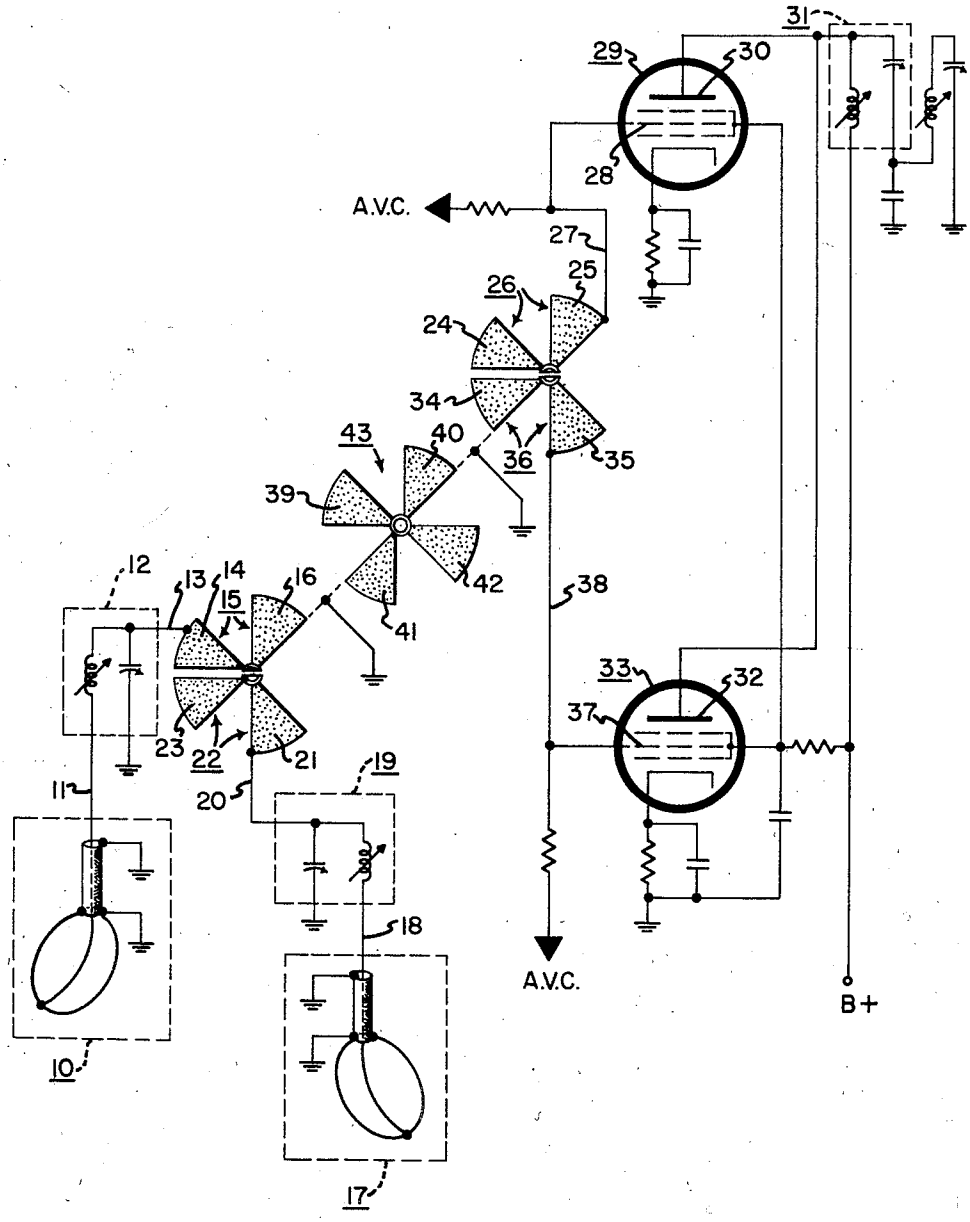
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SEQUENTIAL COUPLER FOR RADIO FREQUENCY CIRCUITS OR THE LIKE

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SEQUENTIAL COUPLER FOR RADIO FREQUENCY CIRCUITS OR THE LIKE

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This invention is related to improvements in R.–F. coupling of R.-F. circuitry, for example, the coupling and circuitry which assure simple and effective sequential coupling of R.–F. circuitry, for example, the coupling of dual antennas to a single receiver.

