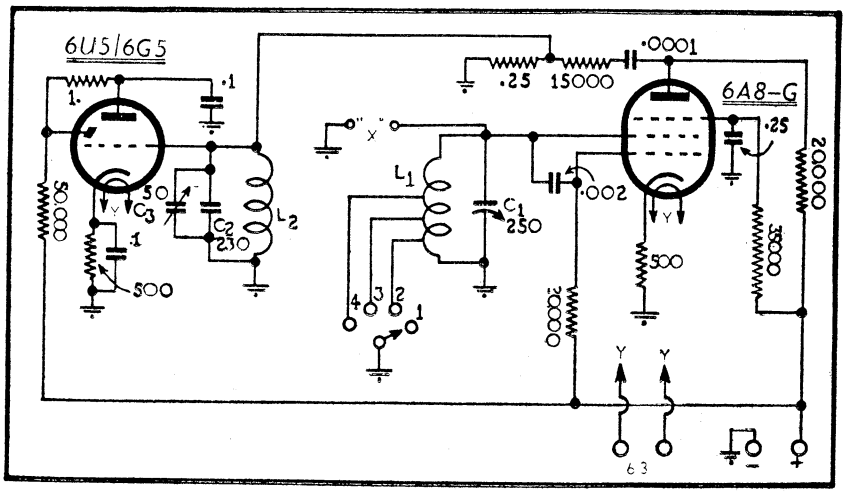
A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

CAPACITANCE METER CHECKS SMALL CONDENSERS



Here is the circuit of the capacitance meter.

Simple to construct and calibrate, this capacitance meter will prove invaluable to servicemen and experimenters. Once installed on the test bench, it solves the problem of small unmarked or coded condensers, and will check the capacitance range of tuning and trimmer condensers.

THE original unit was constructed by Warrant-Officer F. J. Smith and used for some time in an RAAF island workshop. We are indebted to W/O Smith for the article and diagrams.

The meter operates as follows: If an oscillator is operating on a given frequency, with its tuning condenser at maximum capacitance, and a second condenser is connected across that oscillator-tuned circuit, the frequency of oscillation will decrease. Then by decreasing the capacitance of the tuning condenser by an amount equal to capacitance connected across it, the oscillator will operate on its former frequency.

THE OSCILLATOR

In the instrument to be described, a 6A8G was built up as a negative transconductance oscillator. Tuned by L1 and C1 it resonates at about 2 Mc/s with the full coil in circuit and with C1 at maximum capacitance. The exact frequency is not particularly important.

RF is taken from the plate circuit of the 6A8G and fed to the grid of a 6U5 magic eye tube. The coil, L2, the fixed condenser, C2, and trimmer, C3, are adjusted so that they tune the grid circuit of the indicator tube to the selected reference frequency of the oscillator, i.e., 2 Mc/s.

When the oscillator is operating on any frequency other than 2 Mc/s, the magic eye will be completely closed. However, as the oscillator frequency approaches 2 Mc/s, the 6U5 RF grid voltage increases, causing a rise in plate current, for the valve operates effectively as a detector.

OPERATION OF EYE

As the plate current rises, the potential difference between target and plate increases, due to the 1 megohm resistor and the greater this potential difference, the greater will be the shadow angle of the 6U5. At exactly 2 Mc/s, the eye opens to its fullest extent.

Little need be said about the actual wiring of the meter. The usual precautions should be taken in the layout and wiring of the two tuned circuits to ensure rigidity and frequency stability. Make all leads carrying RF as short and rigid as possible. A little care taken here will give much greater accuracy to the finished job. A suggested layout is shown in the diagram.

The finished unit should be built up in a metal case to prevent external influences affecting the frequency.

The coil L1 consists of 37 turns of 24 gauge enamel copper on a 1¼in. former. It should be space wound about 1 diameter of the wire and tapped at 12, 18 and 22 turns from the earthed end. L2 is similar except that the taps are omitted.

by

F. J. Smith

A little experimenting may be necessary to find the best tap points on L1 to give continuous coverage over the capacitance range without gaps or unnecessary overlap.

A suggested method is as follows: Complete the construction of the meter with the exception of the coil taps. Then, with C1 at maximum capacitance, adjust C3 for maximum shadow angle. Then set C1 at minimum capacitance and connect a large variable condenser across the terminals "X." Vary the capacity of this condenser until the eye is again fully open. This will give you the top end point of the first range.

SECOND RANGE

Now set C1 again to maximum capacitance and, without altering the setting of the external condenser, find the tapping point (about 12 turns from the earthed end) on the coil at which the eye again opens to its fullest extent. You now have the lower end of range 2 coinciding with the top end of range 1.

