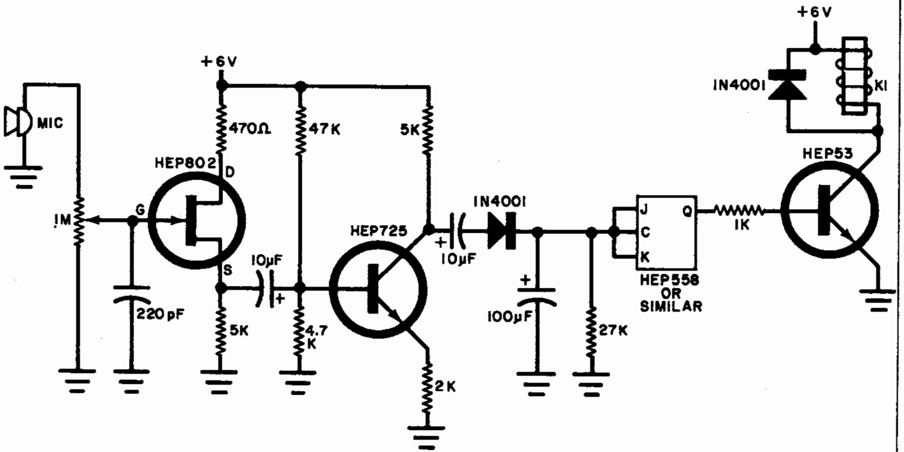
AUDIO-OPERATED RELAY

Q. ***Do you have a circuit for a simple voice- or sound-controlled relay?***—*J. Lengenfelder, Trenton, N.J.*

A. The circuit shown here will perform this function. The Radio Shack 275-004 relay is used. Its contacts can handle 1 ampere at 125 V ac. The diode across the coil protects the transistor from inductive surges. An SCR or triac can be used instead of the relay and the switching transistor if solid-state switching is more desirable. Also, an active filter (bandpass) could be inserted at the FET output if you want to activate the circuit with only one specific tone.



Automatic Recorder Controller

by Marshall Lincoln

A simple controller that automatically turns on a tape recorder whenever a signal is picked up by the radio receiver to which it's connected is a useful accessory for the business radio user as well as the "public service" monitor buff.

With it, the businessman with a two-way radio system will not miss any calls when he is out of his shop or away from his vehicle—public service band monitor enthusiasts can keep a taped record of their favorite frequencies—and amateur radio operators can use this controller with fixed frequency VHF equipment for signal tests and to keep an automatic taped log of transmissions on a particular frequency.

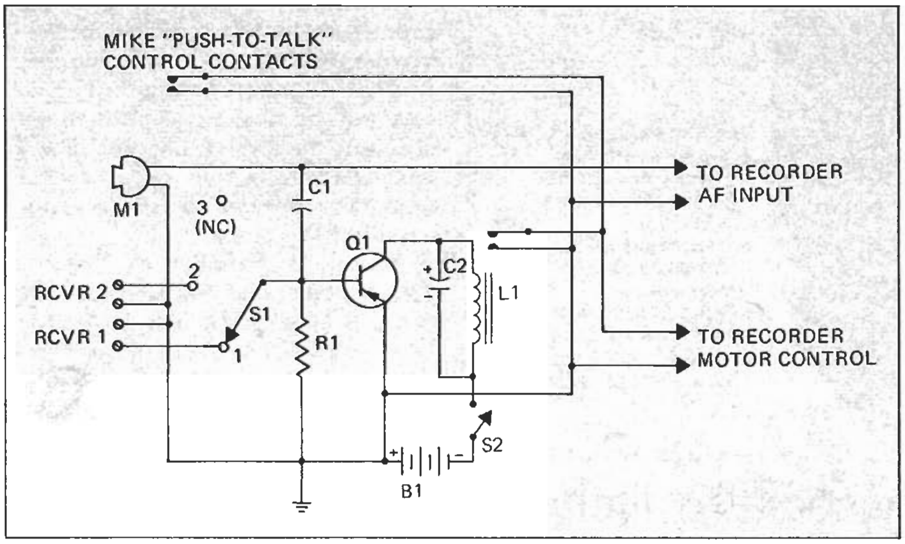
This controller does not require modifications to either the receiver or the tape recorder; there's no need to dig into the wiring of either unit to connect it. Since the controller operates on self-contained batteries, it can be used with portable or mobile radios (assuming you use a battery-powered tape recorder), as well as "base station" equipment.

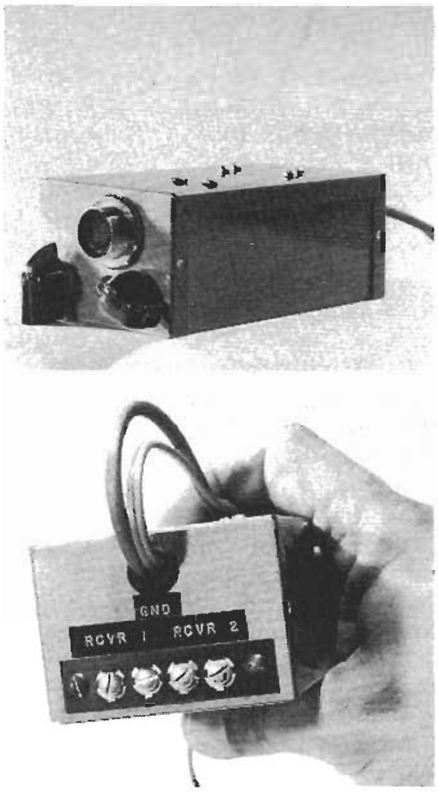
In use, the controller starts the tape recorder when a signal is picked up by the receiver, and stops the recorder when the signal disappears, so tape is used only when there is a radio signal present to be recorded.

The controller receives its input from the radio receiver speaker terminals, and it controls the tape recorder through the control circuit normally used for a push-to-talk mike. Since the FM gear used in business radio, on public service bands, and by many VHF amateur operators is totally quiet except when an RF signal is present, this control method works smoothly.

Referring to the wiring diagram, Q_1 operates as a current amplifier, and closes relay L_1 whenever there is a significant audio signal coming from the receiver. L_1 is a SPDT relay, so its contacts will control tape recorders with either normally-open or normally-closed motor switching.

C_2 also charges when current flows from collector to emitter of Q_1, and this charge serves to hold L_1 closed for a brief interval after the audio signal from the receiver drops out, to avoid clipping the tail end of the received transmissions, and to keep the recorder running during brief pauses in speech.





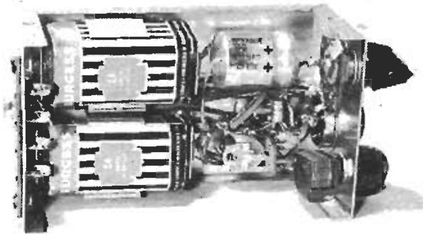
Terminal strip on rear of box accommodates leads from speaker connections of two receivers. Two inner terminal screws are grounded. Match these with grounded side of receiver speaker, if it has one side grounded.

Provision is made for two receivers, covering different frequencies, to be connected to the control unit. A front-panel selector switch determines which receiver will activate the control and be taped.

Provision also is made for a mike input to the controller, so that identification comments may be added to the recordings, either directly on top of the received audio signal from the radio, or separately. Whenever the mike is plugged into the controller, it may be used for taping your own words. If you wish to put comments on the tape with the mike without any of the radio transmissions being present, place selector switch S_1 in position 3. This disconnects both receivers from the audio circuitry, so their signals will not be fed through to the recorder. If you wish to add your own comments while recording a radio signal, just leave S_1 in the position for the receiver you wish taped, and operate the mike simultaneously. Most push-to-talk mikes contain a second set of contacts which kill the audio output from the mike when the push-to-talk button is released, so the mike will not put room noise on the tape, even though the recorder is running, unless you press the mike button.

