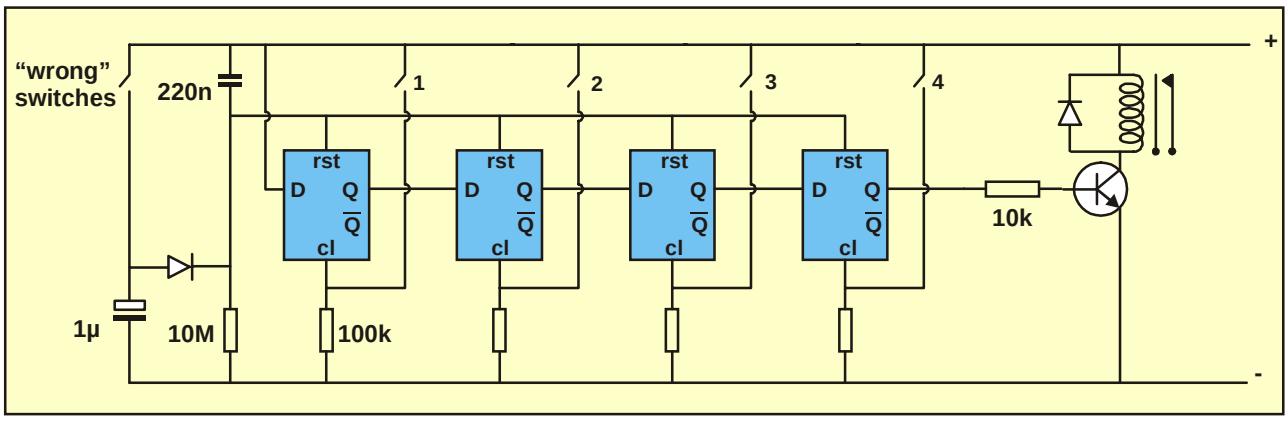
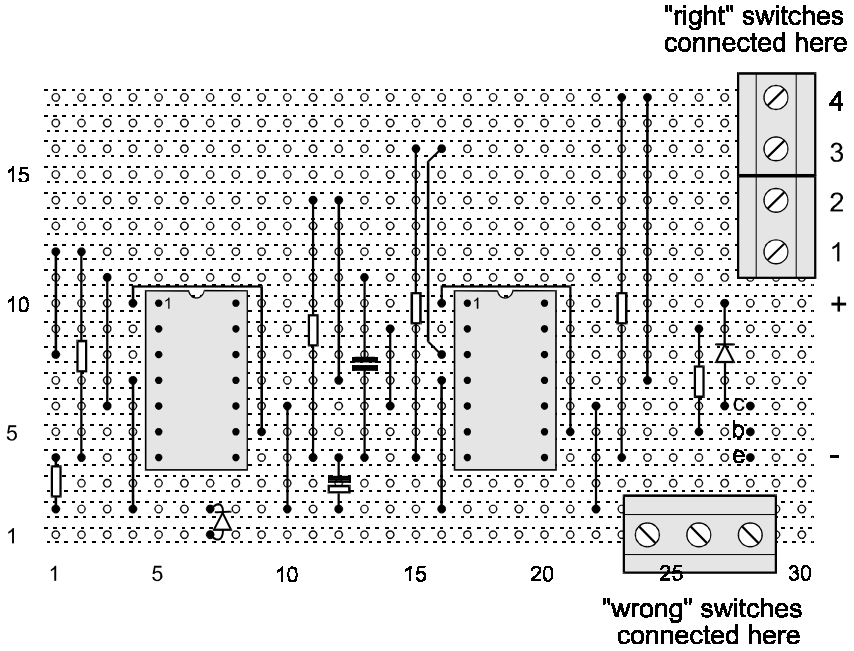
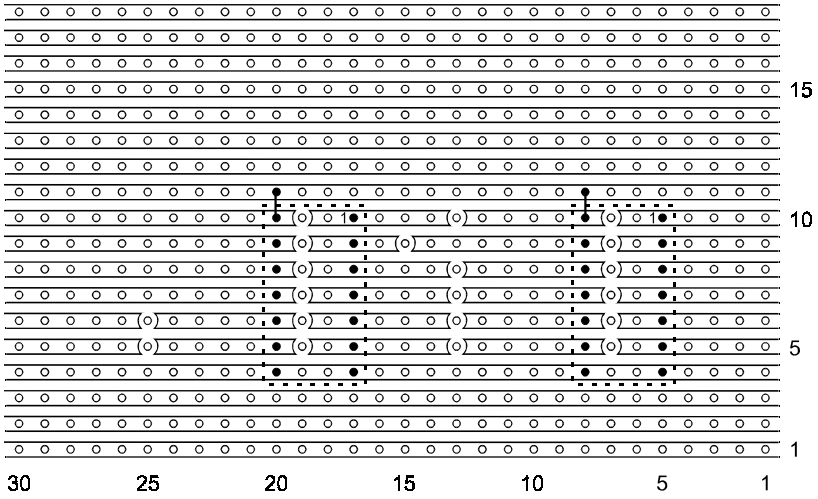
Combination Locks

