Audio-visual controller synchronizes museum display

by William S. Wagner
Northern Kentucky University, Highland Heights, Ky.

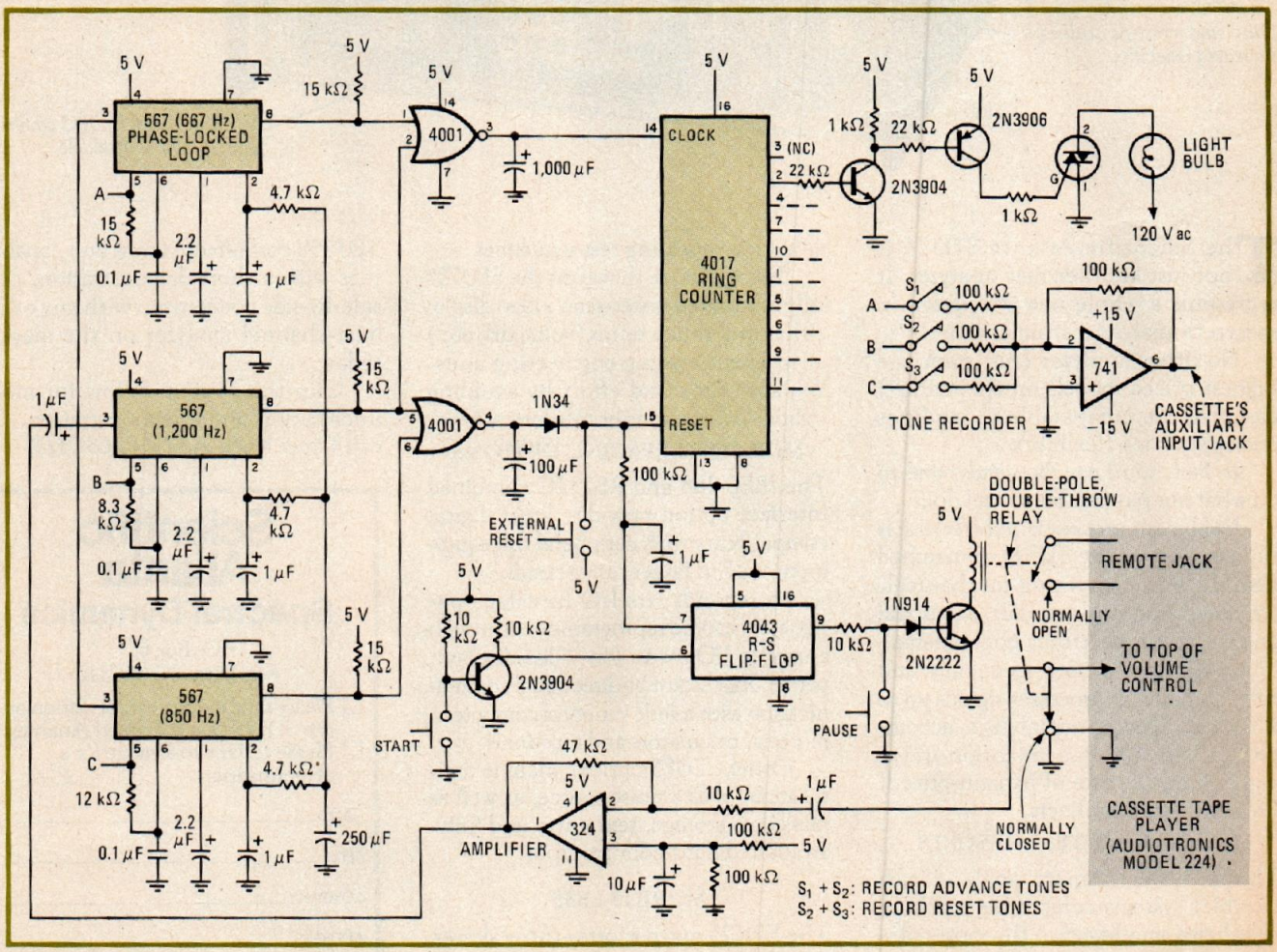
A synchronized sound-and-transparency show that may be placed in any convenient area of a museum or science building can be created with this interface. Built entirely with off-the-shelf components, the cost of the circuit is below $20.

The interface controls a cassette player and a display having several illuminated panels. Each panel contains a color transparency and a source of light (in this case, a light bulb). The circuit causes these transparencies to light in sequence, while advancing the cassette tape, which contains a recorded message for each panel. Pairs of recorded audio tones control panel sequencing and thus synchronize the audio-visual display.

When the show ends, a second pair of audio tones shuts the entire display off. Because a continuous tape loop is used, the show may be restarted by pressing a start button. A pause button is included to extend the viewing period of any panel.

As for circuit operation, when the start button is pressed, the 4043 reset-set flip-flop sets, turning on the 2N2222 transistor and pulling in the double-pole, double-throw relay. Its normally open contact closes, turning on the cassette player's motor. At the same time, the relay's normally closed contact opens, allowing the audio signal to reach the LM324 amplifier. A 667- and a 1,200-hertz tone combine to form the initial sound heard and to activate their respective 567 phase-locked loops. This causes pin 3 of the first 4001 NOR gate to go high and advance the 4017 ring counter.

