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RELAY CIRCUIT

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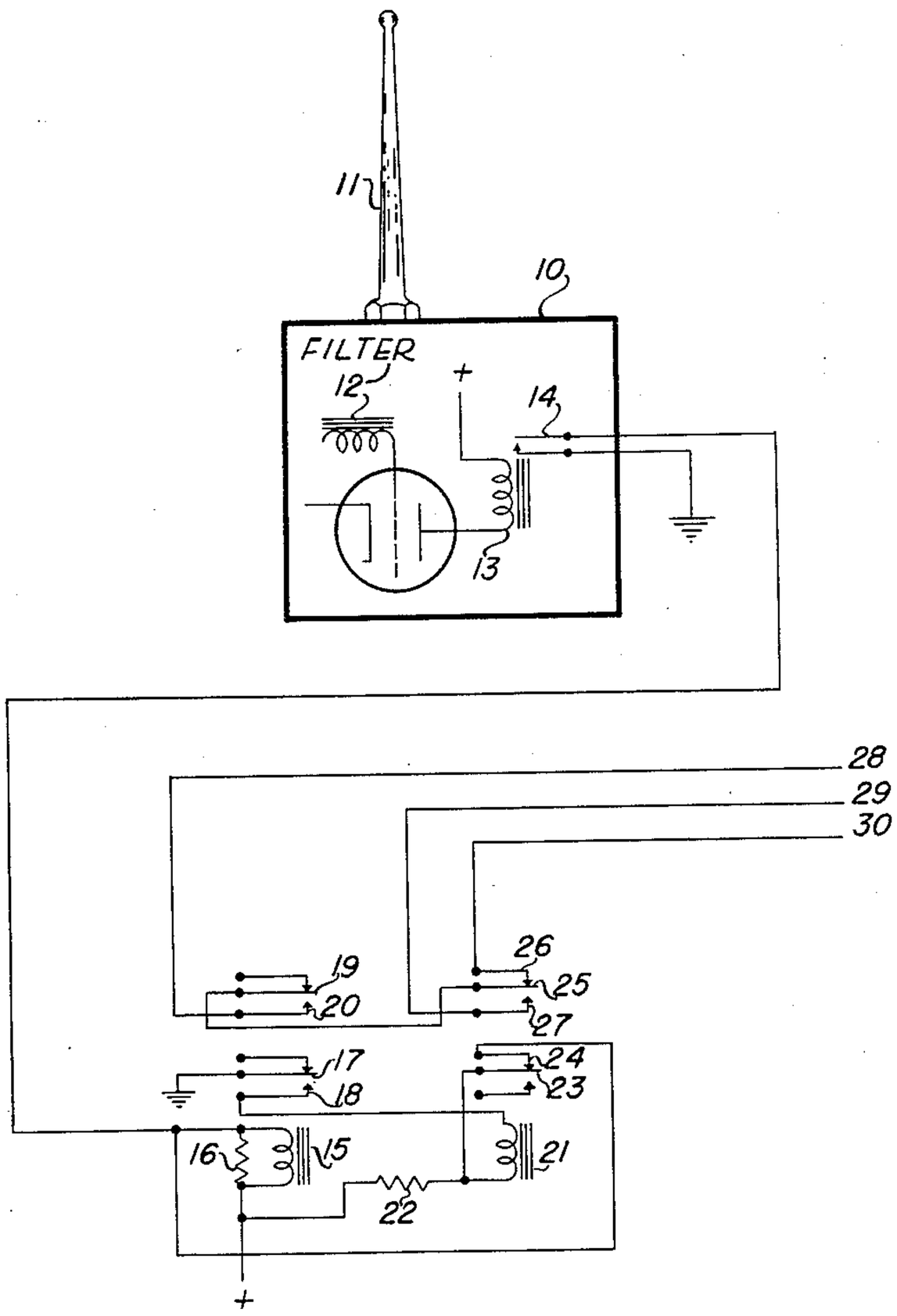

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RELAY CIRCUIT

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to a circuit for doubling the number of channels available from a radio receiver selector.

One of the objects of the invention is to provide a channel doubling circuit which requires no alterations to the existing equipment and which maintains the initial efficiency of the system.

Another object is to provide a channel doubling means which utilizes an interrupter circuit for keying the fixed frequency tones of the modulator and which is not critical as to the speed and length of duration of the pulse.

A further object is to provide such a channel doubling means which requires only two relays in each channel available in the receiver selector and which operates independently of adjacent channels.

These and other objects and advantages of the invention will become apparent in the specification and in the accompanying drawing in which the single figure illustrates schematically a typical circuit embodying the invention.

