KITCHEN APPLIANCE TIMER

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ELECTRIC food mixers and blenders are common items in every modern kitchen. Although taking much of the hard work out of food preparation, most models have one major drawback. They do not have a built-in timer so a lot of time is wasted "clock watching". This simple project frees the hands of the busy cook by providing a mains power socket which switches on kitchen appliances for a selected time. Although designed principally for food mixers there could be other uses for this project, as an enlarger timer, for example.

The Kitchen Timed Outlet appears as a plastic box which plugs into the mains. A 13-amp socket, rotary switch and two push-button switches are mounted on top. The rotary switch selects the required time interval from a choice of eleven values or "continuous". The push-button switches initiate the process and end it prematurely if need me. Safety features include: a fuse, and a double-pole mains on-off switch with neon indicator.

The electronic part of the circuit is battery-powered for reasons of low cost and simplified construction. Excellent service should be given by the battery since it is totally disconnected from the circuit except while actually timing. The battery may be replaced without removing the lid of the case. Although construction is straightforward, this project does involve making mains connections and readers are advised to seek help if they are unsure of their ability to make a safe job.

CIRCUIT DESCRIPTION

The circuit for the Timed Outlet is shown in Fig. 1. The timing section consists of a 555 timer integrated circuit and associated components. These are connected as a *monostable*. This means that when IC1 is triggered by taking pin 2 low, the output (pin 3) will go high for a time then revert to its original state. The time period is determined by the values of C1 and the "switched resistance" (R1 to R11). In this circuit C1 has a fixed value so timing depends on the value of the switched resistance (R1 to R11). The rotary switch, S1, selects R1 + R2 + R3, etc, to gain the required timing. VR1 is the calibration control whereby the timings are adjusted accurately. This is necessary since the value of C1 is not known precisely due to its range of tolerance.

The output of the 555 is far too small to operate mains equipment and this is where the relays RLA and RLB are necessary. Both these components have normally-open contacts. While IC1 is on, both relay coils will be energised. The contacts of RLB connect the appliance to the mains. Meanwhile, the contacts of RLA short-circuit the "start" switch, S2. Thus, when S2 is pressed for an instant, the i.c. will be triggered by the pulse of charging current to C2 taking pin 2 low. The contacts of RLA then "take over" from S2 in allowing battery current to flow until the end of the timing cycle. Timing may be interrupted at any time by momentary breaking of battery current by means of S3 which is a push-to-break switch.

The reason for using *two* relays instead of just one component with two pairs of contacts, is to keep the battery and mains totally separate. This avoids the possibility of "flash over" from one set of contacts to the other.

D1 is necessary to prevent false triggering which could occur in its absence. No diode need be connected in parallel with either relay coil as would be normal practice, as RLA has a diode already built in which serves RLB also. A diode is important in by-passing the reverse voltage spike which occurs when the magnetic field in a relay core collapses.

MAINS RELAY

The choice of RLB deserves special mention. This component must have at least one pair of normally-open or changeover contacts. Readers who are not using the specified relay must give consideration to *contact current rating, coil operating voltage, coil resistance* and overall physical size.

For mixers and blenders a maximum load figure of 500 watts will be found adequate (that is, about 2 amps on 240V mains). The relay contacts must be rated to this figure at least. Catalogues often specify contact ratings for a *resistive* load; for a motor or other *inductive* load de-rating is necessary. In practice, a resistiva contact rating of 5 amps will be satisfactory. The coil should operate from as low as 6 volts. Some relays have an 8·4 volt coil which is not suitable, especially as the battery ages. The relay coil should have as high a resistance as possible to minimise drain on the battery.

COMPONENTS

Resistors

R1–4	82kΩ	(4 off)
R7	150kΩ	(1 off)
R5,6,8	180kΩ	(3 off)
R10	220kΩ	(1 off)
R9	270kΩ	(1 off)
R11	470kΩ	(1 off)
R12	10kΩ	

All resistors ¼ to ½W ±5%

Potentiometer

VR1	10kΩ miniature preset potentiometer horizontal mounting

Capacitors

C1	47µF electrolytic 10 volt working or higher
C2	100µF 10 volt working or higher

Semiconductors

IC1	NE555V timer
D1	1N4001 silicon

See Shop Talk page 534

Relays

RLA	d.i.l. reed relay 5 volt 500 ohm coil with built in diode and one set of N/O contacts
RLB	"Open relay" 410-ohm coil: 6 volt operation. N/O or changeover contacts rated at 240V a.c. 5 amps (Maplins "Open Relay" or R.S. type 349–125