When pin 2 of the counter goes high, the 2N3904 and 2N3906 transistors turn on and the triac fires, causing the first light bulb to illuminate the first transparency. Then the recorded message corresponding to that trans-



Show and tell. This interface synchronizes sound with illuminated panels and can be used in museum or science building displays. Cassette tapes hold recorded segments corresponding to information seen on illuminated display panels. When the circuit detects a chord preceding a given segment of text, the following panel is illuminated. Also, the interface has an automatic shut-down feature.

parency is played. At the end of the message a second pair of recorded tones (667 and 1,200 Hz) causes the 4017 counter to advance to pin 4, turning off the first light and turning on the second with its appropriate interfacing transistors and trlac.

This process is repeated until all transparencies have been displayed and described. At the end of the show, recorded tones at 850 and 1,200 Hz activate their respective PLLs and the 4017 is reset so that all lights are turned off. The 4043 R-S flip-flop is also reset and turns off the 2N2222, which deactivates the relay and turns off the cassette player. □

aking a clock chip keep better time

by M. F. Smith
Department of Computer Science, University of Reading, England

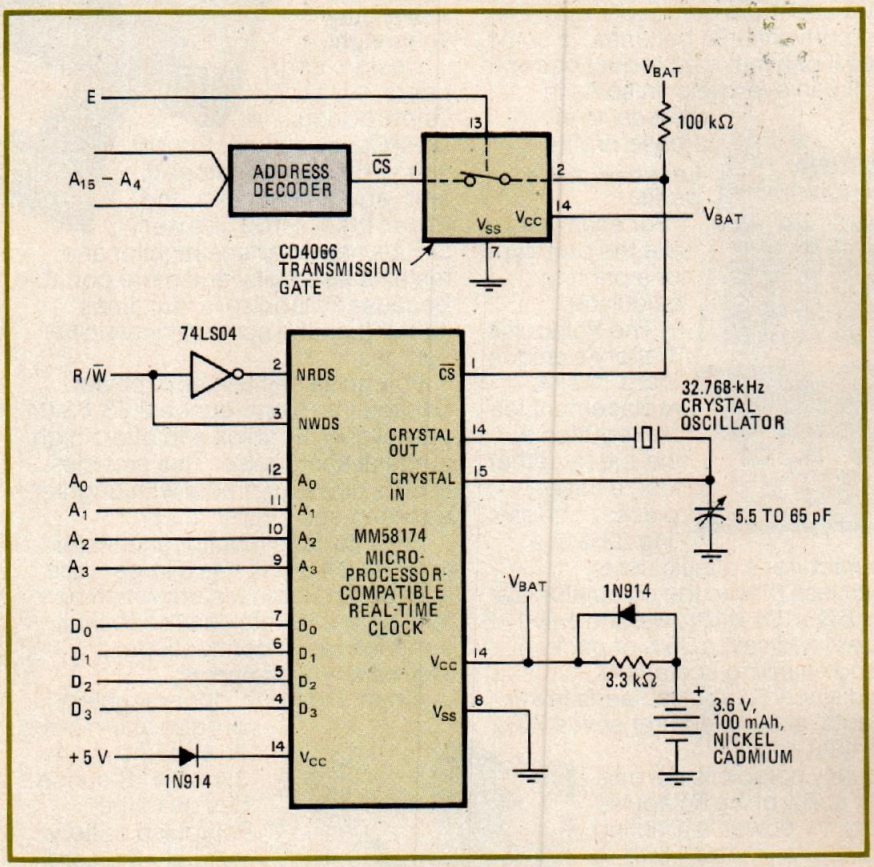
Maintaining both the time and date functions in microprocessor applications became much easier when National's MM58167 and MM58174 microprocessor-compatible real-time clocks were introduced. The software approach that was used before their introduction simplified software and memory requirements, allowed increased flexibility of clock rates and selection of time resolution, and easily accommodated scheduling protocols. However, keeping time during a brown-out was still disastrous to system operation as was attempting to maintain the correct time despite the occasional timing difficulties that occur under software control.

Yet, occasional read errors and problems with spurious writing to the MM58174 when power is going down creates difficulties with the hardware-based system. These difficulties can be overcome with the software and hardware fixes prescribed here, which are intended for the MC6800 microcomputer system.

The problem with occasional read errors may be easily overcome by modifying software control to ensure that a valid binary-coded decimal number is read before the program continues and by ordering a rereading of the data if it has not been captured the first time (see printout of the partial listing, line 84). The cause of the read errors has never been definitely ascertained, although the problem has been encountered when other microprocessors have been used, such as National's 1NS8073. Thus, there may be a rare timing problem within the MM58174 itself, or the difficulty may occur between the microprocessor and the clock chip.

Trying to write to the clock chip when the power is going down will ordinarily cause a loss of timing information. A number of methods of preventing the loss were tried, and the one in the figure was the simplest and most successful.

Here, the CD4066 electronic switch will allow the chip to be selected only when the MC6800 clock enables



Glitch-free. The CD4066 transmission gate prevents loss of time-date information that is associated with an MM58174 hardware clock during a power-down condition. Read errors in time-date information may be eliminated in the software of a microprocessor system by writing a loop to ensure the program does not advance until the data has definitely been read correctly.

