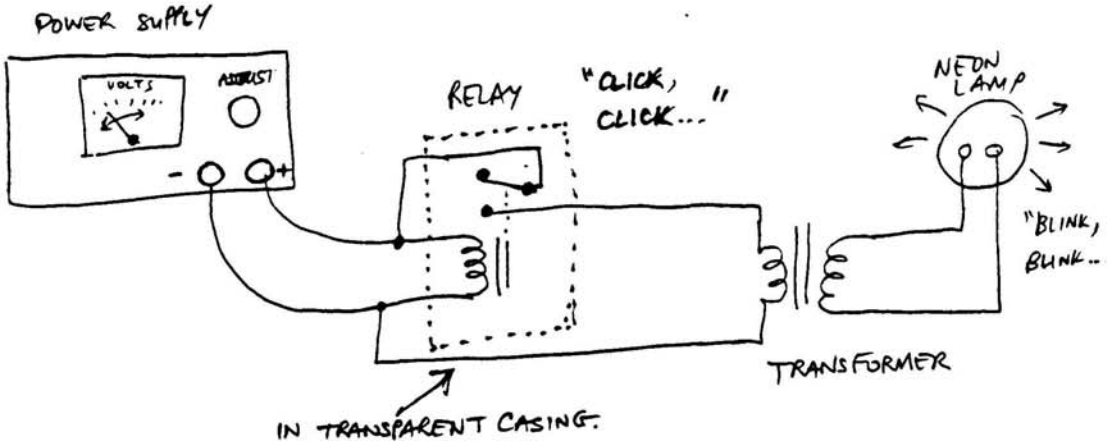
1993 Qualifying Exam Question - G. Kovacs

The philosophy of my question this year was to test the abilities of the student to understand and describe the operation of an extremely simple circuit consisting of three circuit elements known at the turn of the century and a regular, bench-top adjustable D.C. power supply. The point was to see if the student could think on his or her feet, so to speak.

The circuit is shown in schematic form below:



When the power was turned on, the circuit oscillated, producing audible "clicks" of the relay and visible flashes of the neon lamp. The analog voltmeter on the power supply could also be seen to be oscillating between its "unloaded" voltage and a lower voltage.

The relay used was encased in transparent plastic, the wiring was simple (only 5 wires) and the entire setup was in plain view.

The operation of the circuit is best described as:
1) The relay, connected across the outputs of the power supply is energized and closes.
2) The transformer is then placed in parallel with the coil of the relay.
3) This current pulse on the primary of the transformer creates a higher voltage pulse on the secondary which lights the neon lamp transiently.
4) The additional load of the transformer on the power supply causes the voltage to drop, forcing the relay to open.
5) The cycle repeats.

The student did not need to discuss the secondary circuit (e.g. neon lamp) in any way, and was told that it did not affect the oscillations of the circuit.