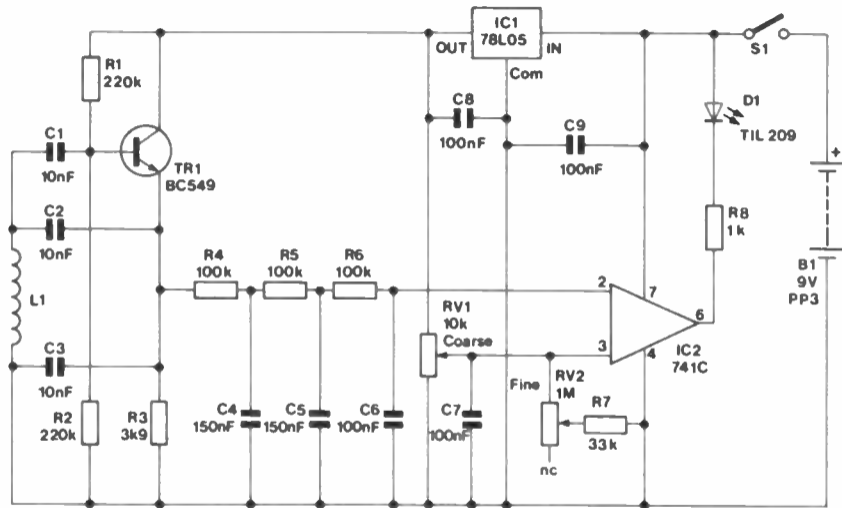


## Simple Metal Locator

This is an unusually simple and inexpensive metal locator design, but it is suitable for use as a pipe locator, treasure hunting, etc., and has a level of performance that is at least as good as the more usual BFO type detectors. Large metal objects can be detected at ranges of up to about 300 to 500 millimetres, and small objects such as coins can be detected at a range of 50 millimetres or so. The unit provides a clear and unambiguous indication if metal is detected – it switches on a LED indicator light.

The circuit is basically just an L - C oscillator operating at about 65kHz, plus a voltage comparator circuit. The circuit makes use of the fact that a metal object near the search coil (which is the inductive component in the L - C oscillator) produces a change in Q. This Q change is



reflected in the strength of oscillation, which is in turn reflected in a shift in the average voltage levels in the circuit. The voltage comparator is used to detect this voltage shift and activate an indicator LED.

TR1 is used in the oscillator, and it is connected as an emitter follower stage. L1 acts as a tuned circuit in conjunction with C2 and C3, with these two capacitors providing a capacitive centre tap on the tuned circuit. This enables a voltage step-up through the tuned circuit to be obtained so that oscillation can be sustained despite the fact that TR1 provides slightly less than unity voltage gain. R4 to R6 and C4 to C6 form a three stage passive lowpass filter, and this provides a DC output voltage that is equal to the average voltage at the emitter of TR1. This voltage is coupled to one input of operational amplifier IC1, while RV1 supplies a variable reference voltage to the other input. In this application IC1 acts as a straightforward voltage comparator, and RV1 is adjusted so that the reference voltage is just marginally higher than the output from the filter. This sends the output of IC1 high so that LED indicator D1 is switched off. A piece of metal close to the search coil results in the output from the filter dropping to a lower potential than the reference voltage, which in turn causes the output of IC1 to go to the low state and switch on D1.

In practice it is essential (in the interests of good performance) to adjust the reference voltage to just a minute fraction of a volt less than the quiescent output level from the filter, and this is difficult using RV1 alone. A fine adjustment control has therefore been provided in the form of RV2. A stabilised 5 volt supply is used for critical parts of the circuit so that frequent readjustment of RV1 and RV2 is not required.

Electrically construction of the unit is mostly quite straightforward, but mechanically the design must be varied to suit the particular application you have in mind. From the electrical point of view the only difficulty is L1 which must be wound by the constructor. On the prototype this coil consists of 70 turns of 22 swg enamelled copper wire wound on a temporary coil former (an old plastic case) measuring 120 by 80 millimetres. Bands of tape can be used to prevent the coil from unwinding when it is removed from the temporary former. It is useful to shield the coil and connect the shield to the negative supply rail. A shield can merely consist of some aluminium foil wrapped around the coil and completely covering it. This should help eliminate any problems with ground capacity effects. With this design the exact size and number of turns on the coil are not critical factors as the exact operating frequency of the oscillator is unimportant.

## SIMPLE METAL LOCATOR PARTS LIST

### RESISTORS - All 0.4W 1% Metal Film

R1,2	220k	2	(M220K)
R3	3k9	1	(M3K9)
R4,5,6	100k	3	(M100K)
R7	33k	1	(M33K)
R8	1k	1	(M1K)
RV1	Lin Pot 10k	1	(FW02C)
RV2	Lin Pot 1M	1	(FW08J)

### CAPACITORS

C1,2,3	10nF Carbonate	3	(WW29G)
C4,5	150nF Polyester	2	(BX77J)
C6,7,8,9	100nF Polyester	4	(BX76H)

### SEMICONDUCTORS

IC1	$\mu$ A78L05AWC	1	(QL26D)
IC2	$\mu$ A741C	1	(QL22Y)
TR1	BC549	1	(QQ15R)
D1	Red LED	1	(WL32K)

### MISCELLANEOUS

S1	SPST Ultra-min Toggle	1	(FH97F)
B1	Battery 9V PP3	1	(FK62S)
L1	See text		
	Battery Connector	1	(HF28F)