Miscellaneous

S1	12-way rotary switch with knob
S2	miniature push-to-make switch
S3	miniature push-to-break switch
S4	mains on/off switch d.p.s.t. with neon indicator—3-amp contacts or higher
FS1	5A fuse and holder
SK1	13-amp mains outlet socket
B1	9V PP3 battery and drawer matrix stripboard, size 16 strips x 40 holes

Approx. cost Guidance only **£10.50**

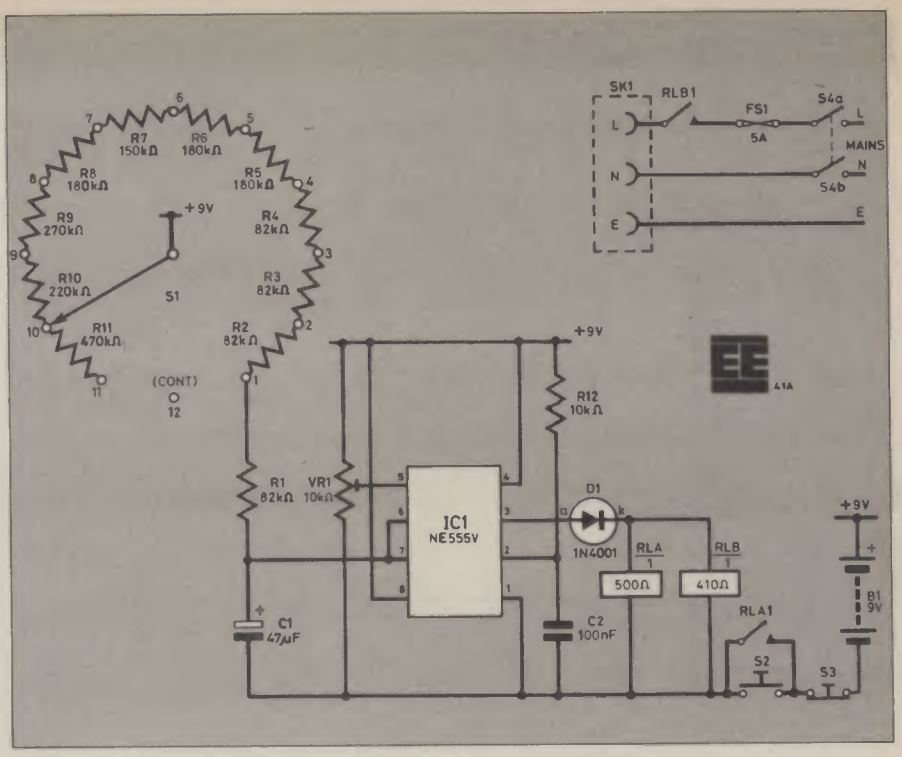


Fig. 1. Circuit diagram of the Kitchen Appliance Timer.

CONSTRUCTION

The wiring diagram is shown in Fig. 2. Prepare the circuit panel using a piece of 0·1in matrix stripboard 16 strips by 40 holes in size. Cut it a little larger then file it to fit tightly into the runners of the plastic box. Solder all components into position but do not insert the 555 into its holder until all construction work has been completed. Solder RLA direct to the panel using minimum heat from the soldering iron to prevent damage. Make the eight interstrip links and all breaks in the copper tracks as indicated. Note that the strips are broken between the pins of IC1 but not between those of RLA. If RLB is not as specified then some modifications will be needed to its