The value of C_1 may be changed to suit individual requirements. Normally, it would be about .1 mfd for good audio response. This value may be changed, if desired, to obtain an audio balance at the recorder input between receiver audio level and mike audio level. These levels will vary, depending on the output of the mike you use and on the volume setting you normally use for your two-way receiver, or monitor, so the value of C_1 must be determined by experiment. Start with .1 mfd and try various values to find one that suits your operating conditions. The author used a .001 mfd, which is quite small for audio use and produces somewhat "pinched" audio quality, but is adequate for communications purposes and produces a comfortable balance between receiver audio level and mike level in the author's radio shack.

If added delay is desired at the end of recorded transmissions before the recorder is stopped, increase the



All components are accomodated in "top" half of Bud minibox. Terminal screws on back of box at left are connections for two receivers. Mike connector, input selector switch and battery on-off switch are on front of box at right. Relay, near bottom of box in photo, has SPDT contacts, so it may be wired to control either a recorder having a normally-open motor control circuit, or a unit such as the Uher recorder, which uses a normally-closed motor control circuit.

value of C_2.

A $5\frac{1}{4} \times 3 \times 2\frac{1}{8}$-inch Bud "minibox" holds the components comfortably, but since parts placement is not critical, virtually any reasonable size metal or plastic box may be used. Use audio coax for the line to the recorder audio input; hook-up wire or lamp cord is suitable for all other wiring.

When installing the relay, inspect the contacts with a magnifier to be sure there is a gap—this gap is quite small and may be accidentally squeezed closed in handling the relay.

PARTS LIST

R_1 1K ohm ¼ watt
C_1 .001 mfd mylar (see text regarding value)
C_2 500 mfd 25 volt electrolytic
S_1 1 pole 3 position rotary switch
S_2 SPST switch, rotary (shown) or toggle
L_1 Calectro 1,000 ohm coil relay (part D1-962)
Q_1 2N408
B_1 6 volt battery (two Burgess Z4 in parallel)
M_1 tape recorder mike (builder's choice)
Assembled in Bud minibox (CU-2106-A) $5\frac{1}{4} \times 3 \times 2\frac{1}{8}$ inches
Also: 4-screw terminal strip, 5-lug solder terminal strip (with center lug ground), short lengths audio coax & lamp cord to reach recorder, input connectors to fit recorder, panel mike connector (builder's choice).

CHFI *(cont'd from p. 25)*

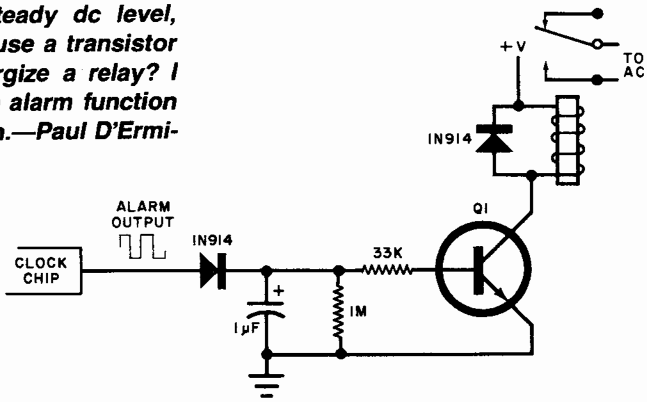
a shoal of mail. None were able to enjoy the extra two channels as decoders for this system are not yet available but most commented on the improved quality from the station during the test. According to CHFI's vice-president Engineering Ron Turnpenny this was because the programme was originated at the transmitter with master tapes and went out with full dynamic range. "We couldn't use four-channel limiters," he said, "because we don't have them.". Obviously from the reports, mono and two-channel stereo compatibility was fine. Tests made by DOC engineers before the system was put on the air confirmed by spectrum analysis that the four-channel transmission does not exceed their present specification for a stereo FM signal.

Tom Lott, president of Quadracast Systems, was pleased with the test and hopes to be able to use the DOC test results to support applications to the FCC. He said that he is still trying to get the Federal Trade Commission in the US to require all matrix four-channel manufacturers to qualify their claims to read 'simulated four-channel'. *(E.W.)*

TONE-ACTIVATED RELAY

Q. ***I have built a digital clock using a Mostek MK50252N chip which incorporates a "beeper" alarm. Is there a circuit I can add which will convert the beeps into a steady dc level, which will in turn cause a transistor to conduct and energize a relay? I would like to use the alarm function to turn appliances on.—Paul D'Ermilie, Staten Island, NY.***

A. One way of performing this function is to use a tone decoder IC like the 567. This chip has been featured in the Experimenter's Corner and has an output stage that can sink up to 100 mA. All you would have to do is select the proper values of resistance and capacitance for response at the output frequency of the alarm. Here's another solution. In the circuit shown, the diode produces pulsating dc which is smoothed out by the RC combination with a time constant of about one second. (Values can be changed for a different time constant). When the capacitor charges up sufficiently, it will source base current for the switching transistor, which will turn on and energize the relay. When the beeper stops, the transistor will cut off. Any general-purpose switching transistor can be used. Be sure that the relay coil is compatible with the transistor, and that its contacts can handle the current demand of the appliances.

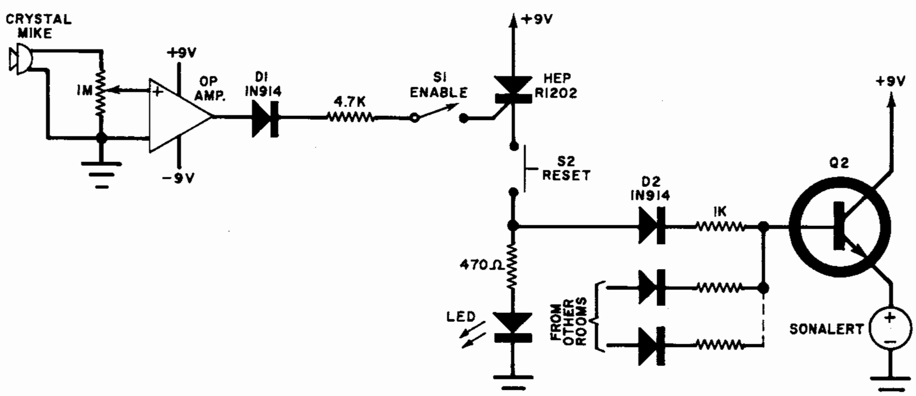


INFANT ALERT

Q. ***Here at an orphanage we need a sound-activated alarm so that the night nurse can tell at her desk when one of the children wakes and starts crying. Do you have a circuit that will light an appropriate LED and enable a beeper when this happens?***

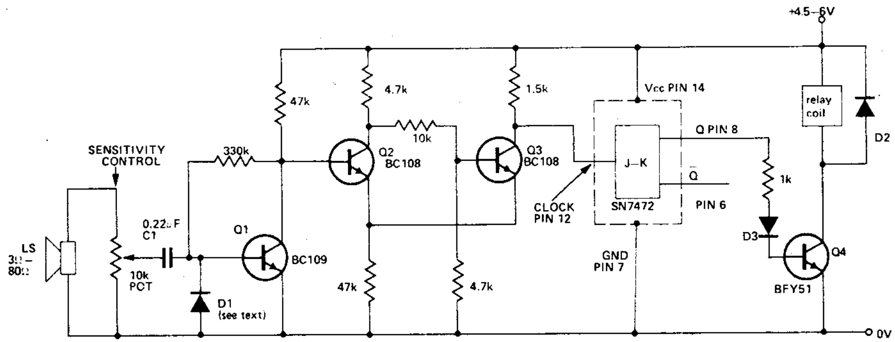
–Robert Wong, Aruba, N. Antilles

A. The circuit shown will work for you. When the infant starts to cry, the crystal mike (an inexpensive tape-recorder type) triggers the output of the op amp, which in turn activates the SCR. The SCR will cause the LED for that room to light, and enable the common beeper. When the nurse sees to the child's needs, she will push *S2* and cut off the SCR and transistor *Q2*. The leads from the rooms to the LED's and diodes can be any convenient length. Any medium-power (1 watt or so) npn transistor is suitable for *Q2*. Note that separate op amps (any general-purpose type), SCR's, etc., are needed for each location. Total cost can be reduced by using quad op amps. When the child is awake, *S1* should be left open to eliminate false triggering.