A radio receiver selector 10 is provided with an antenna 11 and includes a given number of filter circuits responsive to different frequencies, one of which is shown at 12. This filter is shown as a self-resonant coil but may be any type of selective filter. The signal passed by filter 12 is fed to a receiver relay including a coil 13 and contacts 14, one side of the contacts being grounded as shown.

The channel doubling circuit includes relays 15 and 21 having corresponding resistors 16 and 22 in shunt and in series respectively. Contact 17 of relay 15 is grounded as shown and is normally open with respect to contact 18 which connects to one terminal of relay 21. Contact 19 is connected to contact 25 of relay 21 and is normally open with respect to contact 20, the latter being connected to conductor 28 which is part of one of the circuits to be controlled. Contact 23 of relay 21 is connected to the relay as shown and is normally closed with contact 24 which connects to one side of relay 15. Contacts 27 and 26 connect to conductors 29 and 30, respectively, which are the other terminals of the circuit to be controlled.

In a circuit of the general class of that just described the received signal in a given channel will ordinarily operate only a single circuit in a positive manner. In the present invention a signal at a given frequency may be sent either continuously or intermittently to operate either one of two separate circuits in a positive manner without requiring any change in the receiver.

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When a continuous tone is received in the radio receiver selector, the relay 13 responsive to the corresponding frequency is energized and contact 14 is closed, completing the circuit to relay 15. A completed circuit between 28 and 30 is now present due to the closing of contacts 19 and 20 and through closed contacts 25 and 26 of relay 21. Relay 21 will not be energized because ground is applied to both ends of the coil through contacts 23 and 24 and contact 14 on one side, and through contact 17 and 18 in relay 15 on the other side.

Absence of any received signal in the particular frequency channel opens the contacts 14 in receiver 13, resulting in deenergization of relay 15 and opening of contacts 19 and 20, thus opening the circuit between 28 and 30 and returning the entire circuit to normal, unoperated position. This completes one cycle in the operation of one channel in the relay box from one channel in the radio receiver selector.

A second channel is now available using relays 15 and 21 by keying this same channel in the radio receiver selector. On receiving the first pulse relay 15 is again energized by the closing of the relay contacts 14. Opening of contacts 14 momentarily at the end of the first pulse removes the ground from the coil of relay 21, causing it to energize by a flow of current through resistor 22 and through contacts 17 and 18 on relay 15. Contacts 17 and 18 remain closed beyond the end of said first pulse, even though the contacts 14 are opened, since relay 15 is given a delay characteristic by the resistor 16 which is connected across its winding, causing the relay to remain energized over a time interval at least equal to the time between the pulses of the pulsed signal. On the second pulse and pulses thereafter relay 21 will not deenergize because the ground return between resistor 22 and the coil has been broken through contacts 23 and 24 on relay 21. The continuance of pulses will cause relay 15 to remain energized by delaying the drop-out time due to resistor 16. A circuit is thus established and maintained between 28 and 29 by closed contacts 19 and 20 on relay 15 and contacts 25 and 27 on relay 21.

Absence of received pulses in the radio receiver selector opens contacts 14 on the receiver relay causing relay 15 to deenergize, opening contacts 17 and 18. This results in deenergization of re-

lay 21 and opening the circuit between 28 and 29 due to opening of contacts 19 and 23 in relay 15 and contacts 25 and 27 in relay 21. This completes one cycle in the operation of the second channel in the relay box from the same first channel in the radio receiver selector. The keying of the modulator may be accomplished by means of a motor driven circuit breaker or relay operated circuit breaker. The speed and length of the pulse from the transmitter is not critical but must be fast enough so as to overlap the drop-out time of relay 15 in the relay circuit. In practice, changes of pulse speed and input voltage to relays 15 and 21 of approximately 25% do not affect the operation of the circuit.

While I have shown only a single embodiment of my invention various modifications are possible within the scope and extent of the appended claims.

I claim:

1. In a relay system adapted to operate in response to a continuous or pulsating signal for selectively closing either one of a pair of electric circuits, the combination comprising first relay means arranged to be energized in response to input signals, second relay means a first circuit controlled by said first relay for effecting energization of said second relay when said first relay means is energized, first delay means associated with said second relay means to prevent deenergization thereof for an interval at least as long as the intervals between pulses of said pulsating signal, third relay means, a second circuit controlled by said first and said second relay for effecting initial energization of said third relay only when said first relay means is deenergized and said second relay means is still energized under operation of said first delay means, second delay means associated with said third relay means for preventing deenergization of said third relay for an interval at least as long as the intervals between pulses of the pulsating signal, and a double-throw switch arranged to be controlled by said third relay for completing one or the other of said circuits.