Dual tones advance slides automatically

by J. A. Connelly and Douglas Martin
Georgia Institute of Technology, School of Electrical Engineering, Atlanta, Ga.

This circuit generates dual audio tones that are recorded on a tape so a slide projector will advance whenever both tones are present during playback. Two LM567 tone decoders are the heart of the circuit and the individual voltage-controlled–oscillator frequencies are set by R_1, C_1 and R_2, C_2.

For the circuit shown, $f_1 = 1/(R_1C_1) = 10$ kilohertz and $f_2 = 1/(R_2C_2) = 7.7$ kHz. The highest frequencies that the recorder can reliably reproduce were chosen to minimize possible annoyance to the listener. Two phase-locked–loop tone decoders prevent false triggering that would allow music or voices to be recorded with the tones.

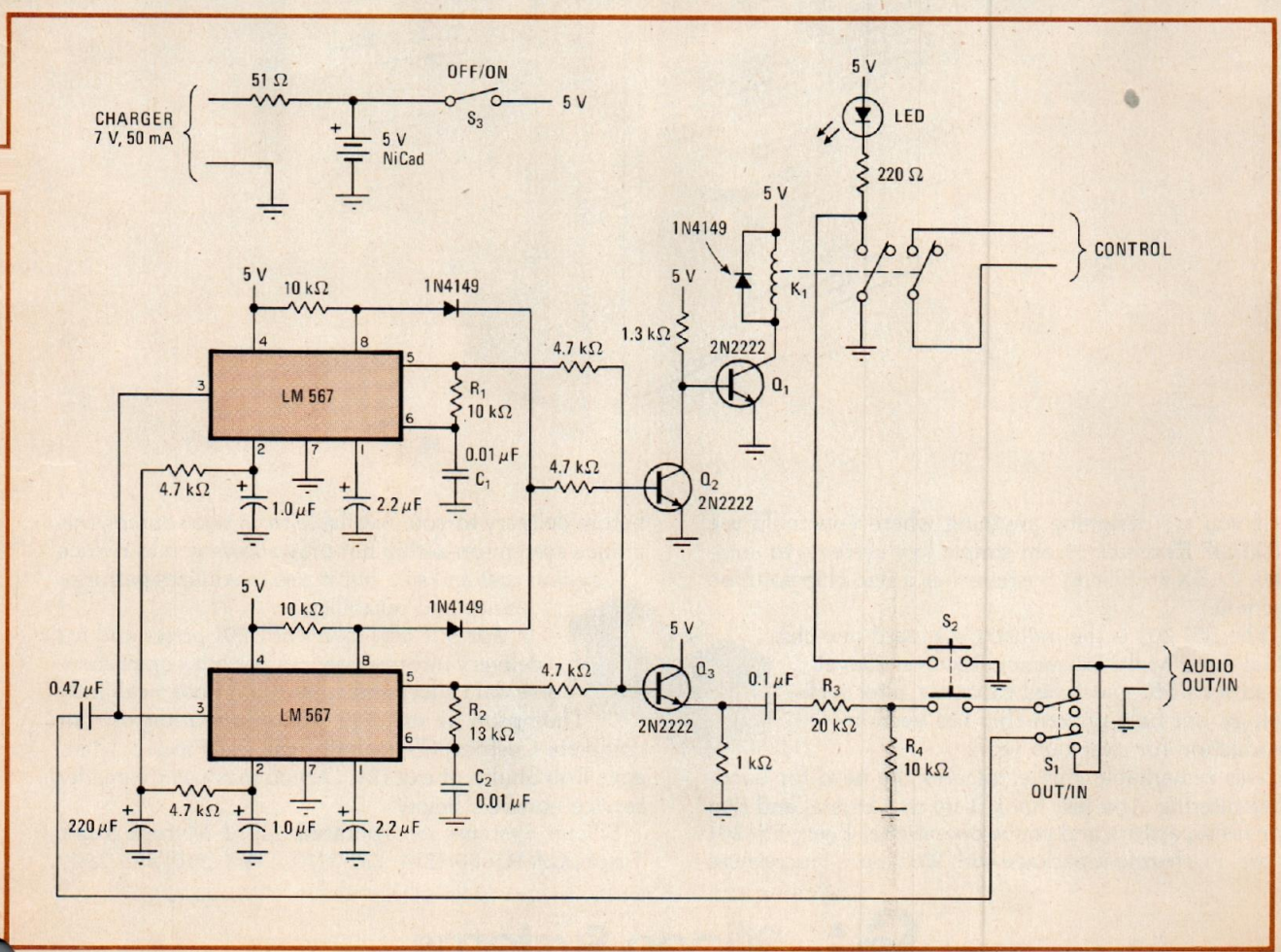
The VCO frequencies from pin 5 of both tone decoders are summed at the base of Q_3, which buffers the output tones. This prevents any recorder loading from changing the VCO frequencies. When the VCO frequency is present at the pin 3 inputs, the PLL locks and an internal transistor saturates, shorting pin 8, an open-collector output, to ground. The outputs at pin 8 of the two PLLs are diode-OR-ed, so that only when both VCO frequencies are present at the input does the transistor Q_2 switch off.

