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A. L. KEMPER

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MICROPHONE BIAS SUPPLY FOR ELIMINATING OR REDUCING KEY CLICKS

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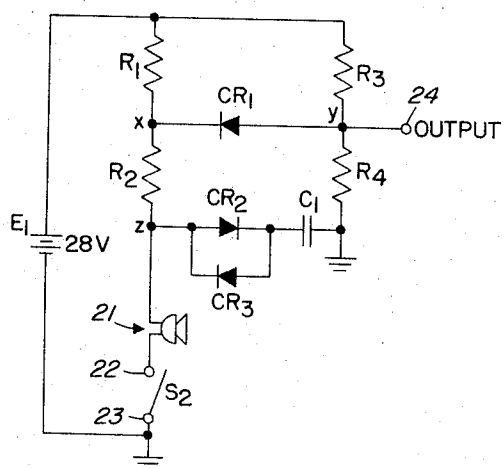


FIG 1

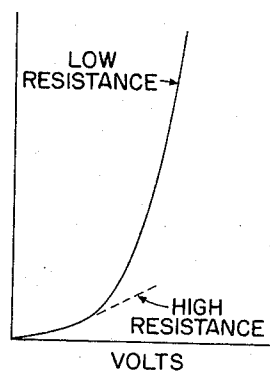


FIG 2

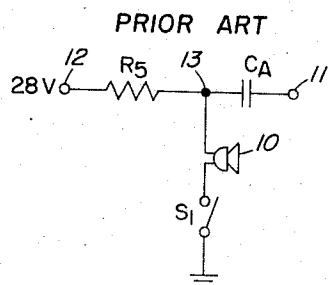


FIG 3

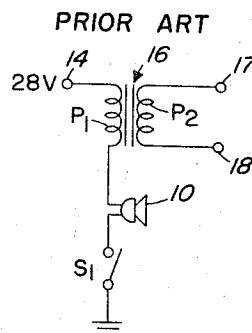


FIG 4

INVENTOR.

ARTHUR L. KEMPER

BY

Marvin Moody

ATTORNEY

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MICROPHONE BIAS SUPPLY FOR ELIMINATING OR REDUCING KEY CLICKS

Arthur L. Kemper, Marion, Iowa, assignor to Collins Radio Company, Cedar Rapids, Iowa, a corporation of Iowa

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ABSTRACT OF THE DISCLOSURE

Non-linear resistance elements are provided to shunt key clicks of high voltage but to pass without distortion microphone signals of low voltage.

This invention relates in general to a circuit for preventing objectionable voltage excursions and in particular to a circuit for use with a keyed microphone to eliminate clicks in the output circuit.

An objectionable key click is oftentimes heard when a microphone switch is closed and it is an object of the present invention to provide a circuit which substantially eliminates such key clicks.

Another object of this invention is to provide an improved keying circuit.

A feature of this invention is found in the provision for a keying circuit comprising a pair of diodes connected in parallel with opposite polarities in a microphone keying circuit so as to eliminate or reduce key clicks.

Further objects, features, and advantages of this invention will become apparent from the following description and claims when read in view of the accompanying drawings, in which:

FIGURE 1 is a schematic diagram of the circuit of this invention;

FIGURE 2 is a current versus voltage characteristic of a typical diode;

FIGURE 3 illustrates a prior art microphone keying circuit; and,

FIGURE 4 illustrates another form of a microphone keying circuit common in the prior art.

FIGURE 3 illustrates a conventional method of keying a microphone in which a switch S₁ has one terminal connected to ground and the other terminal connected to a microphone 10. Condenser C_A is connected between microphone 10 and output terminal 11. A biasing potential is connected to input terminal 12 and is coupled to the microphone through a resistance R₅. The bias voltage might be 28 volts DC. R₅ might be 470 ohms in a conventional circuit and the internal impedance of the microphone might be 150 ohms. When switch S₁ is closed, the direct current voltage at point 13 between the resistor R₅ and condenser C_A quickly falls to approximately 6.75 volts which is a change of 21.25 volts from the open circuit condition. An amplifier is connected to point 11 and such amplifier is designed to work from the normal microphone AC voltage of 0.1 to 0.5 volt and the 21.25 voltage surge drives it to saturation or full output resulting in a loud pop on both make and break of the microphone switch circuit at the receiver.

A similar situation occurs in the circuit shown in FIGURE 4 wherein the 28 volts DC bias is connected to terminal 14 and to the primary P₁ of a transformer 16. Microphone 10 is connected between the primary and switch S₁. The other side of switch S₁ is connected to ground. The secondary P₂ has output terminals 17 and 18 which are connected to a following amplifier, not shown. In the circuit of FIGURE 4, a pop occurs at the receiver due to the high output voltage induced in the transformer secondary P₂ which is caused by the high

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surge circuit in the transformer primary when the switch S₁ is closed.

The circuit of FIGURE 1 completely eliminates such key clicks on the make of microphone switch S₁ and drastically reduces them on the break.

A battery E₁ which might be 28 volts, has its positive terminal connected to a pair of resistors R₁ and R₃. A diode CR₁ is connected between points X and Y at the other sides of resistors R₁ and R₃. A second pair of resistors R₂ and R₄ have one of their sides connected to points X and Y respectively. Connected between the other sides of resistors R₂ and R₄ from point Z to ground are a pair of diodes CR₂ and CR₃ which are connected in parallel with their polarities reversed and a condenser C₁. The second side of resistor R₄ is connected to ground.

