

Aug. 16, 1938.

L. LENG

2,127,336

CHANGE-OVER OR SWITCH DEVICE FOR RADIO FREQUENCY FEED LEADS

Filed April 22, 1935

Fig. 1

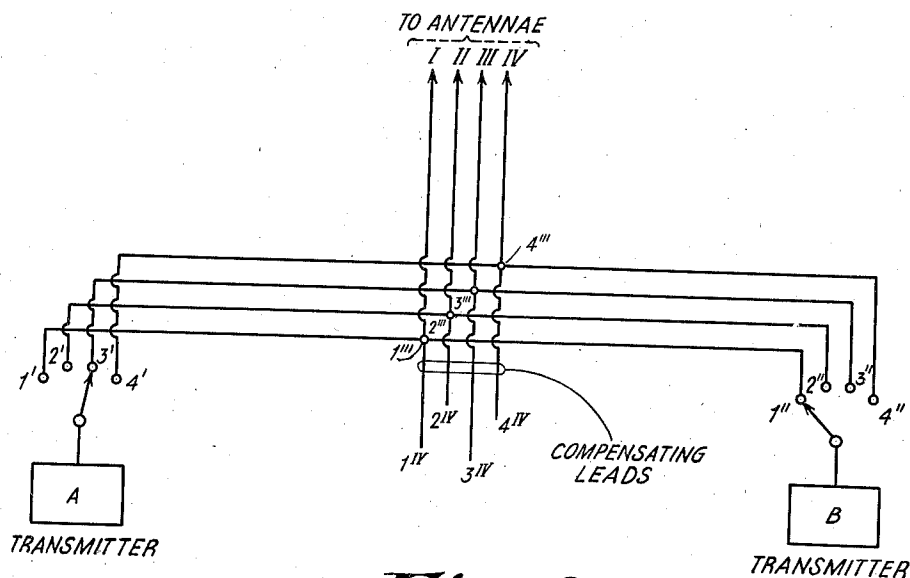


Fig. 2

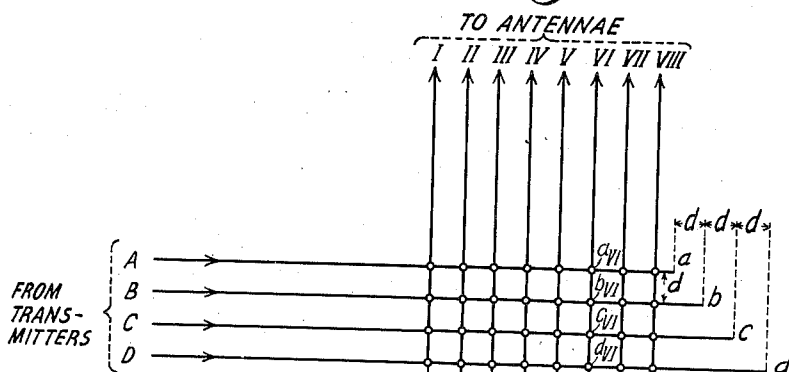
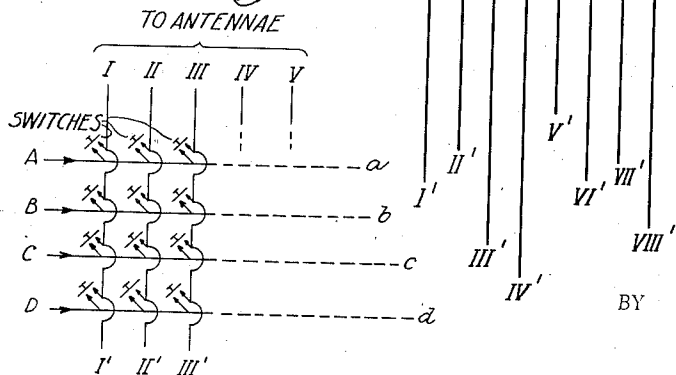


Fig. 3



INVENTOR.
LEOPOLD LENG

BY

W. S. Swann
ATTORNEY.

UNITED STATES PATENT OFFICE

2,127,336

CHANGE-OVER OR SWITCH DEVICE FOR
RADIO FREQUENCY FEED LEADS

Leopold Leng, Berlin, Germany, assignor to Telefunken Gesellschaft für Drahtlose Telegraphie m. b. H., Berlin, Germany, a corporation of Germany

Application April 22, 1935, Serial No. 17,650
In Germany May 3, 1934

9 Claims. (Cl. 250—33)

In changing the connections of radio frequency leads (downleads), for instance, for selectively establishing connections between a plurality of transmitters and antennae, there exists the difficulty that dummy pieces of conductor remain connected with the transmission line or leads which, on changing connections, take a capacitive or inductive current so that the conditions of matching of the lead with the transmitter or antenna are disturbed. For this reason, circuit schemes have been conceived which will also cause dummy conductors to be disconnected whenever such circuit changes are effected. However, switch arrangements of this kind involve comparatively complicated schemes.

According to this invention, the harmful effect of dummy conductors is eliminated by compensating for the wattless current in them. For such compensation, according to the length of the dummy conductor piece compared with the length of the communication wave, a capacity or an inductance may be used which takes a wattless current of like size as the dummy piece. Also, another piece of conductor could be connected instead of a concentrated capacity or inductance, for the same purpose. Two pieces of lengths of conductors of like surge impedance, which are open at the end or both short circuited at the end, will compensate each other whenever the sum total of their lengths is equal to one-half wave length, or an odd multiple of a half wave. If one of these pieces is open, and the other one short circuited, compensation will be produced when the sum total of their lengths is a quarter wave length, or an odd multiple of a quarter wave.

