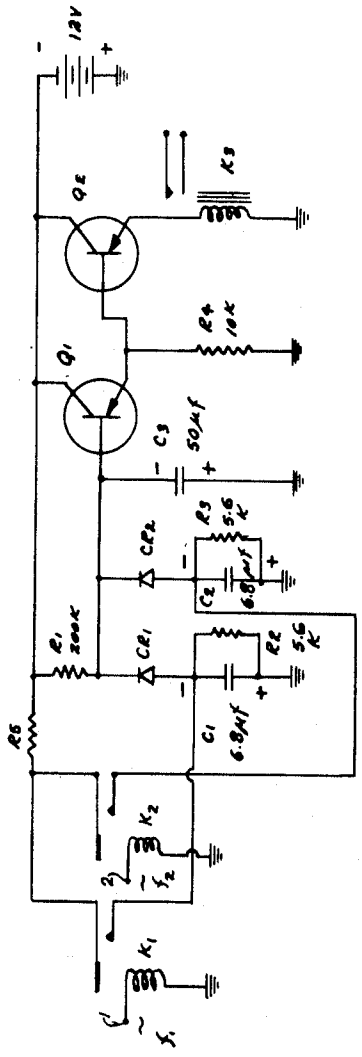
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RESONANT REED RELAY CIRCUIT WITH LONG ACTIVATION TIME DELAY

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RESONANT REED RELAY CIRCUIT WITH LONG ACTIVATION TIME DELAY

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Resonant reed relays are highly selective frequency sensitive devices used in remote control and selective calling systems where the frequency of an audio tone is used to actuate the desired function. When an audio tone of the proper frequency is applied to this type relay, a momentary closure of the output contacts occurs during a portion of each cycle. The contacts are normally connected to a circuit in such a manner that the momentary closures will charge a capacitor. The charge on the capacitor can then be used to turn on a switch such as a transistor or in some cases pull in a secondary D.-C. relay.

In the conventional circuit, there are several undesirable features. One of these is the difficulty in obtaining long activation time delays that help to prevent functioning on noise signals. Also, the short duration of each contact closure makes it necessary that the capacitor circuit discharge time be longer than the charge time. This is opposite to the desired condition since the probability of intermittent noise pulses charging the capacitor to the activation level is less if the charge time is longer than the discharge time.

The purpose of the invention therefore is to provide a resonant reed relay circuit having a long activation time delay. Briefly, this is accomplished through controlling the output relay of the circuit by means of a long time constant R-C circuit the capacitor of which is normally held in a state of low charge by a shunt resistance. The resonant reed relay is then used to actuate a switch, which may be a diode, to remove the shunt resistor and allow the capacitor to charge slowly to the point where the output relay is actuated. Cessation of the audio tone restores the shunt and rapidly discharges the capacitor of the long time constant circuit.

Referring to the single figure of the drawing for a more detailed description of the invention, the circuit shown responds to audio tones of frequencies f_1 and f_2 applied simultaneously to input terminals **1** and **2** to actuate relay K_3 the contacts of which may be included in a circuit to be controlled. This relay is actuated by a two-stage amplifier, employing transistors Q_1 and Q_2, which has the voltage across C_3 as its input voltage.

In the absence of input signals f_1 and f_2 the contacts of K_1 and K_2 are open and the voltage across C_3 has a low value due to the shunting effect of relatively low resistances R_2 and R_3, which are connected in parallel across C_3 by diodes CR_1 and CR_2, and the relatively high value of R_1. With the low value of voltage across C_3 the emitter current of Q_2 is below the operating threshold of K_3.

Input signals having the frequencies f_1 and f_2 to which the vibrating members **1** and **2** of relays K_1 and K_2 are

resonant cause oscillations of these members of sufficient amplitude to produce periodic closings of the relay contacts. This causes condensers C_1 and C_2 to rapidly charge through the vibrating contacts and current limiting resistor R_5. The resulting increase in potential across C_1 and C_2 back biases diodes CR_1 and CR_2 thus rendering them nonconducting and removing R_2 and R_3 from their shunt connection across C_3. This condenser is now free to charge to the potential of C_1 and C_2 through R_1 at a rate determined by the time constant of the R_1–C_3 circuit. As the voltage across C_3 increases the Q_2 emitter current through the coil of K_3 increases, eventually actuating this relay. Thus the time interval between the start of the input signals and the actuation of relay K_3 can be made as long as desired by proper choice of the R_1–C_3 time constant.

When the input signals cease, the charges in C_1 and C_2 are no longer maintained through the K_1 and K_2 contacts so that these condensers rapidly discharge through R_2 and R_3. The fall in the C_1 and C_2 potentials causes diodes CR_1 and CR_2 to again become conductive and C_3 rapidly discharges through R_2, R_3 and these diodes thus releasing relay K_3.

While the illustrated embodiment employs two resonant reed relays, the invention is independent of the number of such relays employed. A single relay may be used, but two or more relays increases the security against false operation. Also, any type of amplifier may be used between C_3 and K_3, the transistor circuit shown being merely one example of a suitable amplifier.

I claim:

1. A resonant reed relay circuit having a relatively long time delay, said circuit comprising: a resonant reed relay; an output relay; a source of direct current; a relatively long time constant circuit comprising a first resistor and a first condenser connected in series across said source; a relatively short time constant circuit comprising a current limiting resistor, the contacts of said resonant reed relay and a second condenser connected in series across said source; a third resistance having a value small relative to the value of said first resistance connected in shunt to said second condenser; a switching device arranged to connect said third resistance in shunt to said first condenser whenever the voltage across said second condenser is less than the voltage across said first condenser; and means having an input coupled across said first condenser and an output coupled to said output relay and operative when the voltage across said first condenser exceeds a predetermined value to actuate said output relay.

2. Apparatus as claimed in claim 1 in which said switching device is a diode.

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