tech-tips

SOUND OPERATED TWO-WAY SWITCH

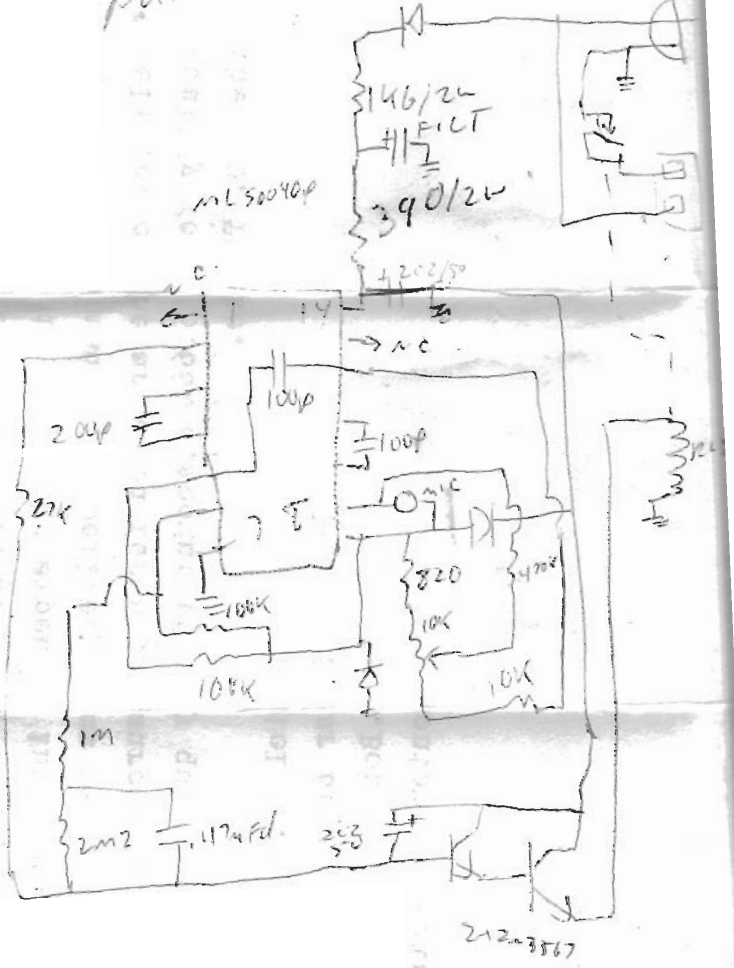


The circuit operates a relay each time a sound of sufficient intensity is made, thus one clap of the hands will switch it one way, a second clap will revert the circuit to the original condition. Q2 and Q3 form a Schmitt trigger. The JK flip-flop is used as a bistable whose output changes state every time a pulse is applied to the clock input (pin 12). Q4 allows the output to drive a relay.

Under quiescent conditions Q1 is on, holding the base of Q2 low and keeping the output of the Schmitt trigger low (Q3 collector). If a sharp noise is made (e.g. a clap) it will generate a pulse in the loudspeaker which is fed through C1 and switches Q1 off. D1 prevents any large pulses damaging Q1. As Q1 switches off, its output goes high causing the output of the schmitt trigger to go high. When the clap is finished Q1 again conducts, causing the output of the schmitt trigger to go low. Therefore each clap causes a high pulse at the Schmitt trigger's output which is fed to the clock of the JK flip-flop causing it's output to change state. This is used to turn a relay on and off. Because the circuit is only sensitive to sharp noises it is generally unaffected by talking or sounds caused by movement. (The sensitivity control can be adjusted to prevent such noises triggering the circuit if this does arise). A moving coil loudspeaker is used as a microphone as it can respond to sounds from any direction. It was found that any loudspeaker from 3–80Ω worked in the circuit. The $\overline{Q}$ output of the JK flip-flop could be used as well, allowing two relays to be switched on and off complementarily.

The circuit has limitless applications like turning on a radio or controlling motorised toys by clapping. The diodes can be any general purpose silicon types (1N914 etc) and the relay a 5–6V type with minimum resistance of 50 ohms.

PUT 1000 pF from pins 5 to 12 or



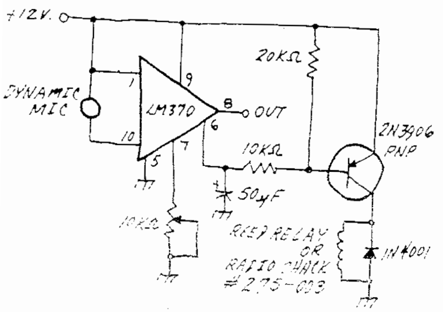
WHISTLE SWITCH

Voice actuated relay

I'm one of the many future subscribers to Modern Electronics, and have been enjoying assembling and applying your circuits around my shop. Can you provide me with a circuit for a voice actuated relay using ICs and a circuit that would provide a verbal output so my computer can talk to me directly?

R.J.R., Kinston, NC

I'm afraid I can't help you with the verbal output circuit—maybe one of our readers has such a circuit. If so, I'd like to see it. Fortunately, I can do a little better on the other circuit. This one, taken from the National Semiconductor Linear Applications Handbook, Volume 1. It's built around an LM370



IC. The level at which the circuit trips is set by the 10K pot connected to pin 7 of the IC. When activated, the relay is switched on. How the contacts are wired is left to you. By the way, the LM370 seems to be the IC of choice for voice actuated circuits.

Hobby Scene

By John McVeigh

VOX POPULI

Q. Could you please explain how a voice-operated switch in an SSB transmitter works?—R. Lloyd, Goldsboro, NC.

Q. Can you suggest a circuit for a VOX switch for use with my transmitter?—Dan Brown, New Albany, IN.

A. A VOX circuit samples the microphone signal, usually after amplification by a mike preamp. The signal is further amplified by a VOX amp, then rectified and smoothed into a positive dc level by an RC filter with a fairly long time constant. The receiver's audio output is also sampled, conditioned by an anti-VOX amp, then rectified and filtered by a diode and RC filter into a negative dc level. The VOX and anti-VOX signals are summed and applied to a comparator.

When the operator is not speaking, the microphone picks up the audio. But the anti-VOX signal prevents the receiver audio from tripping the VOX circuit. When the microphone detects speech, a positive input is applied to the comparator. When the VOX input exceeds a reference voltage (applied to the comparator to limit VOX sensitivity), a relay driver such as a transistor conducts, energizing the VOX relay. This relay in turn activates the transmitter's T/R relay. Also included in most VOX circuits is a delay circuit. This holds the VOX relay closed for an adjustable interval of time, thus preventing relay drop-out and chatter between syllables and closely spaced words.

A really nifty VOX circuit appeared in an article called, "A VOX for a Very Small Box," in *QST* for March 1976. It uses just two IC's and is powered by +12 volts dc. Back issues of *QST* are available for $1.50 from the American Radio Relay League, 225 Main Street, Newington, CT 06111.

Sonic Switch

By JOSEPH RITCHIE

ALI Baba had it made. He clapped his hands and the genie carried out all his commands. Unfortunately, the genie got trapped in the bottle and no one figured a way to get him out. EI has uncorked the bottle with an electronic genie to carry out your wishes. And all you have to do is clap *your* hands.

