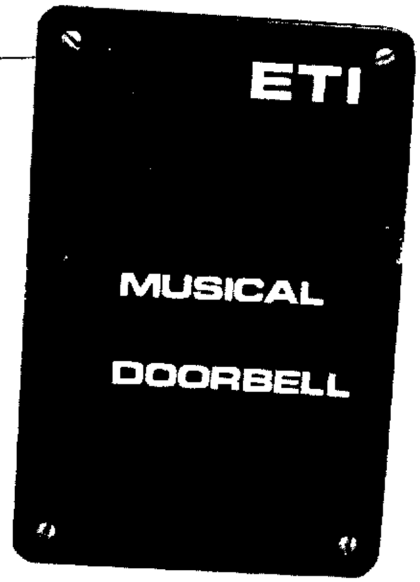
Musical Doorbell

An inexpensive programmable doorbell project for your home. This instrument will play any nine-step melody of your choice.



MODERN DOORBELLS come in two basic types, the simple electrical 'ding-dong' (chime) or the sophisticated microprocessor-controlled multi-tune Oh Canada, etc. types. In either case you pay your money and have to accept the sounds that the manufacturers have pre-programmed into your particular device. If you ever get tired of your bell's limited range of sounds, you have little option but to buy a new unit.

We have decided to overcome this by designing a musical doorbell project that the owner can self-program to play any desired (but brief) melody. The essence of our project is that it is simple; it is devoid of hard-to-get micros, PROMs, double-sided PCBs, etc, yet gives an entertaining performance.

Our doorbell is designed to play a nine step melody made up of a selection of five basic notes or tones. The melody lasts for 2-3 S. If the bell-button is briefly operated, the complete melody plays once only; if the bell-button is held closed, the melody repeats continuously. The unit is designed so that the owner can select or 'program' his own melody by hard wiring the interconnections between various pins on the unit's PCB. The nine step, five note choice enables any one of a selection of almost two million (5^9) different melodies to be programmed into the unit!

A feature of our doorbell is that it incorporates a bistable electronic switch that connects power to the unit in such a way that it consumes virtually zero power when in the 'standby' mode. Whenever the bell-button is pressed, the bistable connects power to the unit for the duration of the tune play and then automatically disconnects the power when the melody is complete; this facility ensures long battery life.

Construction

Construction of this unit should present very few problems, if the overlay is followed with care. Note that IC1 and IC3 are CMOS devices and are best mounted in suitable sockets. Also note that an insulated link is connected between pin 3 of IC2 and pin 14 of IC3 on the underside of the board and that Veropins are used to facilitate top-side connections on the PCB.

When construction of the PCB is complete, connect up a suitable speaker, battery and push-button switch and prepare to give the unit a functional check. When selecting a speaker, note that output volume is proportional to speaker impedance and that a high impedance unit will give the loudest results.

When you are ready to try out the unit, connect a flying lead from D1 to one of the A–E note-select points and press PB1 to test the first note in the sequence. You can then wire in the D2 to D9 note-selection connections, one at a time, to establish the rest of the sequence, testing the unit at each step in the wiring sequence.

Once you've finished 'programming' your unit you can fit the PCB, battery and speaker into a suitable box, hang the unit on your front door and finally connect it up to a suitable push-button switch.

