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TIMING CIRCUIT

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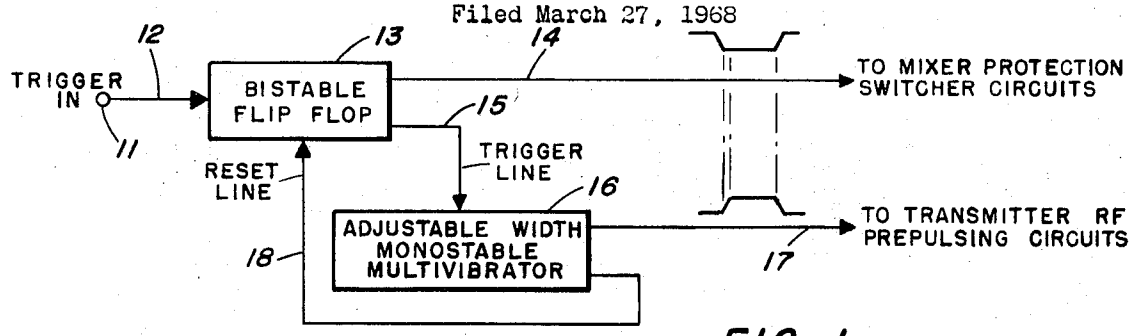


FIG. 1

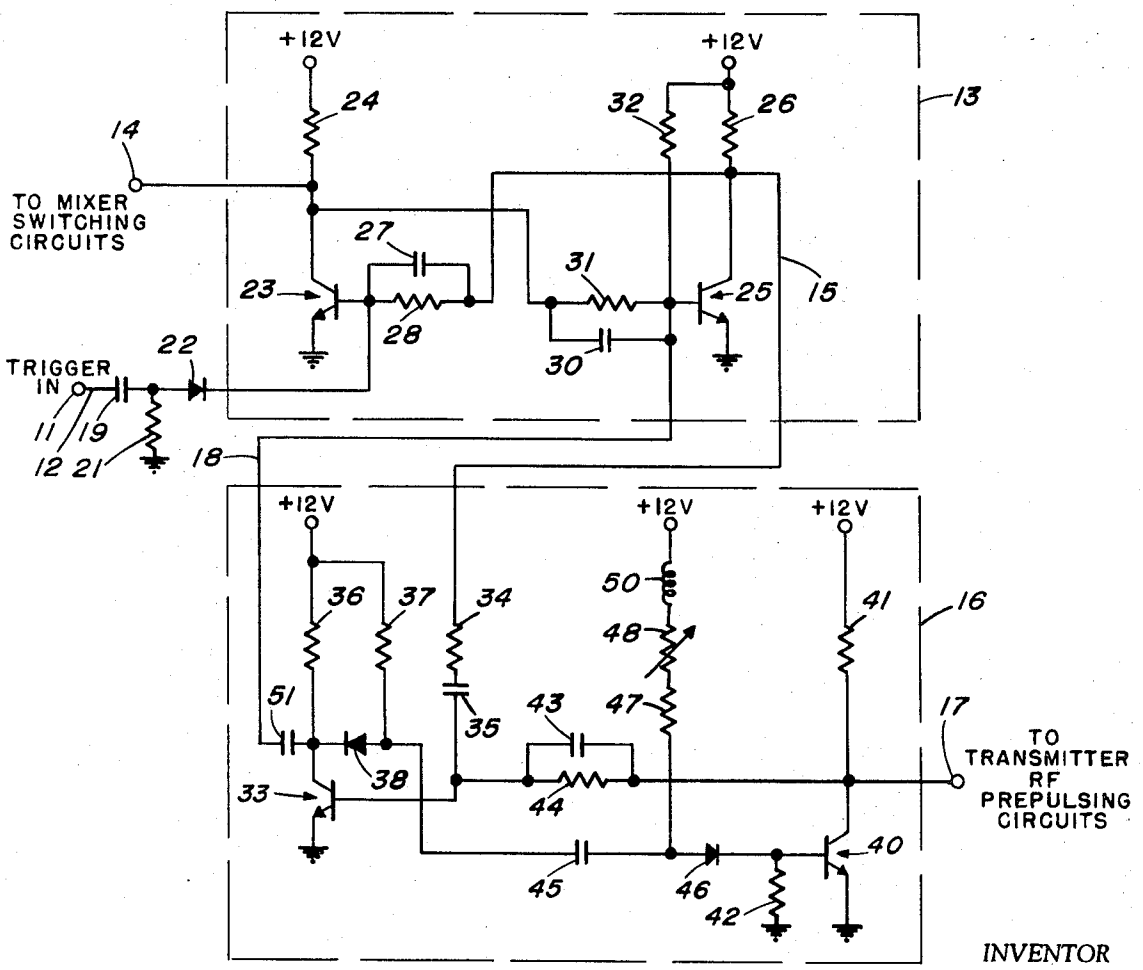


FIG. 2

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TIMING CIRCUIT

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ABSTRACT OF THE DISCLOSURE

A circuit in which pulse A is always produced before pulse B, and pulse B will always terminate before pulse A terminates, the circuit serving as a safety device. A timing signal turns over a flip-flop circuit, the output of which produces not only pulse A but also a trigger signal for an adjustable width monostable multivibrator. The monostable multivibrator initiates pulse B, which due to natural delay, is subsequent to pulse A. When the monostable multivibrator switches back to its rest state, it terminates pulse B and resets the flip-flop which terminates pulse A.

