

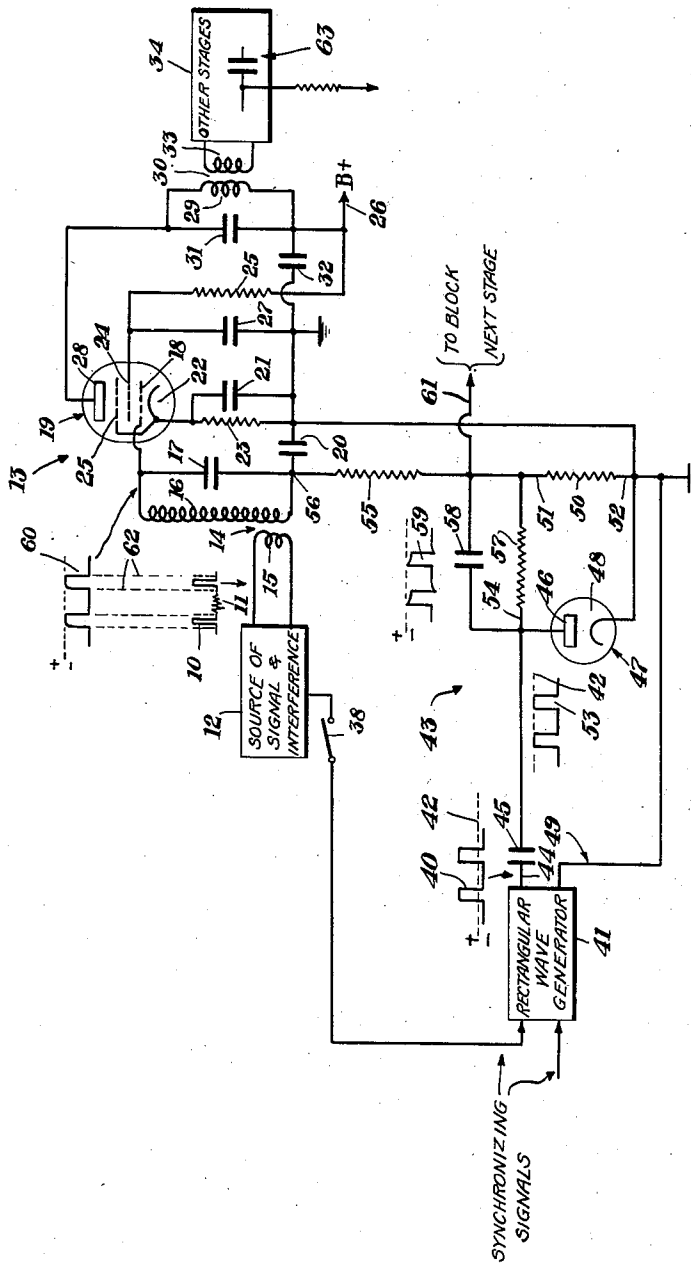
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SIGNAL TRANSLATOR BLOCKING CIRCUIT

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SIGNAL TRANSLATOR BLOCKING CIRCUIT

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This invention relates to the blocking of electronic circuits, such as for example one or more stages of a receiver.

Blocking has many uses in connection with the operation of electronic circuits. For example blocking is used in radio receivers to eliminate interfering pulses or transients. In multiplex signalling systems it is used to separate and channelize at the receivers separate signal trains. In both the foregoing instances the desired pulses are selected by blocking the receiver during the major portion of the period between reception of the desired pulses, thereby suppressing the unwanted pulses or other transients reaching the receiver during said period.

Blocking is also used in obstacle detection systems but in a somewhat different manner. Since the receiver is intended to accept only the reflections of the transmitted pulses, the receiver is blocked while the transmitted pulses are radiated by the transmitter. Thus the transmitted pulses are suppressed in the receiver. The receiver is then unblocked and ready for acceptance of the reflection or echo pulses.