This action switches Q_1 on, also turning on relay K_1. One set of the contacts of K_1 are used to advance the projector. The other set of contacts serves to turn on a light-emitting diode that provides a visual indication of when the tone is received. This same LED is also connected with switch S_2 so that it indicates when the tones are being recorded onto the tape. This switch, which is used during recording, is pressed for about 1 second at each point on the tape at which it is desired to advance the slide projector.

Switch S_1 prevents feedback between the output and input tones. If both are connected to the recorder at the same time, the outputs at pin 8 will oscillate as the LM567s try to track their own VCO frequencies.

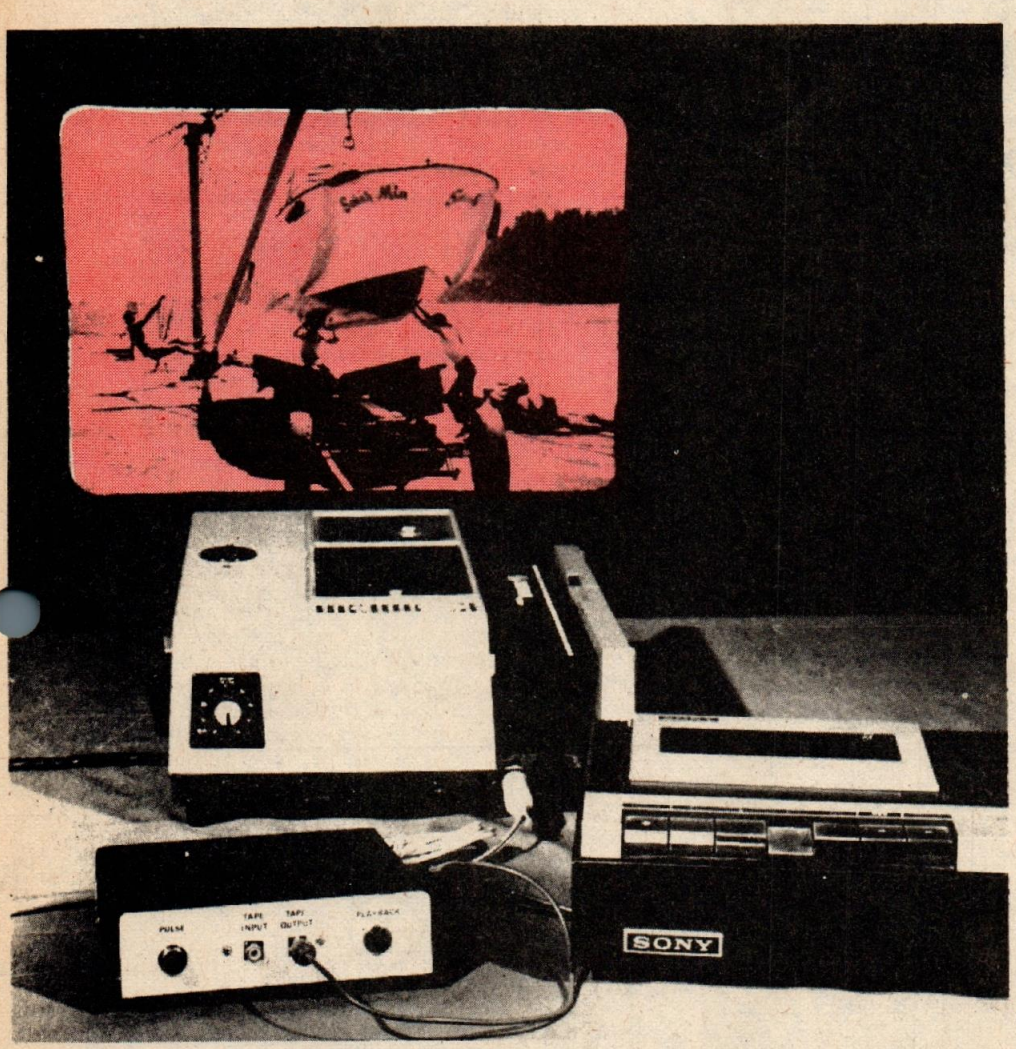
The tone-output–attenuating resistors, R_3 and R_4, should be chosen so that when the tones are recorded at normal levels for music and voice, their playback level is close to 200 millivolts peak to peak. This level will assure reliable phase lock by the PLLs.

The circuit draws a small standby current of 17 milliamperes and can therefore run off a battery. □



Double duty. Two tones are simultaneously recorded onto a cassette tape when switch S_2 is pressed. The LM567 tone decoders, which generate the tones, also decode them from the tape and trigger Q_2 to energize relay K_1, which in turn advances a slide projector.

TAPE/SLIDE SYNCHRONIZER



This unit automatically changes slides on an automatic projector. It does this at predetermined times, synchronizing with the commentary prerecorded on a two-channel, cassette or reel-to-reel tape recorder.

Practically all tape recorders sold today have two-channels, and when used to record commentaries for slide shows, only one of the two available channels is normally used. The automatic slide changer described in this article utilises the second, normally unused channel.