STATEMENT OF GOVERNMENT INTEREST

The invention defined herein may be manufactured and used by or for the Government of the United States of America for Governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

The present invention relates to a timing circuit and more specifically to a timing circuit in which a second pulse cannot be produced before a first pulse is produced, and termination of the second pulse terminates the first pulse.

Prior art radar systems which utilized a prepulsing pulse to initiate transmitter RF drive experienced difficulty in selecting a method for timing and developing the required prepulsing pulse. The nature of the radar required that the prepulsing pulse lie, timewise, inside the mixer protection pulse.

The standard method considered first for timing and developing the required pulses consisted of two adjustable time delays and two adjustable-width multivibrators connected as two parallel channels both fed by a single trigger input. One of the channels led to the mixer protection switching circuits while the other was connected to the transmitter RF prepulsing circuits. This arrangement had many inherent disadvantages, the most important of which were that two adjustable delays were required and also two width adjustments were required. Also, it was possible to adjust the circuit in such a manner as to damage the mixer.

An alternate method used by prior art was to employ an adjustable delay line feeding into a dual multivibrator, one output of which went to the mixer protection switching circuits while the other output was connected to the transmitter RF prepulsing circuits. This arrangement provides some improvement in that one delay adjustment and one width adjustment were eliminated and that it was no longer possible to adjust the circuit in such a manner as to damage the mixer.

SUMMARY OF THE INVENTION

The present invention provides considerable improvement over these prior art devices in that the required trigger is derived from the leading edge of the transmitter pulse thereby eliminating any delay circuits, only one input trigger line is required, only one width determining circuit is required, and it is not possible to misadjust the

circuit so as to permit the transmitter output to be applied to an unprotected mixer.

An object of the present invention is the provision of a timing circuit.

Another object is the provision of a transmitter RF drive prepulsing circuit in which only one input trigger line is required.

Still another object is the provision of a transmitter RF drive prepulsing circuit in which only one width determining circuit is required.

Still another object is the provision of a transmitter RF drive prepulsing circuit in which it is not possible to misadjust the circuit so as to permit transmitter output into an unprotected mixer.

Yet another object is the provision of a timing circuit in which pulse A is always produced before pulse B, and pulse B will always terminate before pulse A terminates, the circuit serving as a safety device.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings in which like reference numerals designate like parts throughout the figures thereof and wherein:

FIG. 1 shows a block diagram of the invention and
FIG. 2 shows a schematic diagram of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1 there is shown an input terminal **11** which receives trigger signals, these signals being passed on by line **12** to a bistable flip-flop circuit **13**. Flip-flop circuit **13** produces a first output pulse on line **14** which may, for example, connect with mixer protection switching circuits (not shown). Also connected to flip-flop **13** is another line **15** which leads to an adjustable-width multivibrator **16**, this multivibrator producing a second output pulse on line **17** which may go to some utilization circuit, such as to a transmitter RF prepulsing circuit, for example. A feedback, or reset line **18**, joins multivibrator **16** with flip-flop **13** and is used to reset the flip-flop once the pulse has been produced, as will be shown hereinafter.

In the schematic circuit of FIG. 2 there is shown the input terminal **11** with its lead **12** connecting to flip-flop **13**. Connected in lead **12** there is a coupling condenser **19** and a bypass resistor **21** leading to ground. Connected to the junction of capacitor **19** and resistor **21** is the anode of a diode rectifier **22**, the base of which leads to the base connection of an NPN transistor, which may be of the type 2N914. The emitter of transistor **23** is connected to ground while its collector leads through a series resistance **24** to a source of positive potential. Also connected to the collector is the first output lead **14** which, as has been stated previously, may lead to mixer switching circuits. The second stage of the flip-flop **13** consists of another NPN transistor **25**, this stage likewise having its emitter connected to ground and its collector connected through a series resistance **26** to a source of positive potential. Cross connected between the base of transistor **23** and the collector of transistor **25** there is an RC circuit consisting of a capacitor **27** in parallel with a resistor **28**. Also cross connected between the base of transistor **25** and the collector of transistor **23** there is another RC circuit consisting of a capacitor **30** connected in parallel with a resistor **31**. A resistor **32** connecting the source of potential with the base of transistor **25** completes the circuitry for flip-flop **13**.

