Notes on the Laws of Variable Air Condensers.

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Among the most important components of a modern wireless receiving set are its variable condensers, and care should therefore be exercised in the selection or design of these units for any particular purpose. If the maximum capacity of a condenser is too great, tuning by its means may become too critical due to its having too great a capacity change for a given angular movement, more particularly at the commencement of its scale. This effect may be minimised by the fitting of a worm gear or other form of fine adjustment gearing to enable very fine angular movement to be smoothly performed, but again it must be remembered that in most wireless circuits employing potential-operated detectors and amplifiers, such as crystals and thermionic valves, the capacity of oscillatory circuits at resonance should be kept within limits, as the oscillatory potential available across these circuits is proportional to the reactance of that capacity, which is inversely proportional to that capacity.

If, on the other hand, a variable condenser has too small a maximum capacity value, there is a probability that it will have a far too limited range of capacity variation, due to the fact that its minimum or "zero" capacity cannot possibly be reduced proportionately to its maximum capacity, especially when it is augmented by the distributed capacity of the inductance coil with which it is paralleled and by various lead capacities, inter-electrode valve capacities, etc. If the condenser is fitted with an electrostatic screen which is connected electrically to its moving plate system, its minimum capacity is even more seriously augmented because of the large surfaces of fixed plate system and screen (between which the full potential difference exists), which are of necessity constantly in fairly close proximity unless the size of the screen is made impossibly large.

When a variable condenser of the correct value has been chosen, some idea as to the "law" connecting its capacity variation with angular movement must be known.

Assuming that the mechanical imperfections of a condenser have been removed (i.e., that each moving plate rotates truly parallel with, and exactly midway between, the pair of fixed plates with which it interleaves) the capacity change, if semi-circular plates are employed, should follow the straight line law

\[ C = a\theta + b \quad \ldots \quad (1) \]

in which \( C \) = capacity, \( \theta \) = degree scale reading and \( a \) and \( b \) are constants, "\( a \)" determining the "slope" \( dC/d\theta \) of the curve (or \( \tan a \)) and "\( b \)" determining the position of its intersection with the "\( C \)" ordinate as shown in Fig. 1.

Actually, however, as is well known, the curve only obeys this straight line law between certain limits of capacity, such as those of \( \theta = 20 \) degrees and \( \theta = 160 \) degrees of Fig. 2. Outside these limits the curve bends owing to the absence of uniformity of field at the edges of both plate systems and to the 5 degrees cut-away portions of the moving plates in some makes of condensers.

If the capacity values of the condenser be measured at, say, 20 degrees and 160 degrees, a pair of simultaneous equations may be