The projector's slide mechanism is actuated by short tone bursts recorded onto this second channel at the points where slide changes are required. The tone that is used for this purpose is derived from the full-wave rectified (but unsmoothed) mains frequency.

To record the tape initially, the slides are loaded into the magazine of the projector in the order in which they will be shown. The commentary is then recorded onto Channel 1 in the normal way, and the pulse button on the front of the control unit depressed whenever a slide change is required. This changes the slide and simultaneously records a control tone onto Channel 2.

Once the tape has been prepared, the control unit can be used automatically to switch the slide projector at the

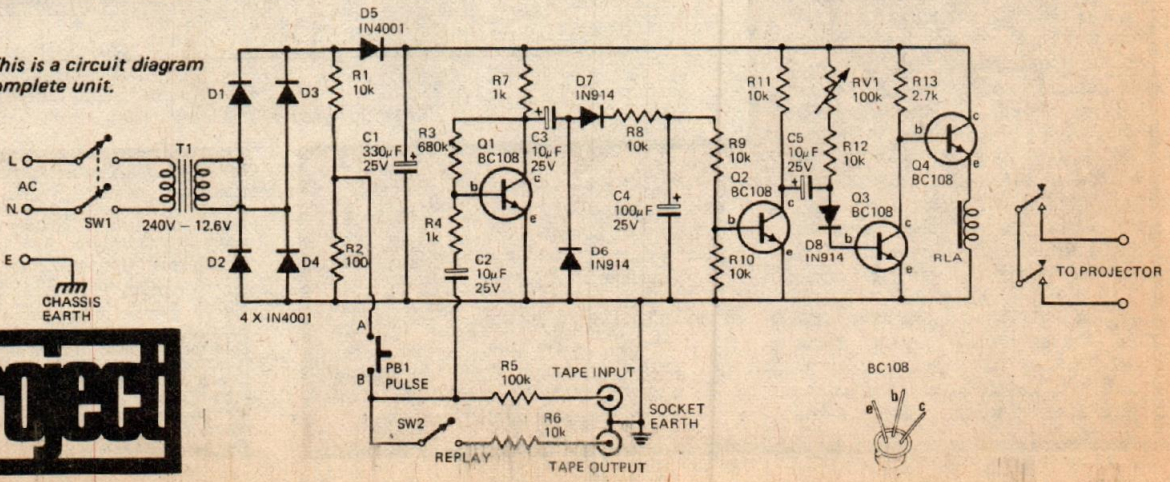


Fig. 1. This is a circuit diagram of the complete unit.

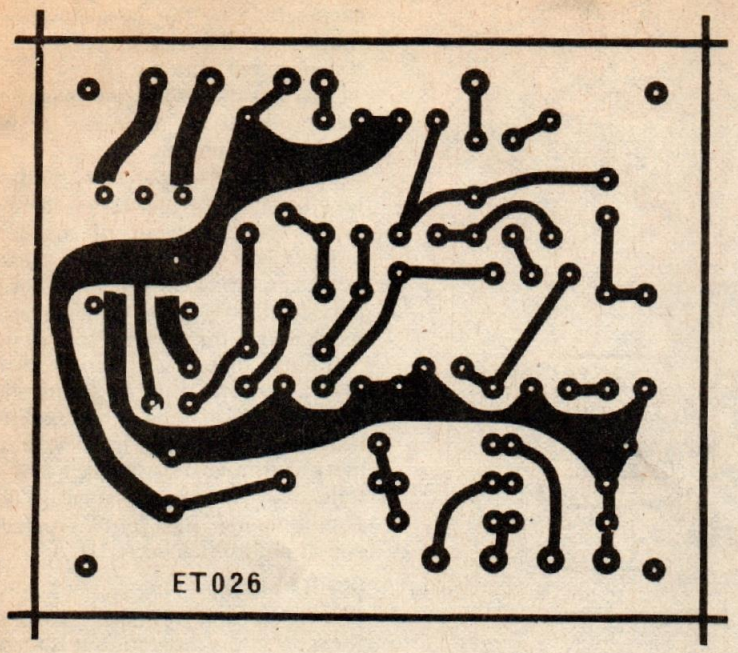


Fig. 2. Foil pattern of printed circuit board – full size.

predetermined times in synchronization with the tape recording.

CONSTRUCTION

The circuit diagram of the complete unit is shown in Fig. 1.

The unit may be assembled on matrix board, tag strips, or, preferably, on the printed circuit board, the foil pattern of which is shown in Fig. 2.

Figure 3 shows how the components are assembled on the printed circuit board. Note that resistors R5 and R6 are mounted on the front panel of the unit – as shown in Fig. 4.

Having completed assembly, check the orientation of diodes, transistors and electrolytic capacitors.

Figure 5 shows how the completed printed circuit board and remaining components are located within the case. Ensure that all wiring carrying mains voltage is adequately insulated and the metal case is well earthed.

CHECKING THE UNIT

Figure 6 shows how the various units should be interconnected – both for checking and for subsequent recording of the tape. The relay output lead of the control unit is connected to the slide projector's external control socket; the second (normally unused) input socket of the tape recorder is connected to the input socket of the control unit, and a microphone is then

HOW IT WORKS

The sync. pulse is derived from the mains. It is simply the 100 Hz rectified but unsmoothed output from the secondary of tranformer T1.