Connected to the collector of transistor **25** is the line **15**, labelled here as a trigger line, which serves to apply an output of flip-flop **13** to the input of multivibrator **16**, the line **15** being connected to the base of an NPN transistor **33**. Series connected in the line **15** before it joins the base of transistor **33** there is a resistor **34** and a coupling capacitor **35**. Transmitter **33** has its emitter connected to ground and its collector connected through a series resistance **36** to a source of positive potential. Also connected to the source of positive potential is a resistor **37** the inner end of which is connected to the anode of a diode rectifier **38**, the rectifier **38** being connected to the collector of transistor **33**. The other half of multivibrator **16** is made up of another NPN transistor **40** having its emitter connected to ground and its collector connected by means of a series resistance **41** to a source of positive potential. A bypass resistor **42** also connects the base of transistor **40** to ground. Cross connected between the base of transistor **33** and the collector of transistor **40** there is an RC circuit consisting of capacitor **43** connected in parallel with a resistance **44**. From the junction of resistor **37** and the anode of diode **38** there is a connection consisting of a capacitor **45** in series with a rectifier **46**, the anode of **46** being connected to condenser **45** and the cathode being connected to the base of transistor **40**. In order to provide a means for adjusting the width of the output pulse of multivibrator **16** there is provided a series circuit connected to the anode of diode **46** and the source of positive potential, the circuit consisting of an accurate, low tolerance, resistance **47** connected to a potentiometer **48** which in turn is connected to a choke coil **50**. The second output of the system as produced on line **17**, and which may go to some utilization circuit such as a transmitter RF prepulsing circuit, is provided at the collector of transistor **40**.

In order to provide a means for resetting flip-flop **13** once multivibrator **16** has cut off there is provided a reset line **18** which joins the collector of transistor **33** with the base of transistor **25**, the line **18** having a coupling condenser **51** therein to provide proper isolation.

Turning now to the operation of the invention it will be seen that the circuit is straightforward. When a trigger pulse is received at terminal **11** it is applied through line **12**, capacitor **19**, and rectifier **22** to the base of transistor **23**. This causes the flip-flop **13** to change state so that transistor **23** now conducts, providing an output at its collector and on line **14** so as to afford protection to the mixer switching circuits. At the same time an output pulse is also produced on line **15** which is applied to the base of transistor **33** and is used to trigger the monostable multivibrator **16** causing the beginning of the transmitter pulse which is provided on output line **17**, leading to the transmitter RF prepulsing circuits. The natural delay in this triggering process, as caused by the RC circuit **43**, **44** insures that the transmitter output will not occur until after the mixer is protected. The width of the transmitter RF pulse is controlled by the adjustable width feature of the monostable vibrator as provided by resistance **47**, potentiometer **48**, and choke coil **50**.

When the monostable multivibrator **16** switches back to its resting state, that is when transistor **40** cuts off and transistor **33** conducts, it terminates the transmitter RF pulse on line **17**. When the multivibrator switches and transistor **33** conducts there is an output pulse produced as its collector which is applied through coupling capacitor **51** to reset line **18**, this pulse being applied to the base of transistor **25** of the flip-flop **13**, thereby causing transistor **25** to reset to its initial state by means of transistor **25** conducting and transistor **23** cutting off. When transistor **23** cuts off it terminates the mixer protection on line **14**; however, the natural delay in this reset process insures that the transmitter will be off before the mixer protection is removed.

From the above description of the structure and operation of the invention it is obvious that the present device offers considerable improvement over prior art protection circuits. It can be seen that pulse A (mixer protection) will always be produced before pulse B (transmitter pulsing), and pulse B will always terminate before pulse A terminates, these circuits serving as a safety device. In accomplishing these ends the invention requires only one input trigger line and only one width determining circuit is required. Furthermore, it is not possible to misadjust the circuit in such a way as to permit transmitter output with an unprotected mixer.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood, that within the scope of the appended claims, the invention may be practiced otherwise that as specifically described.

What is claimed is:

1. A timing circuit comprising:
a bistable flip-flop;
means for applying a trigger signal to the bistable flip-flop;
a first output for utilization by a first external circuit;
a multivibrator;
means for connecting the flip-flop and the multivibrator;
a second output for utilization by a second external circuit; and
reset means from the multivibrator back to the flip-flop, whereby the second output always occurs subsequent to the first output and the second output terminates prior to termination of the first output.

2. The circuit of claim **1** wherein the first output is produced by the bistable flip-flop.

3. The circuit of claim **2** wherein the second output is produced by the multivibrator.

4. The circuit of claim **3** wherein the multivibrator has means for adjusting the width of the second output.

5. The circuit of claim **4** wherein the multivibrator is a monostable multivibrator.

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