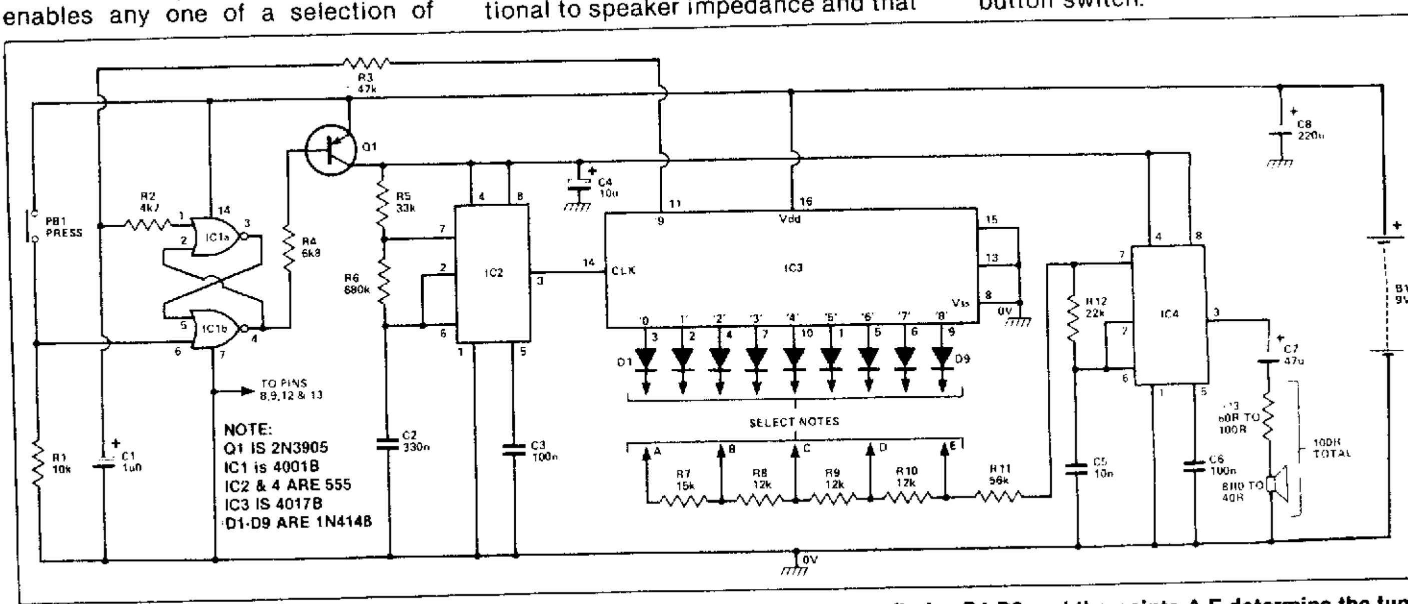
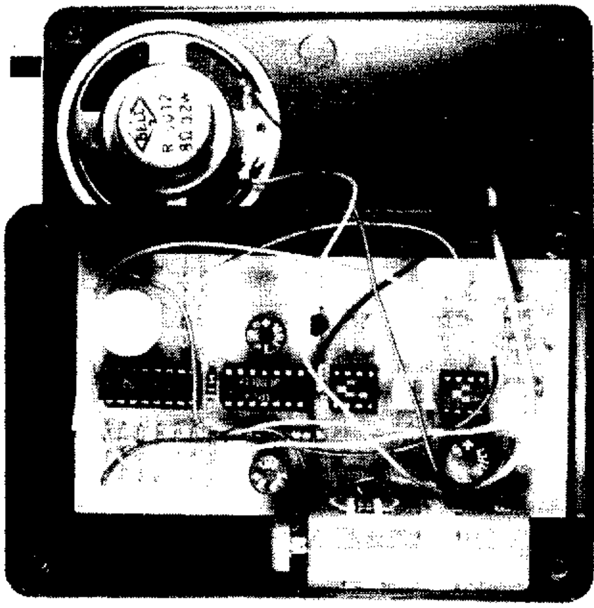
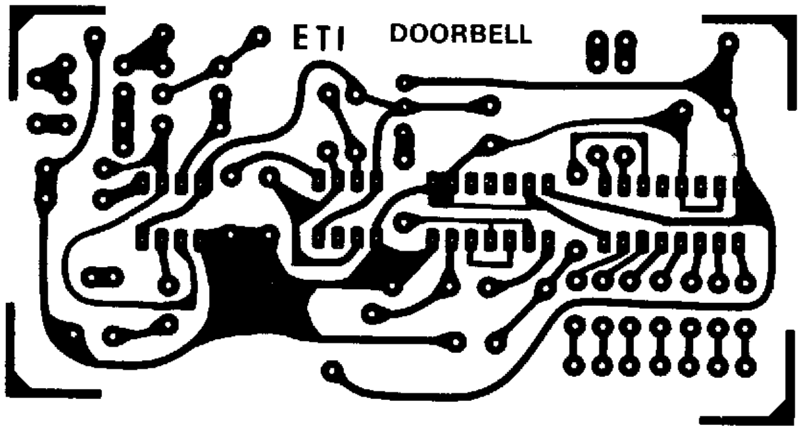


Fig. 1. Circuit diagram of the Musical Doorbell. The connections you make between diodes D1-D9 and the points A-E determine the tune that is played.