The Sonic Switch genie will turn power and TV or radio sound on and off, control lights and, well, just about anything else that has an on-off function. For example, our model is wired to control 117-VAC power. Depending on how relay RY1's contacts are used, the switch can shift power from one appliance to another—say turn off the hi-fi and turn on the TV. Or RY1 can be used to control a speaker or low-voltage circuit. Whichever way you connect RY1, operation is still controlled by two hand claps, finger snaps, whistles or taps within one second.

Fig. 1—Electronics is in box but crystal or ceramic mike must be external to prevent sound of tripping relay from reactivating the circuit.

A single clap or sound, such as that of a dropped book or ash try, will not trip the switch, nor will two sounds spaced more than 1 second apart. Speech and music? Normally they won't affect the switch.

The switch is sensitive to loud hand claps at 30 ft., soft claps at 20 ft. and finger snaps at 10 ft. Loud two-syllable words such as *mag-ic* and *stu-pid* will trip it up to about 10 ft. A lamp could be turned off by saying *light-off*. As you can imagine, an ingenious bit of circuit design makes possible the Sonic Switch's genie abilities. A full explanation appears at the end of this article.

Construction. The Sonic Switch is built in the U-section of a 7 x 5 x 3-in. Minibox. Under no circumstances attempt to mount the microphone in or on the box. The Sonic Switch has been designed for high sensitivity and the sounds of the relay tripping may cause continued cycling or chatter. While the design incorporates some spread to accommodate normal variations between transistors of the same number, it most likely will not work if you substitute other transistors. Do not change component values other than C7 and C8. In case of difficulty, the voltages shown in the schematic (in ovals) will help you get around variations in transistor characteristics (more on this later).

The parts are mounted on a 4½-in.-square piece of perforated board on which Vector T28 terminals are used for tie points. To make certain relay RY1 does not interfere with T1, mount the cabinet components before installing the board. Jack J1 is 1 in. up from the bottom and 3¼ in. from the right side of the panel (see Fig. 1). Position transformer T1 so its windings are almost flush with the edge of the U-section of the box. Power socket SO1 (if used) goes directly behind T1. Before mounting T1, cut off its unused leads. Mark RY1's mounting holes, making certain its contacts do not touch T1. Do not install RY1 until the rest of the wiring is completed.

Follow the pictorial of the board in Fig. 4 closely. Note that components are mounted on-end to conserve space. Don't cut the transistor leads short—use them full length. The diode leads should not be shorter than ¾ in. and use a heat sink on the transistor and diode leads when soldering.

Since there are many connections to the push-in terminals, install the diodes and transistors *after* all other components (except R10). Solder all components before installing the transistors and diodes; then spot-solder (don't wrap) the transistors and diodes to the tie points.

Take particular care of the polarity of the diodes when installing them. Be sure that R10 is installed so it can be removed without damage to other components. If possible, leave at least ¾-in. leads on R10 because it may have to be changed if you don't get the voltages indicated in the schematic.

After the board is complete install it on the bottom of the cabinet with a ¼-in. spacer or stack of washers between the board and chassis at each mounting screw.

Checkout. The proper circuit voltages are shown in the schematic inside ovals. Voltages are measured with a VTVM and may be within 20 per cent of the indicated values. Plug PL1 in an AC outlet. The voltage at the junction of SR1 and C10 should be 21 VDC. If it is higher or lower check to see if you have used the correct wires from T1.

Next, check the voltage at the junction of R16 and R19. If it is zero, or substantially lower than 13 V, check for a short. Similarly, if the voltage at the junction of R8 and R10 is zero or substantially less than 7.5 V check for a short. If the R8/R10 voltage is higher or lower by 1 to 1.5 V change R10's value until you get the correct voltage.

The voltage at Q1's collector should be 5 V. However, due to variations in transistor characteristics it may be 1 or 2 V higher or lower. Change R1's value to get the voltage close to 5 V. Since Q1 has high gain, change R1's value in small increments (30,000 ohms), say from 150,000 to 120,000 ohms.

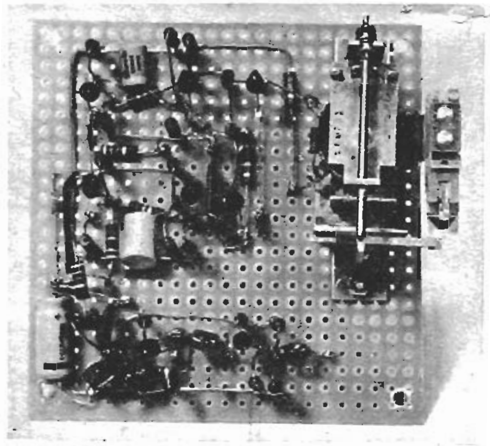


Fig. 2—Completely wired board. To conserve space, mount resistors on end. Drill holes in four corners of 4½-in.-sq. board for mounting purposes.

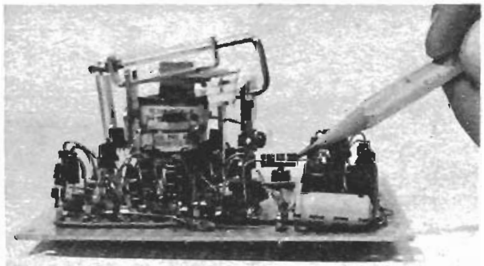


Fig. 3—Side view of board. Pencil points to R10, which should be mounted in clear because it may have to be replaced with different value after test.

