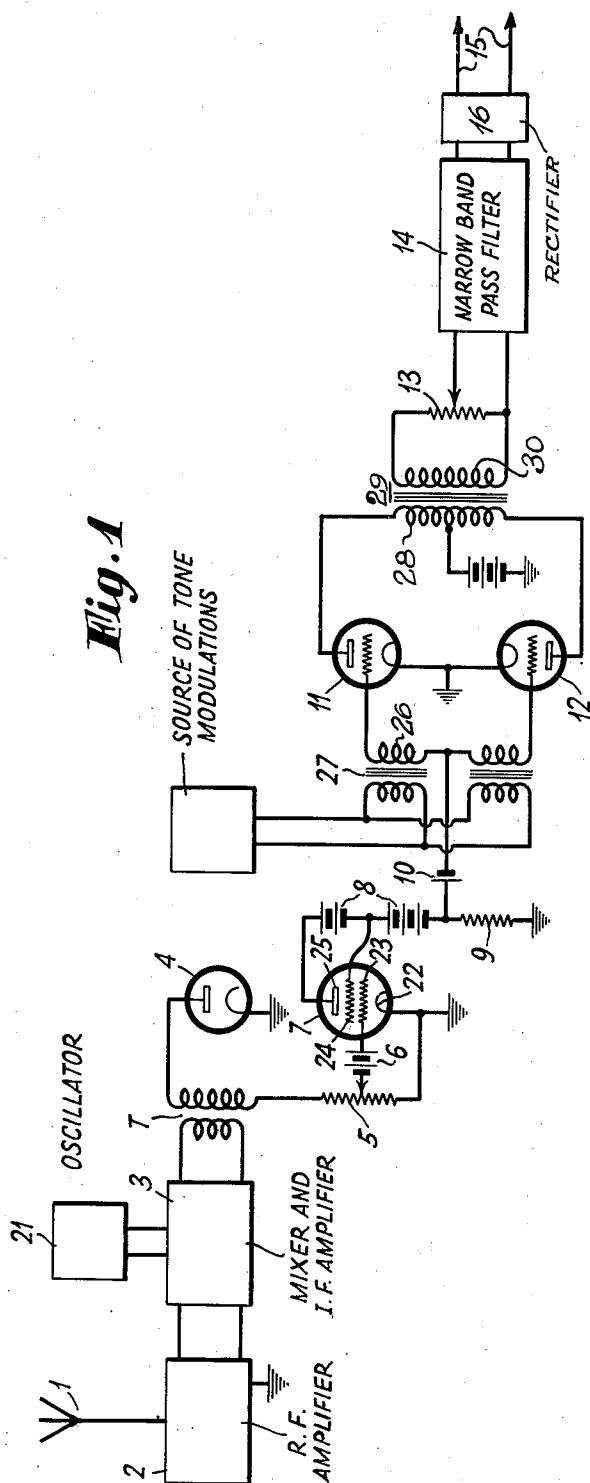
July 29, 1941.

H. O. PETERSON ET AL

2,250,550

INTERFERENCE SUPPRESSOR FOR RADIO RECEIVERS

Filed Nov. 29, 1938



INVENTORS
HAROLD OLAF PETERSON
R. LEE HOLLINGSWORTH
BY *H.B. Sworer*
ATTORNEY

UNITED STATES PATENT OFFICE

2,250,550

INTERFERENCE SUPPRESSOR FOR RADIO RECEIVERS

Harold Olaf Peterson and R. Lee Hollingsworth,
Riverhead, N. Y., assignors to Radio Corporation
of America, a corporation of Delaware

Application November 29, 1938, Serial No. 242,878

4 Claims. (Cl. 250—8)

This invention relates to an interference suppressor for a radio receiver. More particularly our invention is intended for use in radio telegraphic reception for the purpose of limiting the voltage of the signalling energy as applied to the receiving devices, applying tone modulations to the interrupted carrier wave signals, and filtering out the product of the tone modulator mixer through a suitable band-pass filter having the desired characteristics for reducing certain types of atmospheric static and man-made static.

It is an object of our invention to provide a circuit arrangement which renders a radio receiver relatively free from interference such as atmospheric and man-made static.

Another object of our invention is to provide a system including a voltage limiter, a balanced modulator, and a narrow band filter which are so co-ordinated as to obtain satisfactory signal reception while greatly attenuating the effects of noise-clicks and other short impulses.

A still further object of our invention is to improve the conditions for radio telegraph signal reception so that mutilation of the signals shall be reduced to a minimum.

The foregoing and other objects of our invention, together with a full description of the means and methods to be adopted in carrying out these objects, are set forth in the following specification, reference being made to the accompanying drawing in which—

Figure 1 shows a preferred circuit arrangement, and

Fig. 2 shows a group of related graphs by which the theory of operation is more fully explained.

Referring to Fig. 1, we show diagrammatically therein the essential apparatus for carrying out the invention. The telegraph signals are received on an antenna 1 of any suitable type and applied to a radio frequency amplifier 2. If a heterodyne receiver is to be employed, then, by means of a local oscillator 21 and a mixer circuit (not shown) which may be understood to be included in the apparatus group 3, an intermediate frequency wave may be derived and after amplification applied to the primary winding of a transformer T, the secondary of which is in circuit with the rectifier tube 4 and on the other side with a resistor 5 leading to ground. A rectified current which flows through the resistor 5 is used to control a voltage limiter tube 7 which preferably comprises a cathode 22, a control grid 23, a screen grid 24 and an anode 25. The output circuit of this voltage limiter tube may be traced from the grounded cathode through a re-

sistor 9, the direct current source 8, and thence to the anode 25. This tube 7 is rendered conductive when no signal is received and is biased to cut-off by a rectified signal. In the conductive state the potential of the negative terminal of the source 8 with respect to the cathode is such as to block two amplifier tubes 11 and 12 which are disposed in a push-pull relationship to one another. The control grid circuit for these tubes includes the secondary winding 26 of a transformer 27, this secondary 26 having a mid-tap which is connected through a biasing source 10 with the negative terminal of the anode current source 8 for the tube 7.