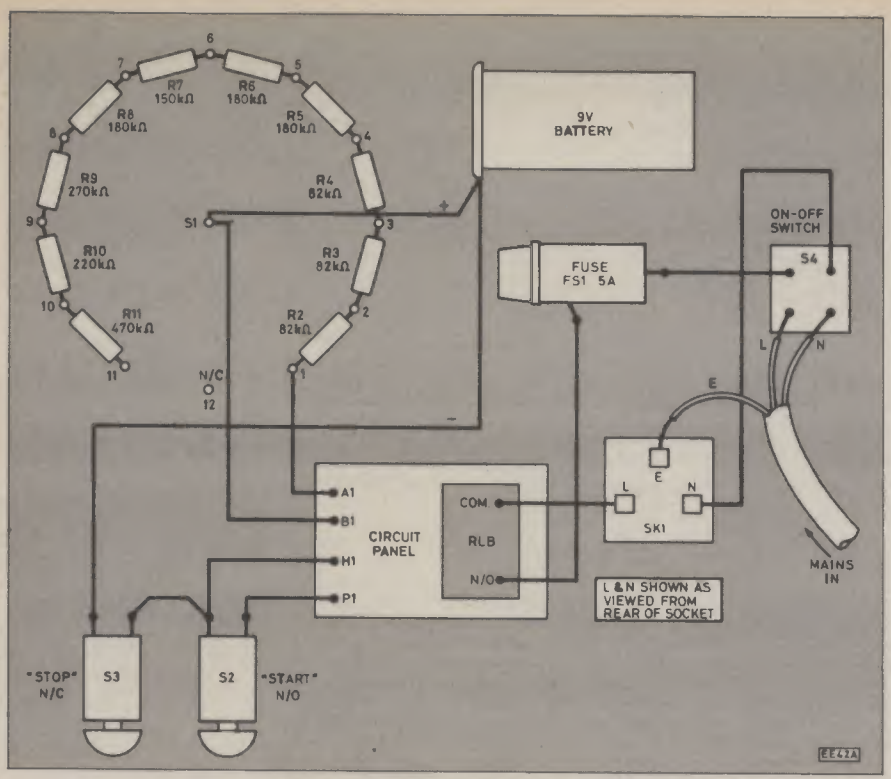
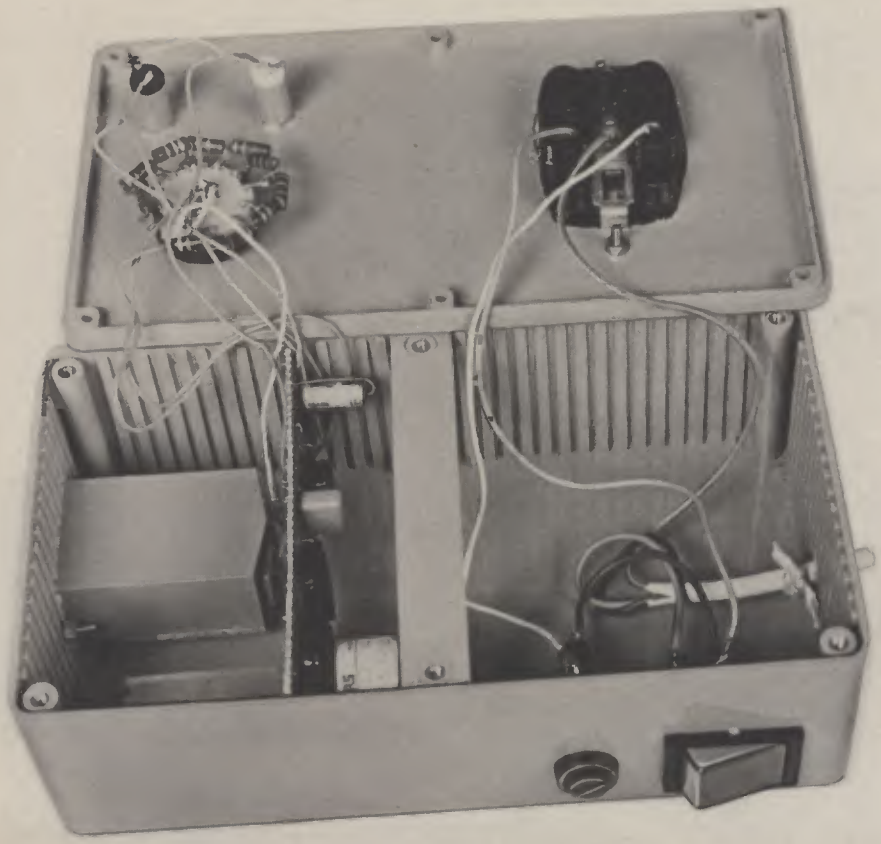


Fig. 2. Wiring details of the Kitchen Appliance Timer.



mounting and connecting details. After soldering the pins of RLB to the copper strips, these strips should then be broken in several places, as indicated, to isolate them from the battery part of the circuit. Carefully-made connections should be made to the normally-open contacts of RLB on the *topside* of the panel using 15 centimetres of 3A stranded wire. A careful check should be made to ensure that no contact connections to RLB make contact with the low voltage side of the panel.