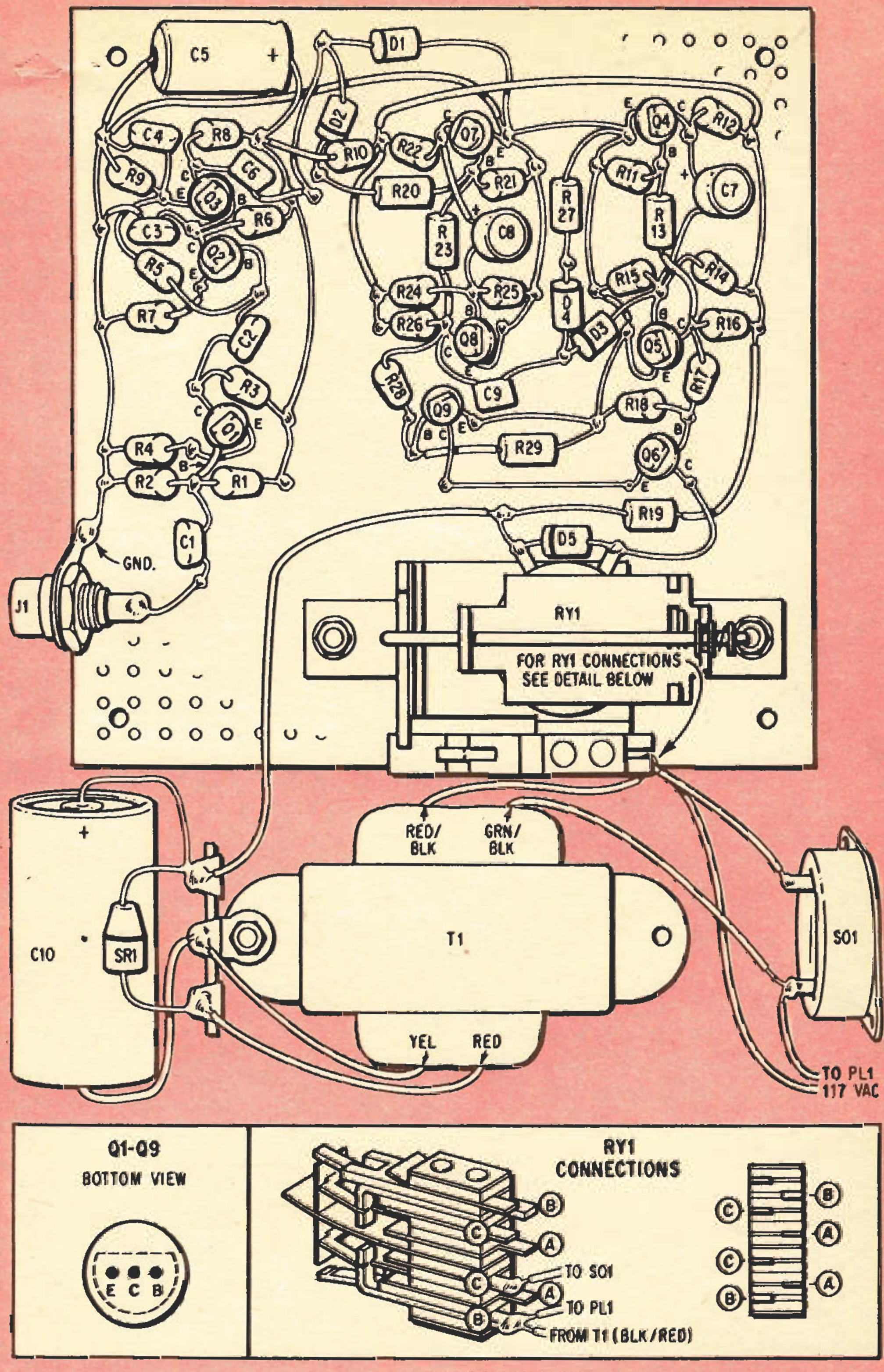


Fig. 4—Wiring is tight in upper half of board so go slowly and carefully. Cathode end of diodes D1 through D5 is indicated with the heavy black band above. It may be a color band on diode. RY1's lugs are below.

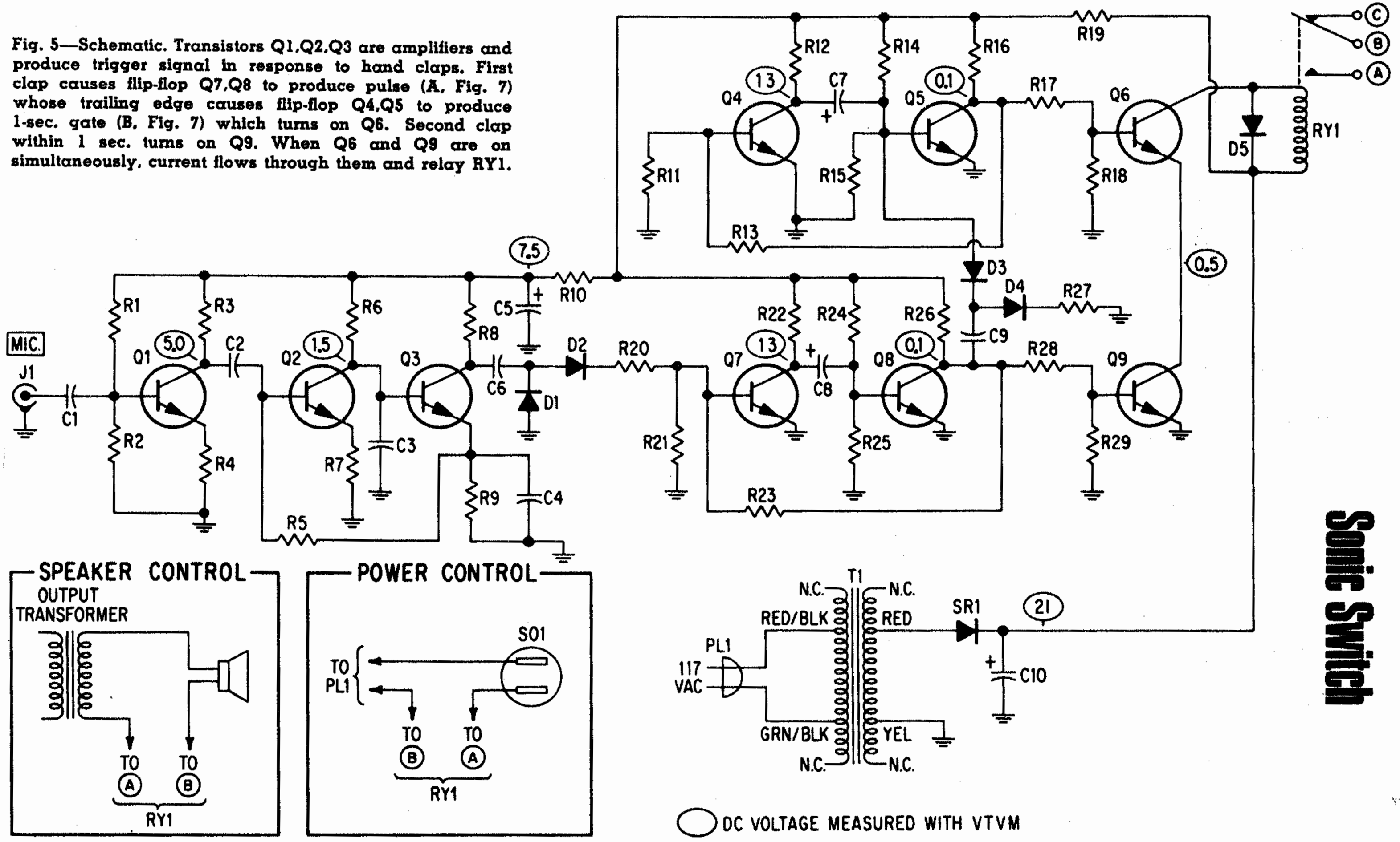


Fig. 5—Schematic. Transistors Q1,Q2,Q3 are amplifiers and produce trigger signal in response to hand claps. First clap causes flip-flop Q7,Q8 to produce pulse (A, Fig. 7) whose trailing edge causes flip-flop Q4,Q5 to produce 1-sec. gate (B, Fig. 7) which turns on Q6. Second clap within 1 sec. turns on Q9. When Q6 and Q9 are on simultaneously, current flows through them and relay RY1.

The collector voltage of Q2 should be close to 1.5 V. Change R5 in small increments to get the voltage close to 1.5 V but keep in mind that you're allowed a 20 per cent variation.

The voltage shown at the collectors of transistors Q4, Q5, Q7 and Q8 will appear only during stand by. If you get a low voltage when it should be high, and vice versa, check the diode polarities and polarities of C7 and C8.

If the voltages check out the Sonic Switch is ready to go. Apply power. Quickly touch J1's hot terminal twice. The hum pulses will cause RY1 to trip. If RY1 doesn't trip, measure the voltage at the collectors of Q5 and Q8. If the voltages don't rise, check the connections of D1 and D2. Each finger pulse (remember, a quick touch) should produce about a 1-VDC indication at the junction of diode D2 and resistor R20.

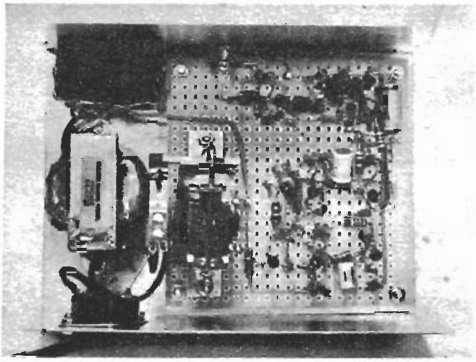


Fig. 6—Completed unit. Input jack is mounted 3½-in. in from left side of the U-section of Minibox (top). Transformer T1 goes at extreme left.

If the unit checks out, connect a crystal or ceramic mike (not dynamic) to J1, make your wish, clap twice and let the switch take over.

