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PHASE CONTROL SYSTEM

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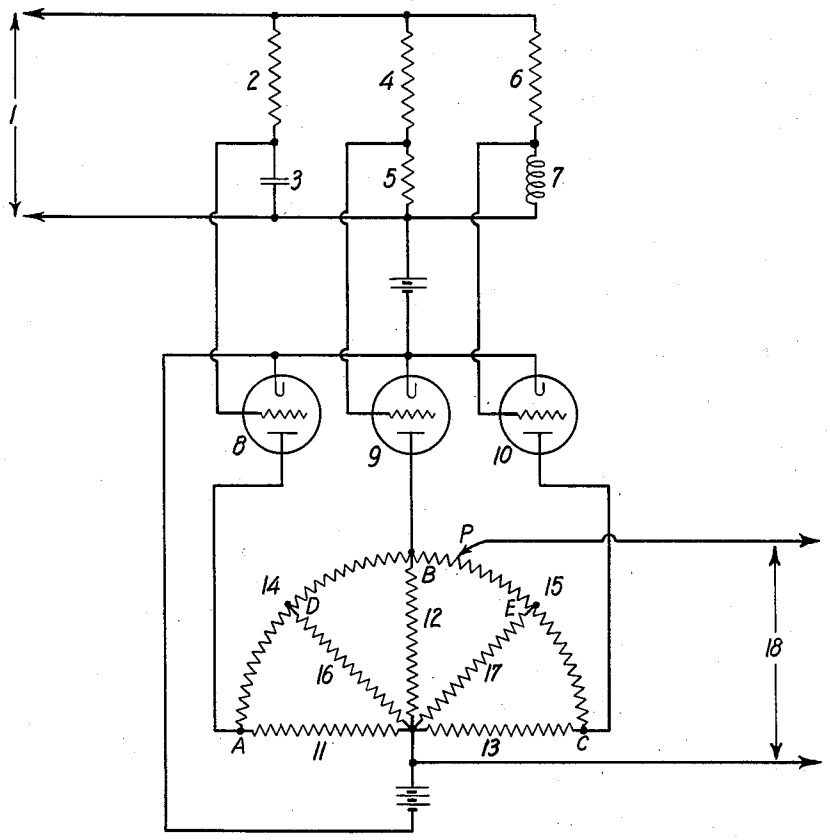

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PHASE CONTROL SYSTEM

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2 Claims. (Cl. 172—238)

This invention relates to a method of securing rapid adjustments of phase of alternating current without simultaneously producing changes in amplitude of these currents. The method is particularly applicable to various forms of wireless signalling devices.

The principle of operation consists in applying to the grids of three vacuum tubes equal voltages which are spaced 90° successively apart in phase and combining the outputs of these three vacuum tubes in such manner that by adjustment of a potentiometer mixing arrangement any phase current at constant amplitude may be readily obtained. The general arrangement of the system is illustrated in the single figure of the accompanying drawing. In this figure, 1 represents the input current whose phase it is desired to alter. 2, 3, 4, 5, and 6, 7 represent three branch circuits each consisting of equal high resistances, 2, 4, and 6. In series with resistance 2 is a capacity 3, in series with resistance 4 is a resistance 5, and in series with resistance 6 is an inductance 7. The impedances of the capacity 3, resistance 5 and inductance 7 are all adjusted to be equal in the frequency to be employed. Three vacuum tubes 8, 9, and 10 have applied to their grids, respectively, the voltages existing across the capacity 3, the resistance 5 and the inductance 7. Three equal resistances 11, 12, and 13 are inserted in the plate circuits of these tubes. Connecting the points A with B and B with C are equal high resistances forming a potentiometer arrangement between these three plates. Connected between the midpoint of the resistance connecting points A and B and the junction point of the three resistances 11, 12, and 13 is a high resistance 16. Similarly connected to the midpoint of the resistance connecting points B and C is a high resistance whose other terminal goes to the junction point of the resistances 11, 12, and 13. The output circuit is taken between the junction points of the resistances 11, 12 and 13 and point P on the potentiometer. The operation of the system is as follows:

The voltages at the three points A, B, and C taken across the resistances 11, 12, and 13, respectively, are 90° apart from each other, C leading point B by 90° and A lagging behind point B by 90°. Since the resistances are all equal and the impedances of 3, 5, and 7 are equal, the voltages at the points A, B, and C are equal to each other. The resistances 14, 16 and 15, 17 are made sufficiently high with respect to the resistances 11, 12 and 13 that their effect on the impedances in the plate circuit is negligible.

By proportioning resistance 16 with respect to the value of resistance 14 it is possible to bring point D midway in phase between points A and B, that is, 45° from either of them and equal in amplitude to either of these voltages. Similarly, it is possible by adjustment of resistance 17 with respect to resistance 15 to produce the same phase and amplitude relations at point E. These five points on the potentiometer are therefore definitely fixed 45° apart and all of equal amplitude. As potentiometer point P travels along the potentiometer it will pass gradually through any degree of phase relationship which may be desired. The variation in amplitude at those points on the potentiometer which are not definitely fixed will be very slight from the average value, but if it is desired more points on the potentiometer may have their amplitudes definitely fixed and the degree of variation reduced thereby below any desired limits. It will be observed that in effect this arrangement corresponds to a tapered potentiometer, the variations in the resistance of the potentiometer compensating for the changes in amplitude which would occur as the pointer is moved around the potentiometer.

While I have illustrated three voltages spaced 90° apart it will of course be understood that other values of spacing may be used and that where an adjustment of phase of less than 180° is required two voltages may be all that is required. Various other modifications and combinations may be employed without departing from the spirit of the invention.

I claim:

1. A system for adjusting the phase of an alternating current without simultaneously producing a change in its amplitude, comprising a series of vacuum tubes, means for dividing an alternating current into a series of currents successively differing in phase by the same amount, means for each of said currents for equalizing the voltages derived therefrom and for selectively impressing them on the input of a vacuum tube, a tapered potentiometer and means for connecting the output sides of said tubes to points on said potentiometer differing from each other in phase by the same amount, the amount of impedance introduced into the output circuit of each tube by the potentiometer being substantially equal, said potentiometer having means for selectively deriving current therefrom.

2. Apparatus for adjusting the phase of an alternating current without simultaneously pro-

ducing a change in its amplitude, comprising a reactance network the reactances of said network being so proportioned that the network produces a plurality of voltages equal in magnitude but different in phase, a plurality of vacuum tubes, means for applying these voltages to the input circuits of said tubes, a resistance network for combining the output voltages of the vacuum tubes; the amount of impedance introduced into the output circuit of each tube by the potentiometer being substantially equal, and means for selecting voltage from said resistance network.

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