This 100 Hz signal is suitably attenuated by R1 and R2 to achieve a level suitable for recording onto the tape.

Diode D5 isolates the filter capacitor from the pulse generating network.

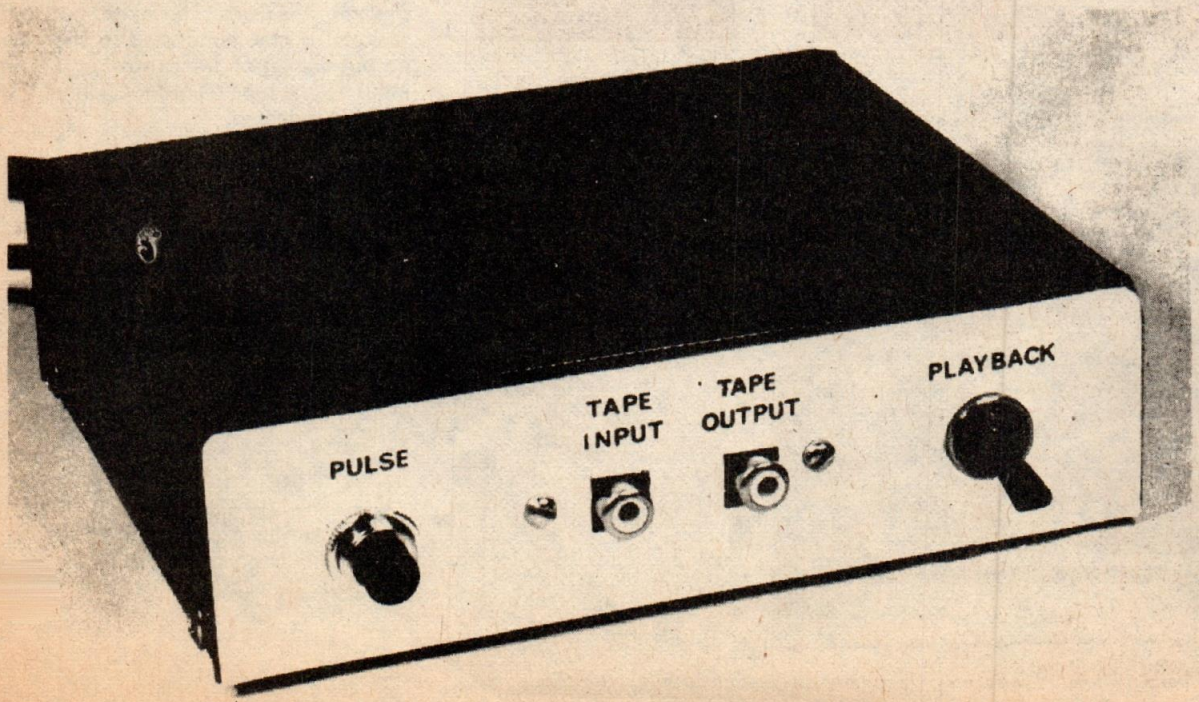
When push button switch PB1 is pressed, the signal from R1, R2 is fed to the tape recorder and also, via C2 and R4, to the remainder of the control unit.

The 100Hz signal is amplified by Q1 and then rectified and smoothed by D6, D7, C3 and C4. Capacitor C4 takes a few cycles to charge, and when it does Q2 turns on.

The action of Q2 turning on, causes C5 momentarily to remove the bias from Q3. The length of time for which the bias is removed is determined by the setting of RV1.

Transistor Q4 is an emitter follower and applies power to the output relay during the time that Q3 is turned off, and so RV1 in effect controls the length of time that the relay contacts remain closed. The contacts of this relay then actuate the slide change mechanism of the projector.

During the replay period, the control pulses from the tape recorder are fed into the control unit via R5, C2 and R4 and then actuate the unit in the same manner as described above.



TAPE/SLIDE SYNCHRONIZER

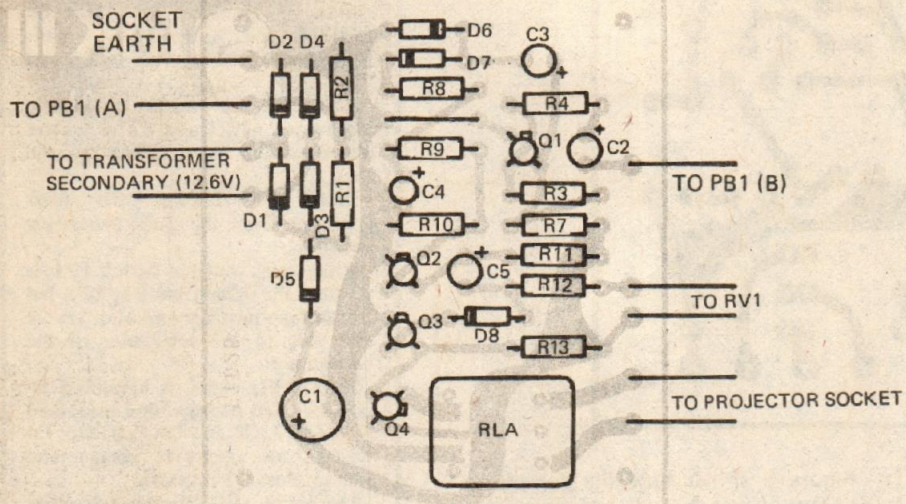


Fig. 3. How the components are assembled on the printed circuit board.