How It Works. The switch's secret of operation is a pair of flip-flops: Q4, Q5 and Q7, Q8. The signal picked up by a mike plugged into J1 is amplified by Q1, Q2 and Q3. The use of small-value coupling capacitors for C1, C2 and C6 attenuates the low frequencies predominant in speech and music or heavy footsteps. Maximum gain is given high frequencies such as are produced by impulse sounds like claps. The amplifier output is fed to voltage-doubler rectifiers D1 and D2.

Normally Q7's base voltage is low and its

[*Continued on page* 113]

PARTS LIST

Capacitors: 15 V or higher unless otherwise indicated
C1,C2,C3,C4,C6—.05 μf
C5—100 μf electrolytic
C7—50 μf electrolytic
C8—20 μf electrolytic
C9—.2 μf
C10—500 μf, 50 V electrolytic
D1 through D5—1N60 diode
J1—Phono jack
PL1—AC plug
Q1,Q2—2N3391 transistor (GE)
Q3—2N3392 transistor (GE)
Q4,Q5,Q7,Q8—2N3393 transistor (GE)
Q6,Q9—2N3415 transistor (GE)
Resistors: ½ watt, 10%
R1—150,000 ohms
R2,R3,R18,R29—10,000 ohms
R4—68 ohms
R5—220,000 ohms
R6—18,000 ohms
R7—150 ohms
R8,R10,R11,R15,R17,R21,R25,R27,R28—4,700 ohms
R9—1,000 ohms
R12,R16,R26—2,200 ohms
R13,R23—22,000 ohms
R14,R24—15,000 ohms
R19—560 ohms
R20—3,300 ohms
R22—2,700 ohms
RY1—DPDT impulse relay, 24 VDC (Potter & Brumfield PC11D-24VDC, Allied 41 B 6506)
SO1—AC receptacle
SR1—Silicon rectifier; minimum ratings: 400 ma, 50 PIV
T1—Low-voltage rectifier transformer; secondary: 10-20 c.t., 40 c.t. @ 100 ma (Allied 54 B 4732)
Misc.—7 x 5 x 3-in. Minibox, crystal or ceramic microphone, perforated circuit board, push-in terminals

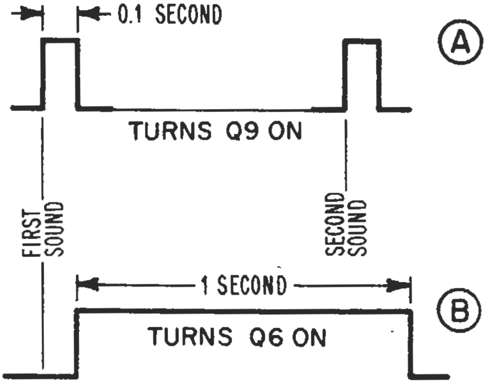


Fig. 7—First clap causes flip-flop Q7,Q8 to produce left pulse (A) whose trailing (right) edge causes flip-flop Q4,Q5 to produce 1-sec. gate (B). Second clap in 1 sec. turns on Q9 and RY1 trips.

Sonic Switch

Continued from page 51

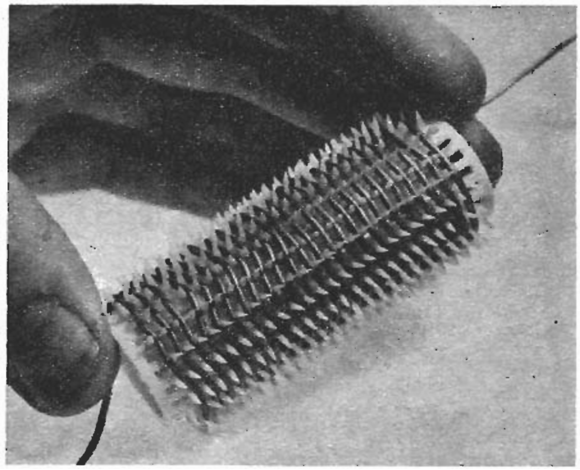
collector voltage is high Transistor Q8's collector voltage is low. When the DC at D2's cathode is applied to Q7's base, Q7's collector voltage falls. Capacitor C8 discharges through R25 and Q8. This reduces the bias on Q8's base and causes Q8's collector voltage to rise. After C8 has discharged it allows Q8's base voltage to rise. This causes Q8 to conduct and its collector voltage falls. Thus, a rectangular pulse is produced as in Fig. 7A. Essentially a square wave, this voltage is applied to Q9's base, turning Q9 on. Since Q9 is in series with Q6 and RY1, RY1 cannot close because Q6 is still off.

The square wave also is applied via C9, D3 and D4 to flip-flop Q4, Q5. The circuit constants of C9, D3, D4 and R27 are such that a spike voltage is applied to Q5's base at the trailing edge of Q8's pulse. The spike causes the Q4, Q5 flip-flop to trigger, but its time period, as shown in Fig. 7B, is much longer than that of Q7, Q8. The waveform at Q5's collector now turns Q6 on.

But note that the Q4, Q5 waveform is turned on after the Q7, Q8 output has returned to normal. Q6 is turned on, Q9 is now off, and RY1 still cannot close. Effectively, the first impulse (clap) has left Q6 turned on and Q9 turned off. If a second impulse is applied to D2 (the second hand clap) while Q6 is on, Q7, Q8 flips again turning on Q9. Since Q6 and Q9 now are both on, current flows through RY1's coil and RY1 closes. Since RY1 is an impulse relay, each pulse causes its contacts to close and stay closed even after the current through the coil stops. It takes two more impulses to open RY1's contacts. The impulses may be two sharp sounds, as we said before, such as claps, finger snaps or even two loud words like *light on* or *light off*.

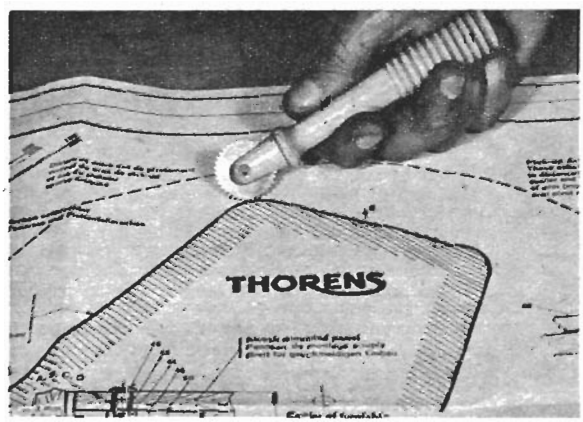
Remember that the second clap must come while Q4, Q5 is flipped (Q6 on). After about 1 second Q4, Q5 flops back to normal, Q6 is turned off and a second clap would have no effect on RY1.

The timing is determined by the values of C7 and C8. By maintaining the same *ratio* between the capacitor values but increasing their capacitance the time necessary for two claps can be lengthened. Similarly, decreasing their value shortens the required two-clap timing.



Next time milady goes out to buy hair curlers ask her to get you a few—not for your hair, for coil forms. They're cheap, low-loss and will keep coil windings from touching each other. By winding the coil between the many tiny projections you can keep the windings about 1/8 in. apart.

TIPS



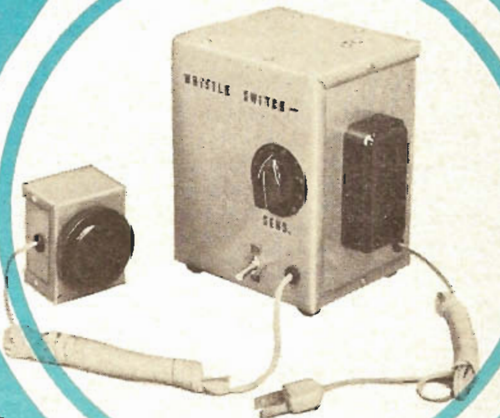
A dressmaker's fabric-marking guide is an excellent tool for transferring the cutout pattern from a record-changer mounting template to a baseboard. Sold in most variety stores for less than $1, the gadget also will serve in other woodworking projects which have full-size templates.

