

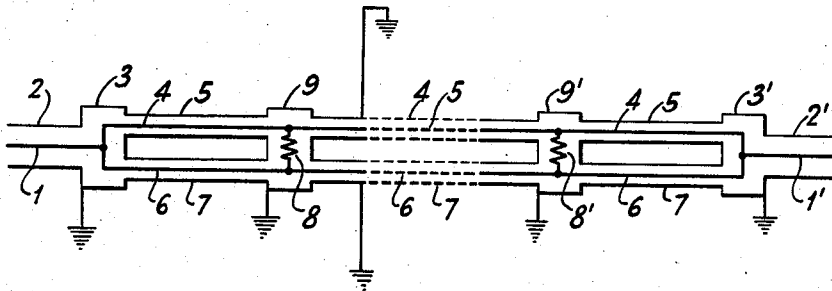
June 18, 1940.

C. S. FRANKLIN

2,205,250

RADIO AND OTHER HIGH FREQUENCY FEEDER ARRANGEMENTS

Filed April 19, 1937



INVENTOR
CHARLES SAMUEL FRANKLIN
BY *H. S. Snover*
ATTORNEY

UNITED STATES PATENT OFFICE

2,205,250

RADIO AND OTHER HIGH FREQUENCY
FEEDER ARRANGEMENTSCharles Samuel Franklin, London, England, as-
signor to Radio Corporation of America, a
corporation of DelawareApplication April 19, 1937, Serial No. 137,692
In Great Britain April 29, 1936

5 Claims. (Cl. 178—44)

This invention relates to radio and other high frequency feeder arrangements, and more specifically to such arrangements wherein a plurality of high frequency feeders in parallel feed energy from a high frequency source to a load, e. g., from a radio transmitter to an aerial.

Occasions where two or more high frequency feeders are required to be employed in parallel to feed energy from a source to a load often arise. For example, it may be required materially to increase the power (e. g. to double the power) in an existing radio transmitting installation; and it may not be economical to discard the existing feeder entirely and replace it by a new feeder capable of handling the increased power. In such a case the existing feeder may be retained and supplemented by another feeder in parallel therewith. In such a case, or in any other case where a plurality of high frequency feeders in parallel is employed, serious difficulties may arise if the individual feeders are not identical, for there may occur unbalanced electromotive forces tending to generate currents in the "loop" or "loops" formed by the parallel feeders, and should the said "loop" or "loops" be in resonance with any of the high frequency currents transmitted along the feeders, the resultant voltages may be sufficiently high to cause feeder breakdown.

The principal object of this invention is to avoid this difficulty, and this object is achieved by coupling the feeders together between substantially equipotential points in the said feeders in such manner as to eliminate or reduce "loop" resonance effects.

In general, in carrying out this invention, it will be sufficient to couple together by resistances corresponding points on the feeders approximately one-quarter of the working wavelength from their ends. The number of points requiring to be so coupled through resistances will, however, depend upon the number of frequencies or frequency range transmitted. As the points coupled by resistances are at equal potentials as regards the direct transmitted power, the coupling will, if the feeders are identical, involve no power loss, for, of course, any current or power loss through the coupling will be a measure of the lack of identity. In practice the power loss is not likely to be serious.

The invention is illustrated in the accompanying drawing, which shows diagrammatically one embodiment.

Referring to the drawing, a high frequency source, e. g., a radio transmitter (not shown) is