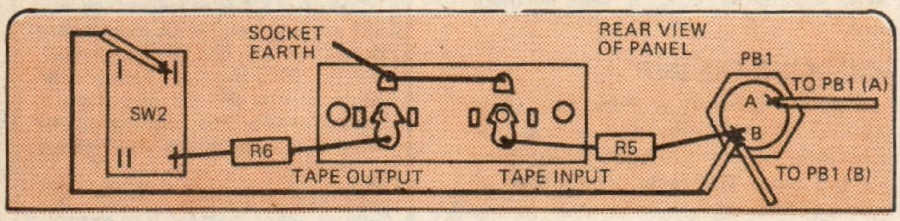


Fig. 4. This drawing shows components and wiring on the front panel of the unit.

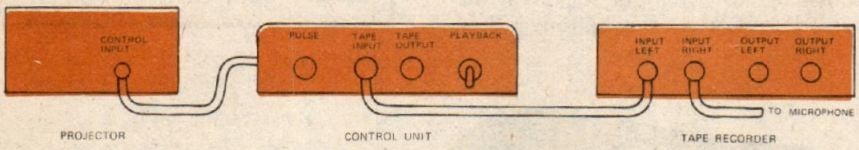
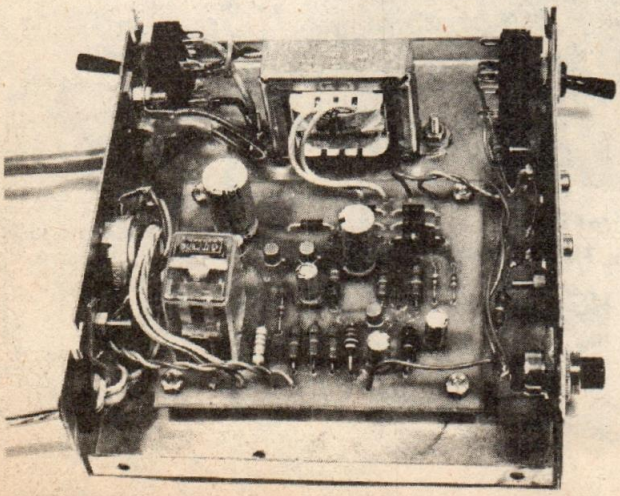


Fig. 6. Interconnections – checking and recording.



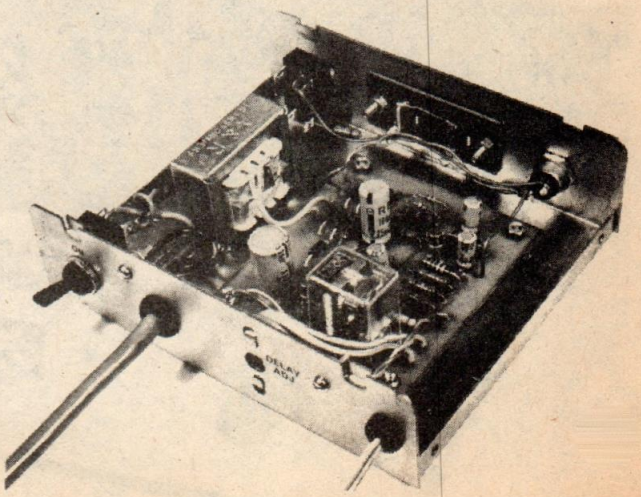


Fig. 5. The printed circuit board and remaining components assembled within the case.

connected to the tape recorder (Input Channel 1) in the normal way. The output of the tape recorder is left disconnected at this stage.

Load the slides into the magazine of the projector in the order in which they will be shown.

Switch on all three units. Slides can now be changed by pressing the 'pulse' button on the front of the control unit. It will be necessary to press this button for about one second. The time period is not critical providing it is long enough for the slide to change.

Internal circuitry – controlled by RV1 – ensures that only one slide is changed at a time, this feature is lacking on many proprietary units. If more than one slide is changed – or a slide does not change at all – adjust potentiometer RV1 until satisfactory operation is obtained.

OPERATION

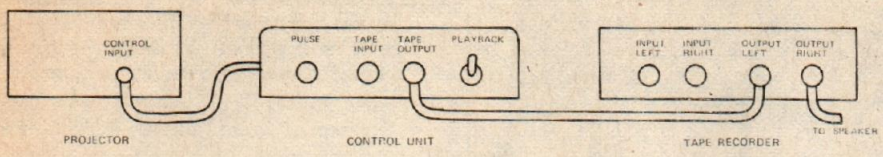
Once the unit has been checked out for satisfactory operation it is ready to use.

A minimum period of about five seconds must be allowed between slide changes to enable the control unit to reset.

Move the first slide in the required sequence into position, start the tape recorder, and record the required commentary, changing the slide whenever required by actuating the button on the control unit. Stop the tape recorder when the last slide has been shown.