In signal pulse receivers, the signal pulses are arranged to pass through one or more blocking mixer stages. The blocking voltages, which may be derived from or synchronized with the incoming signal pulses, are applied through a blocking voltage injector circuit to said stage. A difficulty encountered in such stages is that the application of the blocking voltages affects the sensitivity and balance of the stage during its conductive periods, and frequently gives rise to undesirable transients.

One object of the present invention is to provide for the blocking of the blocking mixer stage without appreciably altering its sensitivity during its conducting periods or otherwise adversely affecting it.

In practicing this invention it is preferred that the blocking voltages have a substantially rectangular wave form. By proper shaping, said wave form may be made of exactly the right height and width without excess or inadequacy in either dimension. This results in greater efficiency and better operating characteristics for the receiver stage affected.

Tuned circuits may be associated with a blocking mixer stage. If a rectangular wave is used for blocking, the steep edges of the wave may shock-excite the circuits and produce undesirable oscillations.

It is a still further object of the present inven-

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tion to modify such waves to avoid shock-excitation of the receiver circuits.

Other and further objects and advantages of the present invention will become apparent and the foregoing will be best understood from the following description of an embodiment thereof, reference being had to the drawing in which the figure is a schematic circuit and block diagram of a part of the receiver including a blocking mixer stage in association with a blocking voltage injector circuit arranged according to the principles of this invention.

Signals 10 intermixed with interference, such as for example a transient 11, are derived from a suitable source 12. Source 12 may be one of the R. F. or I. F. stages of the receiver or any other suitable stage. The signals illustrated are spaced pulses which may be time modulated or modulated according to other known principles.

The signals and interference are introduced into a blocking mixer stage 13 by a suitable input transformer 14 having a primary 15 and a secondary 16 tuned by a condenser 17. The blocking mixer stage 13 may be any stage of the R. F. or I. F. amplifier or any other suitable stage of the receiver, for example, a special stage for this purpose, and its input circuit need not necessarily be tuned. More than one blocking mixer stage may be employed.

In the grid circuit of said stage, one end of the secondary 16 of input transformer 14 is connected to the control grid 18 of a vacuum tube 19, while the other end of said secondary is connected in series with condenser 20 and by-pass condenser 21 to the cathode 22 of tube 19. A grid-biasing resistor 23 is arranged in the cathode lead in parallel with condenser 21. It will be noted that condenser 20 blocks the application of the potential drop across resistor 23 to the grid. The arrangement for applying this potential will be described hereinafter.

In the screen grid circuit screen grid 24 is connected through a suitable voltage-dropping resistor 25 to a source of positive potential 26. A suitable by-pass condenser 27 is connected between screen grid 24 and ground.

In the anode circuit, anode 28 is connected through the primary 29 of an output transformer 30 to the source of positive potential 26. The primary 29 is tuned by a condenser 31. Of course, in certain stages it may not be necessary, or desirable to tune the output. By-pass condenser 32 connects the lower end of primary 29 to ground. The secondary 33 of transformer 30 is connected

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to other stages 34 of the receiver and/or some other form of utilization device.

Rectangular wave pulses 40 are preferably used to produce the desired blocking or de-blocking voltages, as the case may be. These pulses 40 may be generated by any well-known form of rectangular wave generator 41. In a pulse receiver the rectangular wave generator 41 may be controlled and synchronized by the signal pulses in any suitable selected stage of the receiver as is indicated by the switch connection 38. In an obstacle detection system, pulses from the pulsing generator, which supplies pulses to the transmitter, may be the means of controlling the rectangular wave generator 41. In both the foregoing instances the frequency of the rectangular blocking pulses is preferably equal to the repetition frequency of the wanted or transmitted pulses or a harmonic thereof. In still other systems the rectangular wave generator may be independent of such control and may be arbitrarily timed.