This circuit uses 4013 D-type bistable flip-flops (D stands for data). Each flip-flop has a *data* input and a *clock* input. The voltage applied to the input is transferred to the Q output *at the instant* when the clock input goes from 0 to 1. (We say these flip-flops are “edge-triggered”.) Switches 1, 2, 3 and 4 are the switches which form the code and any number of “wrong” switches can be connected, *in parallel*, at the point shown.

Note that there is also a second output which is always the complement of the Q output; that is, if Q is 1 the other output is at 0; if Q = 0 its complement is 1 (these outputs are not used in this circuit).

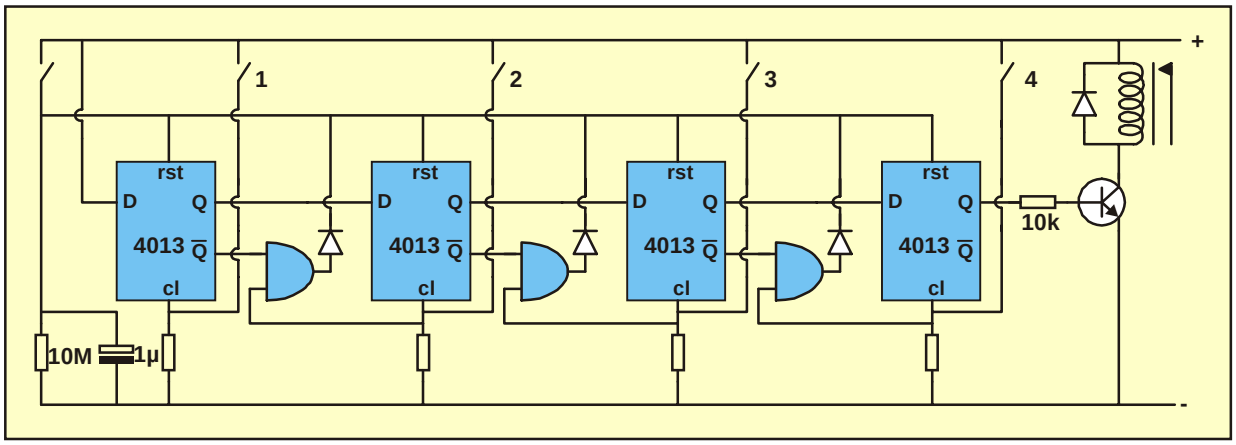






Improved version

One disadvantage of the first circuit is that if a “right” button is pushed at the wrong time, it simply does nothing. In the circuit shown below if one of the “right” buttons is pushed at the wrong time, the whole circuit is reset (again, with a delay, if you include the 1µ capacitor). The flip-flops are 4013 and the AND gates are a 4081.



N.B. In both these circuits it is a good idea to connect the switches to the board using screw connectors rather than soldering them as this makes it easier to change the combination.