2. In a relay system adapted to operate in response to continuous or pulsating signals selectively to close either one of a pair of electrical circuits, the combination comprising a first relay means including a coil and a normally open first switch arranged to be closed in response to signals of either polarity passing through said coil, said first switch having one side grounded, a second relay means including a coil and a normally open second switch, said second switch providing a connection to ground and delay means for preventing deenergization of said second relay coil for an interval at least as long as the intervals between pulses of said pulsating signal, said second relay coil being connected to said first relay switch to prevent energization thereof except when said first relay switch is closed, a third relay including a coil and a normally closed switch and delay means for preventing deenergization of said third relay coil for an interval at least as long as the intervals between pulses of said pulsating current, said third relay coil being connected through said third relay switch to the ungrounded side of said first relay switch and to said second relay switch to prevent initial energization thereof except when said first relay switch is open and said second relay switch closed under the operation of said second relay delay means and to permit the continued energization thereof during said pulsating signal, and a double-throw switch arranged to be controlled by said third relay for completing one or the other of said two circuits.

3. An electrical system for controlling the operation of two circuits, one in response to a continuous signal and the other in response to a pulsating signal, comprising a first source of electrical energy for energizing purposes, a second source of continuous and pulsating signals, a first relay including a single-throw switch normally open having a grounded side and a coil connected to said first source, a second relay including a single-throw switch normally open having a ground connection when closed and a coil connected between said energizing source and the ungrounded side of said first relay switch to be energized only when said first relay switch is closed, first delay means associated with said second relay to delay deenergization thereof for a time interval at least as long as the intervals between pulses of said pulsating signal, a third relay including a single-throw switch normally closed and a coil connected to the ungrounded sides of said first and second relay switches and said energizing source to be initially energized only when said first relay switch is open and said second relay switch is closed under the influence of said first delay means, second delay means associated with said third relay to prevent deenergization thereof for an interval at least as long as the intervals between pulses of said pulsating signal, and a double-throw switch arranged to be controlled by the coil of said third relay for completing one or the other of said two circuits.

4. An electrical system to control two circuits, one in response to a continuous signal and the other in response to a pulsating signal, comprising a source of electrical energy for energizing purposes, a source of continuous and pulsating signals, a first relay including a coil connected to said signal source and a first normally open single-pole, single-throw switch having a grounded side and connected to said energizing source, a second relay including a second normally open single-pole, single-throw switch and a coil connected between the ungrounded side of said first relay switch and said energizing source to be energized only when said first relay switch is closed, a first delay resistor connected to said second relay coil to delay the deenergization thereof for a time interval at least as long as the intervals between pulses of said pulsating signal, a third relay including a third normally-closed, single-pole, single-throw switch and a coil connected between said second relay switch and said energizing source, said third relay switch being connected between said third relay coil and said first relay switch to prevent energization of said third relay coil except when said first relay switch is open and said second relay switch is closed under operation of said first delay resistor, a second delay resistor connected to said third relay coil to prevent deenergization thereof at least as long as the intervals between pulses of said pulsating signal, an additional normally open, single-pole, single-throw switch arranged to be controlled by said second relay coil for keeping both of said two circuits open except when a signal is received, and a single-pole, double-throw switch arranged to be controlled by said third relay coil for completing one or the other of said two circuits.

5. An electrical system to control two circuits, one in response to a continuous signal and the other in response to a pulsating signal, com-

prising a source of electrical energy for energizing purposes, a source of continuous or pulsating signals, a first relay including a coil connected to said signal source and a first normally-open switch connected to said energizing source and having a grounded side, a second relay including a coil connected between the ungrounded side of said first relay switch and said energizing source to be energized only when signals from said signal source close said first relay switch, first delay means associated with said second relay to delay the deenergization thereof for a time interval at least as long as the intervals between pulses of said pulsating signal, a third relay including a coil connected on one side to said energizing source, a second normally-open switch for providing a ground connection arranged to be controlled by said second relay and connected in circuit with said third relay coil and said energizing source, a normally-closed switch arranged to be energized by said third relay coil and connected between said one side of said third relay coil and the ungrounded side of said first relay switch to prevent energization of said third re-

lay when said first relay switch is closed, said third relay being energized when said first relay switch is opened and said second relay switch is still closed under operation of said first delay means, second delay means associated with said third relay to prevent deenergization thereof for an interval at least as long as the intervals between pulses of said pulsating signal and a double-throw switch arranged to be controlled by the coil of said third relay for completing one or the other of said two circuits.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,090,912	Hailes	Aug. 24, 1937
2,098,040	Hoppe	Nov. 2, 1937
2,141,803	Thompson	Dec. 27, 1938
2,277,579	Burger	Mar. 24, 1942
2,293,932	Cooper	Aug. 25, 1942