With this tap connected up to short out portion of the coil, set C1 to minimum capacity once again and vary the capacitance of the external condenser until the eye opens. This will be the top end of range 2. Reset C1 to its maximum value and find the second tap point by the same means

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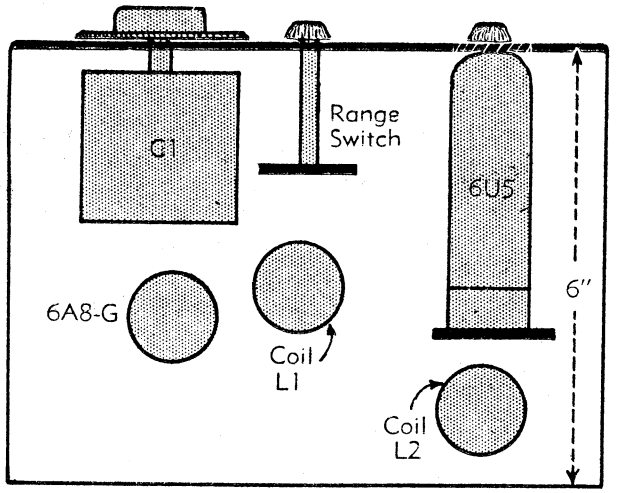
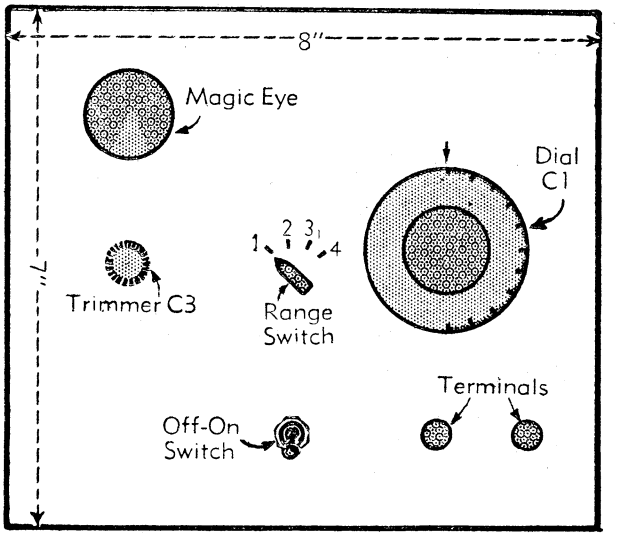
LAYOUT DIAGRAMS OF CAPACITANCE METER





Above—Plan view of meter chassis. Right—Suggested layout for controls on panel.

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as before. The third tap is found in the same manner.

Several variable condensers or a 3-gang with the sections in parallel will be necessary to find the ends of ranges 2, 3, and 4. In the original job, the ranges were approximately 0—240mmf., 240—480mmf., 480—720mmf., and 720—960mmf. The range of the meter depends, of course, on the value of the condenser used in the oscillator circuit. One of about 250mmf. was used in our case, simply because it happened to be on hand.

When using the meter you will find that the larger the capacitance of the condenser being measured, the smaller will be the shadow angle of the 6U5, due to the output of the oscillator dropping off with large capacities across it. However, up to the limit of 960mmf., the eye was found to open sufficiently to give an accurate indication.

(It may help matters to wire the low potential end of L1 to position 1 of the range switch, breaking the present connection to earth. This will avoid having shorted turns closely coupled to the active portion of the coil.—Ed.)

PLATE RESISTOR 6A8G

Which brings up to another point where trial and error is necessary to find the correct value. That is the resistor in the plate circuit of the 6A8G. It was 15,000 ohms in our case. If this resistor is of too low a value, the 6U5 will be overloaded and it will be impossible to adjust C3 accurately for maximum shadow angle.

The correct value is that which will give a shadow angle of slightly less than 90 degrees (the maximum for a 6U5), with the range switch on 1 and with C1 at maximum capacity.

CALIBRATION

To calibrate the meter, an assortment of condensers is required. The more checks made on each range, the more accurate will be the finished calibration curve. You will find the usual fixed condensers available will vary a good deal from their stated value but, if several of each size can be obtained, a reasonable average can be taken.

To calibrate the high ranges, several small condensers can be paralleled to give the required number of points over the range.

Before calibration, and each time the meter is used, always set C1 to maximum capacity on range 1 and carefully adjust C3 for maximmum shadow angle of the 6U5.

USE OF METER

Depending on the type of dial used it can be marked either directly in mmf. or a calibration curve drawn up showing capacity against dial degrees.

To use the meter, switch on and allow a couple of minutes to warm up, adjust C3 as stated above, connect the unknown condenser across the terminals and swing the dial across the

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Layout Diagrams of Capacitance Meter

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scale on each range in turn, until a setting is found where the magic eye opens.

No details of a power supply have been given, but anything capable of supplying a few milliamps at from 150 to 250 volts d-c and 6.3 volts for heaters will be OK.

That concludes the description of what we have found to be a very useful piece of equipment.