Figure 7 shows how the units are interconnected for replay. As can be seen the relay output lead of the control unit is still connected to the external control socket of the slide projector, but the output from Channel 2 of the tape recorder (from preamplifier or speaker output sockets) is now connected to the tape output socket of the control unit. The input to the tape recorder Channel 2 is left disconnected.

Fig. 7. Interconnections — replay.



PARTS LIST ET 513

R1	— resistor	10k	½ Watt	5%
R2	— resistor	100ohm	½ Watt	5%
R3	— resistor	680k	½ Watt	5%
R4	— resistor	1k	½ Watt	5%
R5	— resistor	100k	½ Watt	5%
R6	— resistor	10k	½ Watt	5%
R7	— resistor	1k	½ Watt	5%
R8-R12	— resistor	10k	½ Watt	5%
R13	— resistor	2.7k	½ Watt	5%
C1	— capacitor	330µF	25V electrolytic	
C2	— capacitor	10µF	25V electrolytic	
C3	— capacitor	100µF	25V electrolytic	
C4	— capacitor	10µF	25V electrolytic	
C5	— capacitor	10µF	25V electrolytic	
Q1-Q4	— transistors	BC108		
D1-D5	— silicon diodes	IN4001	or equivalent	
D6-D8	— silicon diodes	IN914	or equivalent	
RLA	— miniature relay 430 ohm coil (or equivalent)			
T1	— mains transformer — 12.6V, 150 mA			
PC board	— ET 026			
SW1	— double pole on/off switch			
SW2	— single pole on/off switch			
PB1	— push button switch — press to make RCA sockets, metal case, three-core flex, cable clamp, plug to suit projector, hook-up wire etc.			

Flick the replay switch SW2 to the off position and move the first slide into position. Now start the tape recorder and switch the replay switch into the on position as soon as the commentary starts. The slides will now be changed automatically at the prerecorded times.

The 'pulse' button on the control unit may still be used to override the control unit at any time.

The replay switch must be in the off position when stopping, starting or rewinding the tape as any signal from the tape recorder will initiate a slide change. ●

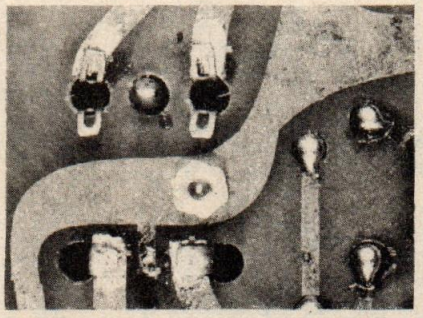
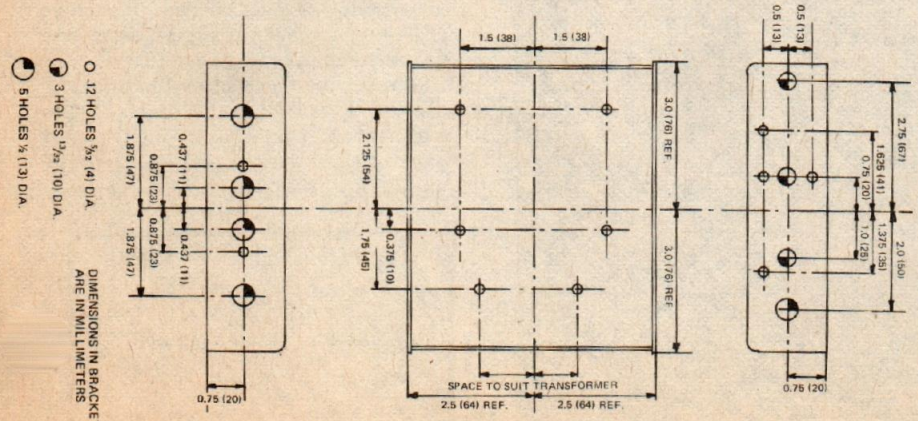


Fig. 8. The relay is soldered directly onto the printed circuit board. The two centre pins of the change-over contacts are commoned — as shown here.



Metalwork details.

BUILD THE

TREASURE TRACER MK III

METAL LOCATOR

AS SEEN ON BBC-1 & BBC-2 TV

- Genuine 6-silicon transistor circuit, does not need a transistor radio to operate.
- Incorporates unique varicap tuning for extra stability.
- Search head fitted with Faraday screen to eliminate capacitive effects.
- Loudspeaker or earphone operation (both supplied).
- Britain's best selling metal locator kit.
- Kit can be built in two hours using only soldering iron, screwdriver, pliers and side-cutters.
- Excellent sensitivity and stability.
- Kit absolutely complete including drilled, tinned, fibreglass p.c. board with components siting printed on.
- Complete after sales service.
- Weighs only 22oz; handle knocks down to 17" for transport.

Send stamped, self-addressed envelope for literature.

Complete kit with pre-built search coil **£10.9**
Plus 60p P&P
Plus 92p VAT

Built, tested and Guaranteed **£15.25**
Plus 60p P&P
Plus £1.27 VAT

South Africa, Rhodesia etc: Send £14.00 for kit, £18.00 built, both include Air Mail.

MINIKITS ELECTRONICS,
6d Cleveland Road, South Woodford,
LONDON E18 2AN
(Mail order only)