connected to a short high frequency tubular concentric cable consisting of an inner conductor 1 and an outer conductor 2 and which is branched out at a junction box represented at 3, near the source, into two tubular concentric cables 4, 5, 6, 7, in parallel. At a point approximately one-fourth of the working wavelength from where the cable 1, 2 branches out into the cables 4, 5, 6, 7, there is provided a resistance 8, connected between the inner conductors 4 and 6, a cross box 9 being provided for the resistance 8. Similarly, at the load end, the load (not shown but which may be, for example, an aerial) is connected to the end of a short concentric cable 1', 2' into which the cables 4, 5, 6, 7 feed in parallel at a junction box 3', and at a point approximately one-fourth of the working wavelength from where the cables 4, 5, 6, 7 join the cable 1', 2', there is provided a resistance 8' between the central conductors 4 and 6, the said resistance being in a cross box 9'. The parallel feeders 4, 5, 6, 7 should be as nearly as possible identical in length. All the outer tubes of the cables are earthed, as is usual. It will be observed that the parallel feeders 4, 5, 6, 7 form a loop having small ohmic and very small radiation resistance. Any small differences between the two parallel feeders will produce a voltage in this loop and, were it not for the provision of the resistances 8, 8', could produce high voltages and currents in the loop should it be in resonance, or approximately in resonance, with any frequency transmitted. The resistances, however, avoid this danger and enable the parallel cables to be used substantially at maximum loading, while, since the points between which the said resistances are connected are substantially equipotential points, practically the only losses occasioned by the provision of the resistances will be the slight losses due to small inequalities between the two parallel cables.

Resistances 8 and 8' are a direct function of the ohmic impedance of the lines. Obviously, if the resistances are zero or infinity, there is no damping in the "loop." In any particular case, there is a certain resistance which would give maximum damping, but it is not necessary to make the damping a maximum. What is required is sufficient damping to prevent large potentials accruing in the loop.

What is claimed is:

1. A radio or other high frequency feeder arrangement coupling a source to a load, comprising a transmission line coupled to said source and a transmission line coupled to said load, and a pair of feeder lines connected together at their

ends so as to be in parallel relation connected between said two transmission lines, resistors connected between substantially equipotential points in said feeders, said resistors having such values as to eliminate or reduce voltage and current differences between said feeders due to unbalanced electromotive forces.

2. A radio or other high frequency feeder arrangement coupling a source to a load, comprising a transmission line coupled to said source and a transmission line coupled to said load, and a pair of feeder lines connected together at their ends so as to be in parallel relation connected between said two transmission lines, resistors connected between substantially equipotential points in said feeders, said resistors having such values as to eliminate or reduce voltage and current differences between said feeders due to unbalanced electromotive forces, one of said resistors connecting said feeders together near that transmission line which is coupled to said source and another of said resistors connecting said feeders together near the other transmission line which is coupled to said load.

3. A radio or other high frequency feeder arrangement wherein a plurality of high frequency feeders in parallel feed energy from a high frequency source to a load, characterized in that the parallel feeders are coupled together between substantially equipotential points in the said feeders by resistances, said resistances having such values as to eliminate or reduce "loop" resonance effects caused by currents in said feeders due to unbalanced electromotive forces, said feeders being connected together through at least two resistive paths, one connected between the feeders at approximately one-quarter the working wavelength from the source end and the other

connected between the feeders at approximately one-quarter the working wavelength from the load end.

4. A high frequency feeder arrangement coupling a source of energy to a load, comprising a coaxial transmission line coupled to said source and a coaxial transmission line coupled to said load, and a pair of coaxial feeders in parallel relation connected between said two transmission lines, there being at least two resistive paths connected between the inner conductors of said pair of coaxial feeders at different points of substantially equipotential therein, said paths having such values as to eliminate or reduce "loop" resonance effects caused by currents in said feeders due to unbalanced electromotive forces, said outer conductors of said transmission lines and feeders being grounded.

5. A high frequency feeder arrangement coupling a source of energy to a load, comprising a coaxial transmission line coupled to said source and a coaxial transmission line coupled to said load, and a pair of coaxial feeders in parallel relation connected between said two transmission lines, there being at least two resistive paths connected between the inner conductors of said pair of coaxial feeders at different points of substantially equipotential therein, one of said resistive paths being connected between said feeders at approximately one-quarter of the working wavelength from the transmission line which is connected to said source, the other of said resistive paths being connected between said feeders at approximately one-quarter of the working wavelength from the transmission line which is connected to said load.

CHARLES SAMUEL FRANKLIN.