Insert the 555 into its holder then solder 15 centimetres of connecting wires to each of the copper strips A, B, H and P. The rotary switch, S1, may now be prepared by soldering the resistors R2 to R11 around its contacts 1 to 11 (see photograph). Note that R1 is already on the circuit panel and contact 12 has no resistor connected to it as this is the "continuous" setting.

Prepare the case by making holes in the lid for the mains outlet socket and for S1, S2 and S3. Make holes in the side of the box for the mains on-off switch, fuse, inlet lead and battery drawer. All remaining components should be assembled and the wiring completed as in Fig. 2. Make a scale of times for S1 and fit this and the knob in position.

ON NO ACCOUNT MOUNT RLB BY BOLTING IT TO THE CASE. THIS IS BECAUSE THE FRAME OF THE RELAY IS "LIVE" AND THE HEADS OF THE BOLTS WOULD BE "LIVE" TOO.

TESTING

Before operating this project from the mains for the first time, it is essential to test it and adjust VR1 using a battery. To do this, connect the live and neutral pins of a discarded 13A plug to a 6-volt bulb. Plug this into the mains outlet socket to simulate the mixer. Connect the mains inlet wires to the terminals of a 6 or 9-volt battery. Adjust the slider of VR1 to approximately mid-track position. Place a PP3 battery in the drawer and the fuse in its holder. Set the mains switch to "on" and S1 to "15 seconds". Press S2. The lamp should light for a time then go off. VR1 may be adjusted for an accurate 15 seconds. Clockwise rotation of the slider will increase the time. Check operation on other time settings and adjust VR1 for best overall performance. Check the "stop" switch, S3.

When the system is operating correctly, *replace the lid of the case,* plug a mixer into the outlet socket and test the unit on the mains. Never remove the lid of the case while the project is plugged in.

OTHER APPLICATIONS

This timer can be used for any low power operation of mains equipment, such as photographic timers, hi fi or video application. □

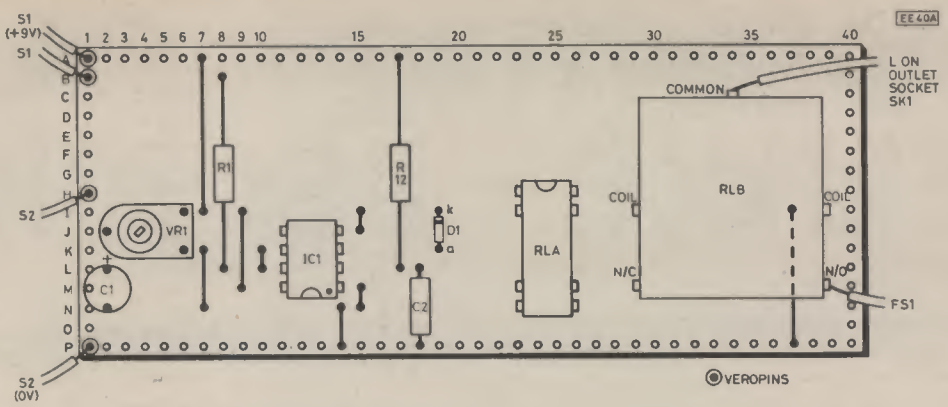


Fig. 3. Component layout of matrix stripboard for Kitchen Appliance Timer.

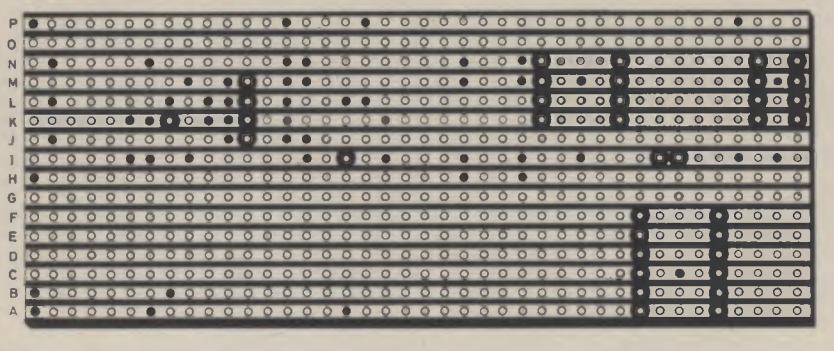


Fig. 4. Drilling details of matrix stripboard for Kitchen Appliance Timer.