In earlier patent applications, such as Serial Nos. 487,535 and 503,190, filed in behalf of the present inventor on February 11, 1955 and April 22, 1955, respectively, there are described several embodiments of antenna systems, for use particularly with vehicles, which rely upon the derivation of a pair of signals from discontinuities in the metal structure. Such antenna systems are completely inconspicuous and are much less subject to man-made and natural types of interference than are the conventional whip or other types of antennas. In application Serial No. 503,190, there is shown a sequential coupling device in which the rotor plates effect the coupling between input and output plates associated with a pair of signal sources. Certain experiments have shown that under some conditions the desired degree of decoupling may not be reached when the rotor plates are absent from proximity to the related stator plates in the foregoing application, and in the art known to applicant. Because what is ultimately desired is a switching phenomenon by which the signals from the separate sources are alternately switched to the translating circutis, a large change in the coupling between the condition of the presence of the rotor plates and their absence is essential.

Therefore, it is an object of this invention to provide a rotary sequential coupling device for a plurality of R.-F. circuits which exhibits a large change in the coupling between input and output elements as the rotor revolves.

It is a further object of this invention to provide an antenna input system for dual antennas which insures the maximum rejection of the undesired signal when the selector is in the position for coupling of the desired signal to the associated receiving apparatus.

According to one form of the present invention the stator of the selector is made up of two groups each group including two sets of plates lying in spaced parallel planes with the vanes in each set lying substantially opposite the vanes in its associated set, the vanes having substantially the shape of a sector of a circle, and a rotor having plates also shaped as a sector of a circle of sectorial angle not less than that of the stator plates is rotated between the spaced sets of stator plates. The disposition of the rotor plates is such that when the sets of plates in one group of stators are coupled the other sets of plates in the other group are shielded from each other by interposed rotor plates, the rotor being grounded. The output signals from the sequential selector are then injected into a dual or single multi-grid input stage of the radio receiver.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The present invention, both as to its organization and manner of operation, together with further

objects and advantages thereof, may best be understood by reference to the following description, taken in connection with the accompanying drawing, in which:

The sole figure is a schematic representation of one embodiment of this invention.

In the sole figure antenna **10** may be of the type described in the copending application, Serial No. 503,190, filed by the present applicant, which antenna may be described generally as a closed loop formed by the conductive boundary about a discontinuity in the structure or vehicle. Output wire **11** from antenna **10** is connected to antenna tuning circuit **12** the output of which is connected through connector **13** to stator plate **14** which is in the first set of stator plates **15**, the other plate in that set being plate **16** which is electrically connected to plate **14**. A second antenna **17**, which provides a signal space-phased with respect to the signal from antenna **10**, has its output signal coupled through connector **18** to antenna tuning circuit **19**, the output of which is connected through conductor **20** to stator plate **21** in the second set of stator plates **22**, the other member of which being stator plate **23** which is electrically joined to stator plate **21**. Set **15** and set **22** are electrically insulated from each other and may lie in the same plane. Stator plate **24** and stator plate **25** in set **26** are coupled through connector **27** to input grid **28** of vacuum tube **29**, the anode **30** of which is coupled to amplifier tank circuit **31** and to anode **32** of vacuum tube **33**. Stator plates **34** and **35** of set **36** are joined electrically and are connected to grid **37** of vacuum tube **33** through conductor **38**. It is to be noted that sets **15** and **26** form a first group and sets **22** and **36** form a second group of stator plates. All of the stator plates have substantially the same shape, namely that of a sector of a circle, and have substantially the same sectorial angle. The plates in set **26** are disposed opposite to the plates in set **15** and lie in substantially parallel planes, each set being insulated electrically from the other. Correspondingly, the plates in set **36** are disposed substantially opposite the plates in set **22**, lie in substantially parallel planes and are insulated from each other. Rotor **43** includes interconnected plates **39**, **40**, **41** and **42** all of which lie in a plane parallel to the planes of the stator plates, the rotor being spaced and insulated from the stator plates. The rotor is connected through an appropriate contact to ground potential.