In signal pulse receivers, where the purpose of blocking is to suppress transients occurring between the desired signal pulses, the rectangular pulses 40 are timed, so that the crests of said rectangular pulses are coincident with the signal pulses and the troughs of said rectangular pulses occur in the intervals between said signal pulses. The troughs occupy at least a major portion of the time between succeeding signal pulses. Where said signal pulses are time modulated, the crests of the rectangular pulses must be made wide enough to allow for the maximum deviation of the signal pulses from their normal position. Various methods of accomplishing this are well known to those versed in the art and are therefore not described here.

The rectangular pulses 40 are of alternating current and have their zero axis located approximately as indicated by line 42. The crests of said pulses are therefore positive. If said pulses were applied to the grid 18 of tube 19, the positive crests of such pulses would affect the operation of said tube during its conducting periods.

To prevent this a direct current component is applied so that the crests of pulses 40 are established at zero direct current potential. This is accomplished by means of the following direct current restoring circuit which is a part of the blocking voltage injector circuit 43.

One side 44 of the rectangular wave generator 41 is connected through condenser 45 to the anode 46 of a diode 47 which, together with its circuit serve to restore the D. C. The cathode 48 is grounded as is the other side 49 of the generator 41. When side 44 of the generator is positive with respect to ground, diode 47 will conduct, thereby charging condenser 45. The time constant of the discharge circuit for this condenser is made of sufficient value to maintain a substantially constant potential thereon from pulse to pulse.

Condenser 45 has its negative side connected through network 57, 58 to end 51 of load resistor 50. The positive side of condenser 45 is connected through the generator 41 to ground and to end 52 of load resistor 50. Thus the potential on condenser 45 appears across resistors 57 and 50 with end 54 negative. As viewed from the load resistor, condenser 45 is also in series with the rectangular pulse generator. These pulses also appear across load resistors 50 and 57, but since they are in effect in series with the poten-

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tial across condenser 45, the direct current zero level of the pulses appearing at end 54 is virtually shifted upward. By proper selection of the various parameters, condenser 45 will have a potential sufficient to shift the zero axis of the pulses so that at end 54 of resistor 57 the crests of the pulses will be established substantially at zero direct current potential. The generated pulses 40 would appear as pulses 53 with the zero direct current axis at the crests of the pulses.

To apply the blocking voltages appearing across resistors 50 and 57 to the grid 18 of tube 19 I prefer to connect end 52 of resistor 50 to ground and end 51 through another resistor 55 to a point 56 intermediate condenser 20 and one end of the secondary 16 of input transformer 14. Condenser 20 and resistor 55 serve as an isolating network for the direct current return, isolating the signal pulses in the blocking mixer stage from the blocking injector circuit 43, thereby enabling application of these blocking voltages to other stages. However, such network would discriminate between the higher and lower frequency components of the rectangular pulses and thereby distort their waveform. To correct this a compensating network consisting of resistor 57 with condenser 58 arranged in shunt is arranged in series between the anode 46 of diode 48 and load resistor 50. By selecting correct parameters the blocking voltage appearing across resistor 50 will have the waveform designated by the numeral 59. When these pulses 59 pass through the isolating network they will have substantially the shape designated by the numeral 60. It will be seen that the blocking voltages 60 are of substantially rectangular form except that one edge is slightly curved. This slight curve was produced as will be obvious to those versed in the art by the correct selection of the parameters of the networks. Pulses of this shape because of the slight curve of the edge will not shock-excite the tuned circuits in the blocking mixer stage. In time modulated pulsing systems, the crests of the blocking voltages are made wide enough to accommodate the maximum modulation deviation of signal pulses 10, shown by dotted lines 62, from their normal position.

It will be apparent that by connecting lead 61 to the next stage in the receiver, which stage may be similar to the blocking mixer stage 13, two stages will be blocked simultaneously. An isolating network 63 should be used in making this connection to the next stage and to any other stages. This network may be similar to the isolating network including condenser 20 and resistor 55 which was hereinabove described. Thus this blocking arrangement can be applied to as many other stages as is desired while using only one blocking voltage injector circuit 43.