A microphone 21 has one side connected to point Z and the other side connected to terminal 22 of switch S₂. The movable contact of switch S₂ is connected to ground. The battery E₁ has its negative terminal also connected to ground. An output terminal 24 is connected to point Y between resistors R₃ and R₄.

In a particular circuit constructed according to FIGURE 1 and with a 28-volt DC battery, the potential at point Y was 14 volts with switch S₂ open. The diode CR₁ is reverse biased and the AC output at output terminal 24 is zero. When the key switch S₂ is closed, the potential at point X between resistors R₁ and R₂ which would normally drop quickly to 10 volts is actually forced to drop slowly to 10 volts due to capacitor C₁ which discharges slowly through diode CR₃ and the microphone. As the potential of point X slowly drops to 10 volts, diode CR₁ turns on since it becomes forward biased and the microphone is connected to the output terminal 24 without a potential change at point Y. Hence there is no click when the microphone switch S₂ is closed.

When the key switch S₂ is opened, the potential at point X between resistors R₁ and R₂ quickly rises approximately 0.5 volt at which time CR₂ conducts and effectively connects capacitor C₁ to point Z. The voltage at point X then slowly rises to 28 volts and again reverse biases CR₁ to interrupt the output. The 0.5 change of potential at the instant switch S₂ is opened gives rise to a slight click in the output circuit. However, the magnitude is never greater than 0.5 volt as compared to 21.25 volts change in the conventional circuit shown in FIGURES 3 and 4.

The practicability of this circuit arises from the employment of the non-linear characteristics of diodes CR₂ and CR₃. A typical characteristic curve is shown in FIGURE 2.

During normal operation of the microphone, the AC output voltage is below 0.5 volt at point Z which is not sufficient to fire diodes CR₂ and CR₃. Under these conditions, the diodes have high resistance (see FIGURE 2) and therefore capacitor C₁ cannot short the signal to ground. However, under conditions of change of state (when the key is opened or closed) the signal or DC potential changes are very large. During these periods the diode resistances are low and the capacitor C₁ is connected in the circuit giving rise to slow charge and discharge times which eliminates or substantially reduces key clicks. When the key S₂ is open, capacitor C₁ charges through resistors R₁ and R₂ and diode CR₂.

In a particular circuit constructed according to this invention, the resistance values in FIGURE 1 were:

R ₁	-----ohms	2,000
R ₂	-----do	1,000
R ₃	-----do	1,000
R ₄	-----do	1,000
C ₁	-----micromicrofarads	50

It is seen that this invention provides a circuit which

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eliminates key clicks caused by use of a microphone switch. Although this invention has been described with respect to a particular embodiment thereof, it is not to be so limited, as changes and modifications may be made therein which are within the spirit and scope of the invention as defined by the appended claims.

I claim:

1. A circuit for preventing key clicks comprising, a first diode, a condenser, a first impedance with one end connected to one terminal of the first diode and the other side connected to the condenser, second and third diodes connected to the other terminal of the condenser and oppositely poled, the second sides of the second and third diodes connected together, a second impedance connected between the second terminal of the first diode and the second and third diodes, and a microphone and switch in series connected between the condenser and the second impedance.

2. A circuit for preventing key clicks comprising, a first diode, a condenser, a first impedance with one end connected to one terminal of the first diode and the other side connected to the condenser, second and third diodes connected to the other terminal of the condenser and oppositely poled, the second sides of the second and third diodes connected together, a second impedance connected between the second terminal of the first diode and the second and third diodes, a microphone and switch in series connected between the condenser and the second impedance, and a voltage source with one side connected to the condenser, third impedance means connected between the other side of the voltage source and one terminal of the first diode and fourth impedance means connected between the other side of the voltage source and the second terminal of the first diode.

3. A circuit for preventing key clicks comprising, a first diode, a condenser, a first impedance with one end connected to one terminal of the first diode and the other side connected to the condenser, second and third diodes connected to the other terminal of the condenser and oppositely poled, the second sides of the second and third diodes connected together, a second impedance connected

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between the second terminal of the first diode and the second and third diodes, a microphone and switch in series connected between the condenser and the second impedance, a voltage source with one side connected to the condenser, third impedance means connected between the other side of the voltage source and one terminal of the first diode and fourth impedance means connected between the other side of the voltage source and the second terminal of the first diode, and the fourth impedance being larger than either the first, second or third impedances.

4. A circuit for preventing key clicks comprising, a first diode, a condenser, a first impedance with one end connected to one terminal of the first diode and the other side connected to the condenser, second and third diodes connected to the other terminal of the condenser and oppositely poled, the second sides of the second and third diodes connected together, a second impedance connected between the second terminal of the first diode and the second and third diodes, a microphone and switch in series connected between the condenser and the second impedance, a voltage source with one side connected to the condenser, third impedance means connected between the other side of the voltage source and one terminal of the first diode and fourth impedance means connected between the other side of the voltage source and the second terminal of the first diode, the fourth impedance being larger than either the first, second or third impedances, and an output terminal connected to the first terminal of the first diode.

References Cited

UNITED STATES PATENTS

3,020,422	2/1962	Mace	325—170
2,316,567	4/1943	Davis.	
1,998,325	4/1935	Lyman	325—170

WILLIAM C. COOPER, *Primary Examiner.*

40 R. P. TAYLOR, *Assistant Examiner.*