THE WHISTLE SWITCH

A cinch to build, this whistle-operated relay will turn electrical equipment on or off from distances up to 100 feet

By MARTIN J. LEFF

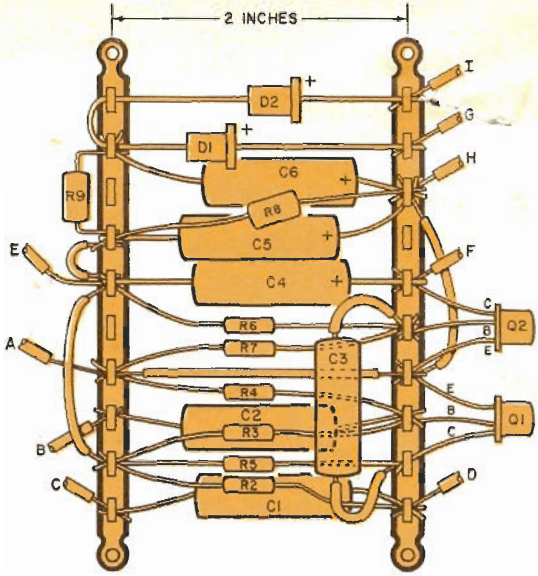
IN A LARGE mid-town Manhattan photo studio, the photographer had just finished posing his pretty model. "We're ready to shoot now," he said; "hold it while I switch on the lights." Expecting him to turn and walk to the distant wall switch, the model was understandably startled when he merely put his fingers to his lips and emitted a piercing whistle. But, in instant response to his signal, the great banks of lights overhead flicked on.



The photographer was using a variation of the "Whistle Switch." Responding to a whistle of the "puckered lips" variety, this unit will turn electrical equipment on or off from up to about 15 feet away. The range can be increased to about 50 feet by using a "lips and fingers" whistle, and mechanical whistles—such as the "police" type—will actuate the switch at distances up to about 100 feet.

Definitely more economical than the conven-

SWITCH



tional radio remote-control system, the Whistle Switch costs about $30.00 to build. And the price will be reduced materially if you already have some of the parts on hand.

About the Circuit. The whistle command is picked up by the carbon microphone *(MIC)* and converted to an electrical pulse. Amplified by transistors *Q1* and *Q2*, the pulse charges capacitor *C4* (which is connected in *Q2*'s collector circuit). Relay *K1*'s coil, connected in parallel with capacitor *C4*, is then energized—and *K1*'s contacts close, connecting the 117-volt line to the coil of latching relay *K2*.

With *K2*'s coil energized, that relay's contacts switch from "off" to "on," or from "on" to "off," depending on which position they were originally in. Then, as soon as the whistle stops, capacitor *C4* discharges, opening *K1*'s contacts and de-energizing *K2*. The contacts of *K2*, however, remain locked in whichever position they were switched to.

Since *K2*'s contacts control the line voltage to outlet *J1*, any device plugged into that outlet will be "whistle-controlled." One whistle will turn it on, the next will turn it off, etc.

The sensitivity of the Whistle Switch is governed by potentiometer *R1*, which acts as a mike gain control. Resistors *R3/R4* and *R6/R7* are voltage dividers, supplying bias for transistors *Q1* and *Q2*, respectively. Coupling capacitors *C1*, *C2*, and *C3* also act (in conjunction with *R1*, *R4*, and *R7*, respectively) as high-pass filters. The filtering action reduces the circuit's response to low-frequency noises (voices, etc.), while having no effect on the response to whistles.

Power for the Whistle Switch comes from the a.c. line via low-voltage transformer *T1* and a rectifying and filtering circuit consisting of diodes *D1* and *D2*, capacitors *C5* and *C6*, and resistor *R9*. Resistor *R8* is a bleeder for the power supply.

PARTS LIST

C1, C2, C3—0.1-µf., 200-volt paper capacitor
C4—2-µf., 25-volt electrolytic capacitor
C5, C6—50-µf., 25-volt electrolytic capacitor
D1, D2—SR-200 diode (Sylvania)
J1—Surface-mounted duplex outlet (household type)
K1—Sensitive relay; 2300-ohm, 4.6.-ma. coil (Sigma 11F-2300-G/SIL or equivalent—see text)
K2—Ratchet-impulse relay, 115-volt a.c. coil (Potter & Brumfield AP11A or equivalent—see text)
MIC—Telephone-type carbon microphone cartridge—see text
Q1, Q2—2N631 transistor (Raytheon)
R1—10,000-ohm, 2-watt potentiometer, linear taper

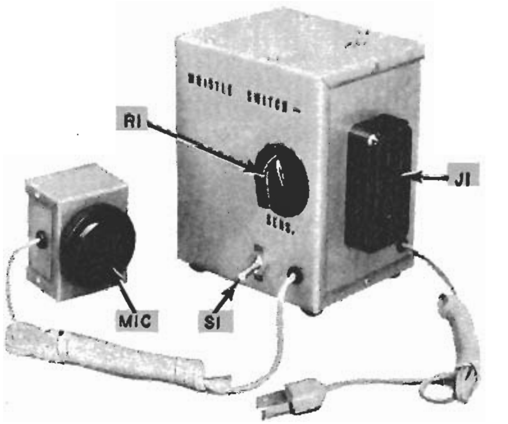
Construction. All of the components within the dotted box on the schematic diagram are mounted between two 10-lug (none grounded) terminal strips. Begin construction by temporarily screwing these two strips (parallel to each other and 2″ apart) to a wooden board. Then wire the components to the strips as shown in the pictorial diagram of the assembly and in the schematic. Install a 6″ lead at all points where a wire must run from the assembly to another part of the circuit. These points are lettered "A" through "I" in both the pictorial and schematic diagrams.

The completed terminal strip assembly is removed from the board and mounted under the top of a 6″ x 5″ x 4″ aluminum

Begin construction by temporarily fastening the two terminal strips to a board. After wiring as shown at left, remove assembly from board and mount in utility box.