In the blocking mixer stage it is desirable that by-pass condensers 21, 27 and 32 should be of sufficient capacity to by-pass not only the signal frequencies but also the blocking voltage frequencies, for otherwise various complicating effects may be produced.

While I have described and illustrated my invention in connection with one embodiment it is obvious that it may be employed in other connections. For example, while I have described one form of my invention in connection with a receiver it is obvious that it is applicable to any electronic circuit nor is it essential that the electronic circuit be one designed for the transmission of pulses for it may also be used with other forms of electrical energy. Therefore while I

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have described above the principles of my invention in connection with one form of apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of my invention as set forth in the objects thereof and the appended claims.

I claim:

1. A method of blocking an electronic signal translating circuit including an electrical space discharge device having a control element and associated tuned circuits, comprising generating a wave of substantially rectangular form, adding a direct current component to said wave to establish the crests thereof at substantially zero direct current potential, shaping at least one edge of the rectangular waveform to change the substantial right angle between said edge and the adjacent portion of the pulse into a gradual curve, and applying said wave to the control element and said associated tuned circuits to block conduction through said device during the troughs of said wave, whereby shock excitation is substantially reduced to negligible proportion in said tuned circuits.

2. In an electronic signal translating circuit the combination, comprising an electronic circuit for the translation of signals including an electrical space-discharge device having a control electrode; means for generating a wave having a rectangular form; means for adding a direct current component to said wave so that the crests of the wave are at substantially zero direct current potential; means for applying said wave to said control electrode including an isolating network connecting said adding means to said electronic circuit to keep the signals in said electronic circuit out of said adding means, said isolating network discriminating between the higher and lower frequency components of said rectangular wave to thereby distort the form thereof, and a compensating network connected with said isolating network and cooperating therewith to retain the substantially rectangular form of said wave.

3. The combination set forth in claim 2 in which the electronic circuit includes at least one tuned circuit and said networks are arranged to produce curved leading edge portions on said wave to prevent shock-excitation of said tuned circuit.

4. A blocking voltage injector circuit for association with one or more stages of an electronic circuit for signal translation, comprising means for generating a wave of substantially rectangular form, means connected with said generating means for adding a direct current component to said wave to establish the crests thereof at substantially zero direct current potential, and an isolating network for each of said stages connecting the direct current adding means to said stage and isolating the signals in said stage from the direct current adding means.

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5. A circuit according to claim 4 wherein said isolating network discriminates between the high frequency and low frequency components of said rectangular waveform, and including a compensating network connected with said isolating network and cooperating therewith to retain the substantially rectangular form of said wave.

6. A blocking voltage injector circuit for association with one or more selected stages of an electronic circuit for signal translation, each of said stages including a tuned circuit, comprising means for generating a wave of substantially rectangular form, means connected with said generating means for adding a direct current component to said wave to establish the crests thereof at substantially zero direct current potential, an isolating network for each stage connecting the direct current adding means to said stage and isolating the signals in said stage from the direct current adding means, said isolating network discriminating between the high frequency and low frequency components of said rectangular waveform, and a compensating network connected with said isolating network and cooperating therewith to retain the substantially rectangular form of said wave, said networks being arranged to produce a curved leading edge portion on said waveform to prevent shock-excitation of said tuned circuits.

7. For use with electronic signal translating means, the combination, comprising means for generating spaced signal pulses, means having a plurality of stages responsive to said pulses and also to transients that may occur between them, means synchronized with said pulses for generating a substantially rectangular waveform having a frequency substantially equal to the repetition frequency of said pulses, means for adding a direct current component to said wave to establish the crests thereof at substantially zero direct current potential, and means for applying said wave to at least one stage of the pulse responsive means in a direction to block substantially all of the interval between successive pulses.

MAXWELL C. DEITMAN.

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