The transformer 27 has a primary which may, if desired, be constituted by one or two separate windings. Two windings are shown in the diagram by way of example and these are connected in parallel to a source of tone modulations (not shown). The output circuit of the tubes 11 and 12 includes the center-tapped primary winding 28 of an output transformer 29. The secondary 30 of this transformer delivers an interrupted tone modulated signal to a narrow band pass filter 14, the amplitude of this signal being controlled by a potentiometer 13. The output energy from the filter 14 is preferably rectified by a device 16, the direct current terminals 15 of which may be connected to any indicating or recording device.

In the operation of the circuit arrangement of Fig. 1 it will be seen that whenever signal or noise energy is collected by the antenna 1 a rectified current is caused to flow through the resistor 5, which current blocks the tube 7. The consequent reduction of the plate current of this tube to zero places a normal bias on the control grids of the tubes 11 and 12. The tone frequency modulations are, therefore, impressed upon the push-pull output circuit of these tubes and the resultant operation of the transformer 29 is such as to apply the modulations to the filter 14. When, however, a no-signal condition exists the current conducted through resistor 9 and the tube 7 is such as to bias the grids of the tubes 11 and 12 sufficiently to block these tubes. Hence no tone modulations are applied to the filter 14.

Four wave graphs A, B, C and D are shown in Fig. 2. Graph A represents typically the time plot of a dot, a dash and a short click of high amplitude. Curve B shows the product of the voltage limiter which reflects the dots, dashes and interference energy at a common amplitude level. Curve C shows the resultant of the tone modulated waves as applied through the push-

pull amplifier under control of the voltage limiter. Zero current prevails whenever the tubes 11 and 12 are biased to cut-off. Graph D shows the rectifier output from the unit 16 as impressed on the terminals 15 in consequence of the tone modulated input energy applied to that filter. It will be particularly noted that the rectified signal as fed to the utilization circuit shows a gradual rise of signalling energy from a zero point so that interference waves of very short duration do not have time to build up to the amplitude level of the dot and dash signals. This is a characteristic of the operation of the narrow band filter since it does not respond to sudden changes. A comparison of graph D with graph A shows, therefore, how effectively the static impulses and other interference waves of short duration are suppressed. In fact, the filter barely responds to such impulses and they do not cause the recorder to make any appreciable response.

It will be understood by those skilled in the art that our invention is susceptible to various modifications without departing from the spirit thereof. The scope of the invention is, therefore, limited only in accordance with the claims.

We claim:

1. In a radio telegraph signal receiving system, the method of suppressing the effects of short bursts of static and other momentary interference phenomena which accompany the reception of useful radiant signal energy, which method comprises heterodyning said radiant energy with local oscillations to produce an intermediate frequency wave, rectifying said wave, producing a substantially square mark-and-space signal wave which is a limited derivative of the rectified wave, locally generating a tone frequency potential, keying said potential under control of said square wave, and filtering the keyed tone frequency potential in such manner as to suppress an initial cycle thereof which occurs at the front edge of a marking element of said signal wave, and also to suppress the effects of a momentary burst of static received during a spacing element of said signal wave.

2. In a radio telegraph signal receiver, an electronic voltage limiter operable by incoming signals, a balanced circuit arrangement comprising two discharge tubes having input electrodes connected to opposite secondary terminals of an in-

put transformer and anodes connected to opposite primary terminals of an output transformer, a connection from the output side of said voltage limiter to a mid-tap on the secondary of said input transformer, a source of direct current negatively connected to the cathodes of said discharge tubes and positively connected to the anodes thereof through a mid-tap on the primary of said output transformer, a tone-frequency modulator in driving connection with a primary on said input transformer, and a narrow band-pass filter having input terminals in driven connection with a secondary on said output transformer.

3. In a radio telegraph signal receiver electronic means for limiting the effects of incoming signalling and interference energy, a push-pull tone modulator circuit comprising a pair of discharge tubes having grid-biasing means symmetrically connected thereto, means interconnecting the limiting means and the grid-biasing means in such manner as to simultaneously shift the control bias of said pair of tubes from a cut-off point to a working point, and vice versa, in response to the operation of said limiting means, and a narrow band-pass filter fed with energy from said tone modulator, said filter being characterized in that it is relatively insensitive to an initial cycle of output energy from said tone modulator.

4. Apparatus for suppressing the effects of transient bursts of static and other momentary interference phenomena comprising, a radiant energy collector and amplifier, a push-pull discharge tube stage under control of signaling output energy from said amplifier, a voltage limiter interposed between said amplifier and said push-pull stage, means for locally generating tone modulations, means for feeding said tone modulations to said push-pull stage while simultaneously causing said modulations to be keyed on and off by said limiter in accordance with marking and spacing intervals of said signaling energy, and a narrow band-pass filter connected to the output side of said push-pull stage and having a time constant such that the effects of said transient bursts of static are substantially suppressed.

HAROLD OLAF PETERSON.
R. LEE HOLLINGSWORTH.