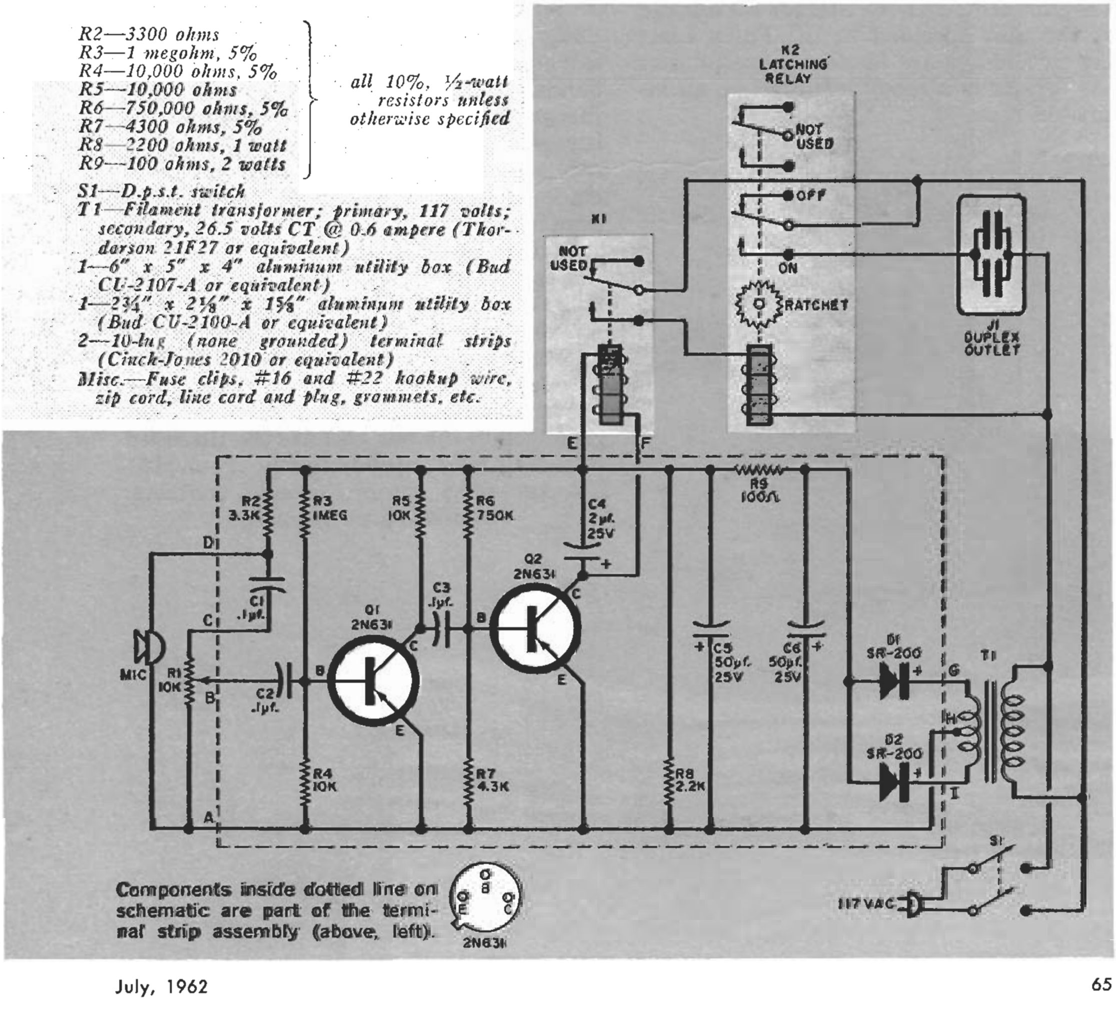
utility box (see photos). Transistors *Q1* and *Q2*, as used in this circuit, are quite temperature-sensitive. Therefore, they are snapped into a couple of fuse clips (which act as heat sinks) fastened next to the terminal strip assembly.

Potentiometer *R1*, switch *S1*, and relay *K1* are mounted on the front panel of the utility box. Since one side of the a.c. line will appear on the frame of relay *K1*, the latter must be insulated from ground. The author solved this problem by in-

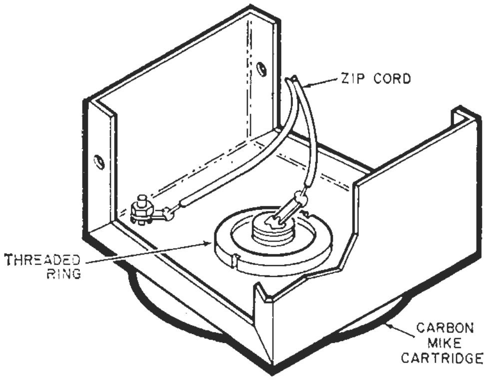


Completed Whistle Switch is shown above. Mike is in separate box to prevent pickup of relay noises.

R2—3300 ohms
R3—1 megohm, 5%
R4—10,000 ohms, 5%
R5—10,000 ohms
R6—750,000 ohms, 5%
R7—4300 ohms, 5%
R8—2200 ohms, 1 watt
R9—100 ohms, 2 watts
(*all 10%, ½-watt resistors unless otherwise specified*)
S1—D.p.s.t. switch
T1—Filament transformer; primary, 117 volts; secondary, 26.5 volts CT @ 0.6 ampere (Thordarson 21F27 or equivalent)
1—6" x 5" x 4" aluminum utility box (Bud CU-2107-A or equivalent)
1—2¾" x 2⅛" x 1⅝" aluminum utility box (Bud CU-2100-A or equivalent)
2—10-lug (none grounded) terminal strips (Cinch-Jones 2010 or equivalent)
Misc.—Fuse clips, #16 and #22 hookup wire, zip cord, line cord and plug, grommets, etc.



Components inside dotted line on schematic are part of the terminal strip assembly (above, left).



Method of mounting mike on box will vary with type of cartridge employed. Author's installation (see text) is illustrated here.

stalling *K1* on a small square of insulating material which, in turn, was fastened to the panel. If you prefer, you can use a Sigma 11F2-2300-G/SIL for *K1* instead of the unit specified in the Parts List; the two relays are identical, except that the former is already mounted on an insulated base.

Mount transformer *T1* and relay *K2* on the bottom of the box. The transformer is located as far as possible from sensitive relay *K1* so that *K1* won't be affected by the transformer's magnetic field.

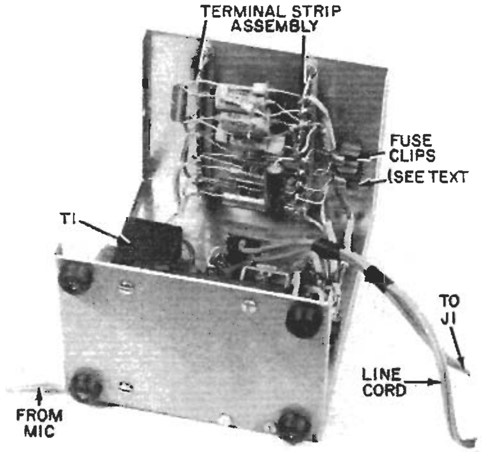
The relay specified for *K2* in the Parts List was used primarily because the author happened to have it on hand. It has two sets of s.p.d.t. contacts. One of these was not employed in this application; the other was used as a s.p.s.t. switch. Any similar relay will work in this circuit as long as it has a 117-volt coil and at least one set of s.p.s.t. contacts.

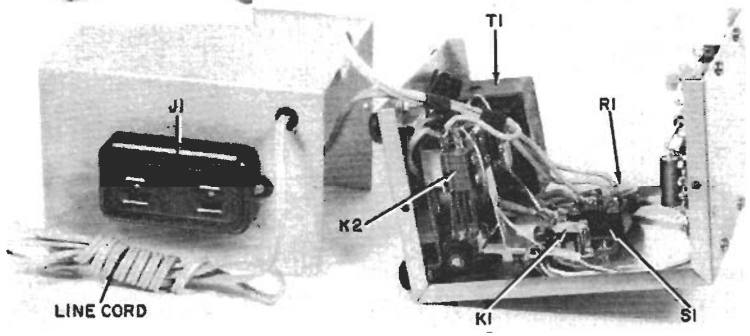
Outlet *J1* is located on one of the sides of the box cover, and both its cord and the line cord enter the box through grommeted holes near the outlet. A similar hole at the bottom of the front panel accepts the cord from the microphone.

To prevent the microphone from picking up noise from relays *K1* and *K2*, it is mounted in a separate utility box (2¾" x 2⅛" x 1⅝"). A carbon mike, salvaged from a government-surplus handset, was used by the author. The threaded ring sealing the carbon chamber was removed and re-installed as a retaining ring to hold the microphone in place on the box's front panel (see drawing). If you use this method of installation, be careful not to spill any of the carbon granules while you have the ring unscrewed.

A 5′ zip-cord cable is attached to the microphone and run out of the utility box through a grommeted hole. In the model shown, one lead of the mike cable was grounded to the box because the threaded retaining ring (automatically grounded) also serves as one of the mike contacts.

(*Continued on page* 98)





Positioning of terminal strip assembly can be seen in the photo above (note fuse clips used as heat sinks for Q1 and Q2). View at right shows wiring associated with cover.