How It Works

The circuit comprises a bistable (IC1) and a transistor power switch (Q1), two 555 astable multivibrators (IC2 and IC4) and a 4017 decade counter/divider (IC3). The bistable (IC1) is designed around two gates of a CMOS 4001B and controls the base bias of Q1, which in turn controls the positive power supply connections to IC2 and IC4, the two 555 chips.

Normally, the output (pin 4) of the bistable is high, so Q1 receives no base drive and is cut off. Under this condition, IC2 and IC4 consume no power: IC1 and IC3, being CMOS devices, also draw negligible power under this condition. The entire circuit, in fact, consumes a typical 'standby' current of only a microamp or so.

The circuit is activated by briefly pressing PB1, thereby causing the IC1 bistable to change state and connect power to the IC2 and IC4 astables via Q1. IC2 is wired as a low frequency astable (a few Hertz) and delivers clock pulses to IC3. IC3 is a 4017B decade counter/divider; it has ten decoded outputs, which sequentially go high on the arrival of successive new clock pulses, only one output being high at any given time. In our application, the first nine decoded outputs are used to sequentially select (via D1 to D9) timing resistors in a second astable, the IC4 tone generator, which drives a speaker via C7.

The first nine clock pulses from IC2 thus cause nine tones to be sequentially selected via the R7-11 resistor network. On the arrival of the tenth clock pulse, pin 11 of IC3 goes high and resets the IC1 bistable via R3 and C1, thereby cutting off Q1 and removing power from IC2 and IC4, thus completing the operating cycle.

The action of the IC1 bistable is such that, if PB1 is briefly pressed, the instrument plays a single sequence of nine notes (total duration is 2-3 S) and then automatically switches off. If PB1 is held closed, however, the sequence continuously repeats. Note that the owner can set up any tone sequence that he wishes by suitably interconnecting the diode outputs of IC3 to the 'A' to 'E' selection pins on the R7-11 note-selection chain.

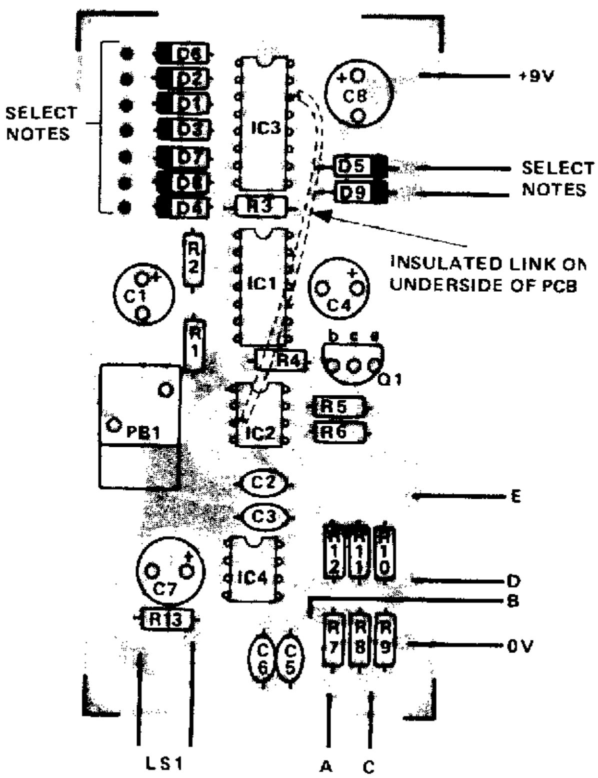


Fig. 2. Component overlay.

Parts List

Resistors All ¼W, 5%		Capacitors	
R1	10k	C1	1u0 63V electrolytic PCB type
R2	4k7	C2	330n polycarbonate
R3	47k	C3,6	100n polycarbonate
R4	6k8	C4	10u 63V electrolytic PCB type
R5	33k	C5	10n polycarbonate
R6	680k	C7	47u 25V electrolytic PCB type
R7	15k	C8	220u 25V electrolytic PCB type
R8,9,10	12k		
R11	56k		
R12	22k		
R13	100R		
Semiconductors		**Miscellaneous**	
IC1	4001B	LS1	Any 8R0 to 40R speaker: see text
IC2,4	555	PB1	momentary action
IC3	4017	B1	9V
Q1	2N3905	Case	
D1-9	1N4148		