DIGITAL COMBINATION LOCK

THIS DIGITAL COMBINATION LOCK NOT only requires you to enter a specific seven-digit number, but to do it within a fixed period of time. Any mistake, and the lock automatically resets itself.

The sequence of numbers is entered either through a non-matrixed keypad (each key has its own set of contacts) or through a similarly arranged group of normally-open, momentary pushbutton switches.

A schematic of the circuit is shown in Fig. 1. To illustrate how the lock works, assume that the correct combination is "1234567." When the first digit is entered, via switch S1, IC1 is triggered and four things happen: The IC, wired as a one-shot, starts timing (duration is set by R1-C1 and is about five seconds as shown); the output of the IC goes high,

the TIME LIMIT LED lights, and a pulse is output, through IC5-a, to IC2, a 7490 counter.

The counter, in turn, outputs the BCD (Binary Coded Decimal) equivalent of "1" to IC3, a 7441 BCD-to-decimal decoder/driver having ten outputs (see Fig. 2).

When a BCD number appears at the inputs of the 7441, the appropriate output pin of that IC goes low.

"Coincidentally," the second switch in the sequence is connected across that output line, so when it is depressed, a negative-going pulse is applied to IC5-b, that inverts it. That "low" is NAND-ed with the "low" from IC1 by IC5-a, and a second pulse is sent to the counter. What happens after that is obvious.

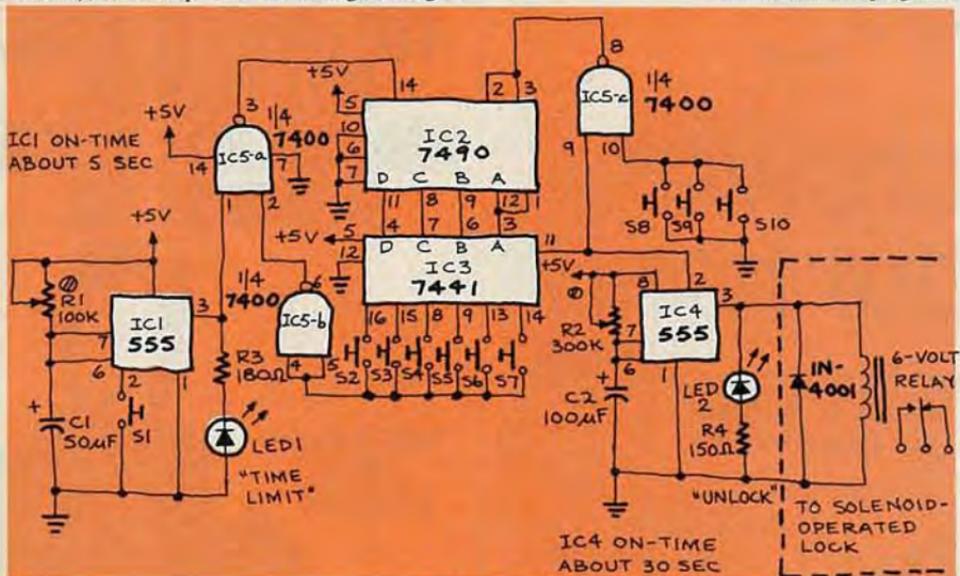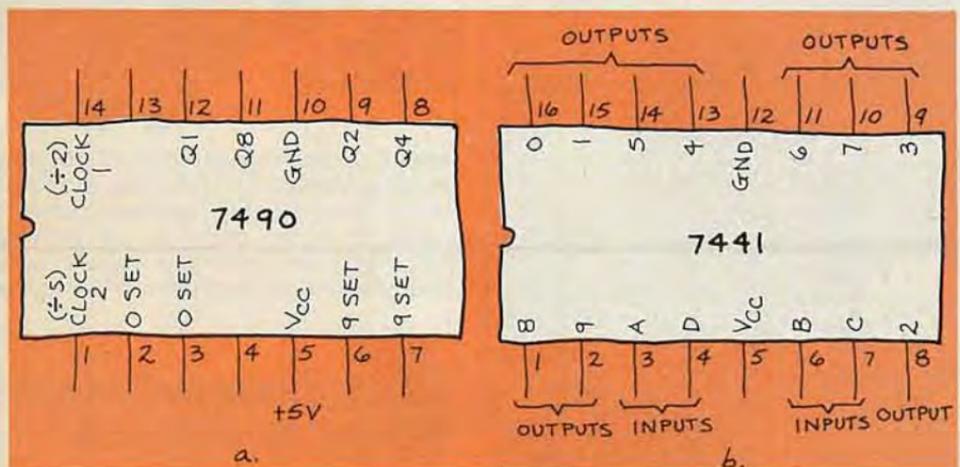Finally, when S7 is closed, the "6" pin on the 7441 goes low. That causes IC2 to

FIG. 1

FIG. 2

reset and also triggers IC4, another 555 one-shot. Its duration is controlled by R2-C2 and during its "on" period, it lights the UNLOCK LED and activates a five- or six-volt relay. The contacts of the relay, in turn, can be used to control a solenoid-operated lock, a car's ignition circuits, an automatic garage-door opener, etc. When IC4 has "timed-out," (about 30 seconds, using the values in the schematic) the relay opens.

The combination lock has several features intended to prevent its being opened by someone who does not know the proper combination. First, of course, is the time limit on entering the combination. Second, if any number is pressed out of sequence, the output line of IC3 will not go low, which means that even if the next key pressed is the correct one, no signal will be transmitted to IC5-b. Finally, switches S8-S10 are connected so that if they are closed, they will reset the counter to 0.

Any seven-digit number, where no digit is used more than once, can serve as the combination. Just wire the switches so the first number corresponds to S1, the second to S2, etc.

In closing, a word to the wise—don't use your telephone number even if you have one without repeated digits! It's too easy for anyone to obtain and is probably one of the first things someone looking for a combination would think of trying.—*Tom Rezachek*