The operation of the foregoing circuit is as follows. Signals derived from antenna **10** after preselection in circuit **12** are applied to plates **14** and **16** in set **15**. Signals derived from antenna **17**, after a preselection in circuit **19**, are applied to plates **21** and **23** in set **22**. With rotor **43** in the position shown in the sole figure there is an unobstructed path for lines of force flowing from the stator plates in set **22** to the stator plates in set **36**, whereas rotor plates **39** and **40** shield the plates in set **15** from the plates in set **26**. Hence, sets **22** and **36** are intercoupled and radio frequency signals from antenna **17** may pass to input grid **37** and ultimately appear amplified in output circuit **31**. When rotor **43** rotates one sector angle, the contrary condition exists, namely plates **14** and **16** are coupled to plates **24** and **25**, respectively, and plates **21** and **23** are shielded by plates **41** and **42** from stator plates **34** and **35**. Hence, radio frequency signals from antenna **10** pass to grid **28** of vacuum tube **29** and appear at the output circuit **31**. This sequence continues as rotor **43** revolves. By driving rotor **43** at an especially high speed and selecting the proper number of plates and the proper segment angle no interference is apparent in the output from the system which may be attributed to the technique utilized. If some loss in performance can be tolerated, conductor **38** may be connected directly to grid **28** and vacuum tube **33** may be

eliminated. This would also permit the merging of sets 36 and 26 into a solid disc. The disadvantages of such an arrangement are that they provide a generally undesired additional capacitance directly from grid 28 to ground potential.

From the foregoing discussion it is apparent that there has been provided a sequential dual antenna system which is particularly adaptable to radio installations in vehicles, propulsion forces for rotation of rotor 43 being available from the electrical, pneumatic, mechanical or hydraulic systems of the vehicle itself. Such sequential selection by its elimination of dual channel circuitry greatly reduces the cost of dual antenna systems of this type. It should be understood that, although this discussion has been directed to dual antennas, any number of antennas or other signal sources may be coupled to a common load, such as a receiver, through this selector by simple changes in vane size, number and distribution. Multiple mixing tubes, or single tubes with multiple mixing grids may be utilized in such systems.

While particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from this invention in its broader aspects, and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

I claim:

1. A coupling element for sequential intercoupling of a plurality of radio-frequency circuits including first, second, third and fourth sets of stator plates, each plate in each such set being of a shape approximating a sector of a circle, the sectorial angle of each such plate having a predetermined value, such sets being disposed in first and second groups each group including at least two sets of plates lying in spaced substantially parallel planes and electrically insulated from each other, and a rotor including a plurality of plates each having substantially the shape of a sector of a circle, the sectorial angle of which approximates that of said stator plates, and the disposition of which is such as to alternately shield the sets within each group from each other as said rotor rotates, said rotor being adapted for connection to ground potential.

2. Apparatus according to claim 1 in which said sectorial angle of said rotor and stator plates approximates 45°.

3. Apparatus according to claim 1 in which said sectorial angle of said stator plates is not less than the sectorial angle of said rotor plates.

4. Apparatus according to claim 1 in which said rotor plates are symmetrically disposed about an axis and are interconnected electrically.

5. Apparatus according to claim 1 in which said first and second sets of stator plates make up said first group and said third and fourth sets of stator plates make up said second group, means for applying signals from a first antenna to said first set and for extracting signals from said second set when said rotor plates are disposed between said third and fourth sets, and means for applying signals from a second antenna to said third set and extracting signals from said fourth set when said rotor plates are disposed between said first and second sets.

6. An antenna system for a vehicle radio receiver including: means for deriving a pair of space-phased signals from at least one discontinuity in the vehicle body; a sequential coupling element including first, second, third and fourth sets of stator plates, each plate in each such set being of a shape approximating a sector of a circle, the sectorial angle of each such plate having a predetermined value, said first and second sets of stator plates making up a first group of plates and lying in spaced substantially parallel planes and electrically insulated from each other, said third and fourth sets of stator plates making up a second group of plates lying in spaced substantially parallel planes and electrically insulated from each other, and a rotor including a plurality of plates each having substantially the shape of a sector of a circle, the sectorial angle of which approximates that of said stator plates, and the disposition of which is such as to alternately shield the sets within each group from each other as said rotor rotates, said rotor being adapted for connection to ground potential; and means for applying the first of said pair of signals to said first set of stator plates and the second of said pair of signals to said third set of stator plates, and for extracting the signals which appear sequentially at said second and fourth sets of stator plates as a result of the operation of said rotor.

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