Figs. 1 and 2 illustrate schematically, by way of example, two embodiments of the invention; and

Fig. 3 illustrates an enlarged portion of Fig. 2 showing the relationship of the various conductors and the switches employed to achieve the desired result.

In Fig. 1, the assumption is made that two transmitters shall be adapted to be connected together with four aerials of different, though fixed, wave lengths. For instance, when transmitter A is connected with antenna III, the piece of conductor marked 3''—3''' acts as a dummy conductor which absorbs current. In order that the effect thereof may be compensated, a piece of conductor marked 3''—3^{IV} is connected in such a way that it, together with the piece 3''—3''' will result in a length substantially equal to half

a wave or three half-waves, etc., in accordance with the teachings set forth above.

In the same manner, and upon the identical principle, switch devices may be designed in the form of line selectors which are specially suited for concentric energy feed leads or downleads (tubular or cable leads). One simplified embodiment is shown in Fig. 2, wherein four transmitters A, B, C, D, are each adapted to be united, ad libitum, by suitable switching mechanism to any one of eight aerials I—VIII of dissimilar but fixed wavelength. Let us say it is desired to connect aerial VI with transmitter A. For this purpose, a piece of lead Aa, at the place marked *av_i*, must be united with the lead VI—VI'. What remains are the dummy ends *av_i*—*a* and *av_i*—VI'. The portion *av_i*—VI' is so dimensioned that, together with *av_i*—*a*, it will result in a length equal to a half-wave or an odd multiple thereof. In order that the conditions (relations) may also be proper when the aerial VI is connected with the transmitter B, C, or D, the piece of lead Bb is extended a length equal to the distance *d*; Cc twice the said distance, etc. If dummy lengths of conductor equal to the wave length are provided for the other antennae, the compensation will also be accurate in their case for connection with any desired transmitter.

In the above exemplified embodiment the assumption has been made that both dummy or idle pieces are open, or that both have been short circuited. Of course, it is also feasible to combine open pieces with short circuited ones; the sum total of the wattless currents (or reactive currents) of the idle pieces or dummies could be made equal to a quarter wave or an odd multiple thereof. It is likewise feasible to combine both forms in one switch device in order to adapt the arrangement to optimum conditions.

Fig. 3 shows the relationship of the various conductors of Fig. 2 and the switching arrangement employed to connect the four transmitters A, B, C and D to the various aerials I to VIII, inclusive.

What is claimed is:

1. In combination, an antenna, a first transmitter and a second transmitter, an energy supply lead in circuit with said antenna, individual connections extending from said lead up to said transmitters, and switching means for selectively connecting each transmitter to its associated connection, and a dummy line connected to said energy supply lead for compensating for the effect of one of said connections when said one connection is not in circuit with its associated transmitter.

2. A system in accordance with claim 1, characterized in this that said dummy lead is open ended and has a surge impedance substantially equal to the surge impedance of said one connection, the sum total of the lengths of said dummy lead and said one connection being equal to an odd multiple of half the length of the working wave.
3. A switching system for connecting together any of a plurality of sources of radio frequency energy with any of a plurality of loads, comprising individual energy feed leads from said sources of radio frequency energy to connections leading to said loads, switches for individually connecting any one of said feed leads with any one of said connections, and compensating means adapted to be connected to said leads and connections whenever said switches are operated for absorbing wattless current of substantially equal magnitude and of opposite phase to the wattless current existing in the idle circuit connections simultaneously and operatively coupled to said feed leads and connections when connected together.
4. An arrangement in accordance with claim 3, characterized in this that said compensating means comprises a concentrated reactance.
5. A switching system for connecting together any of a plurality of sources of radio frequency energy with any of a plurality of loads, comprising individual energy feed leads from said sources of radio frequency energy to connections leading to said loads, switches for individually connecting any one of said feed leads with any one of said connections, and compensating means adapted to be connected to said leads and connections whenever said switches are operated for absorbing wattless current of substantially equal magnitude and of opposite phase to the wattless current existing in the idle circuit connections simultaneously and operatively coupled to said feed leads and connections when connected together, said compensating means comprising a section of line whose electrical length added to the electrical length of one or more idle connections in circuit therewith is equal substantially to an odd integral multiple of one-half the working wave.
6. In a circuit employing radio frequency energy, the method of compensating for wattless currents due to idle connections which includes

simultaneously absorbing a wattless current of substantially equal magnitude and of opposite phase to the current in said idle connections.

7. A switching system having, in combination, a first and second source of high frequency oscillations, a load including a line connected to said load, switches for connecting said first and second sources to different points on said line, and a section of line for compensating for the idle portion of said line when only one of said sources is connected to said line, said section of line having a surge impedance equal to the surge impedance of the idle portion of the line at the point of connection, the electrical length of said section together with the electrical length of said idle portion being substantially equal to an odd integral multiple of one-half the operating wave, said idle portion and said section of line each having one open end.

8. A switching system having, in combination, a first and second source of high frequency oscillations, a load including a line connected to said load, switches for connecting said first and second sources to different points on said line, and a section of line for compensating for the idle portion of said line when only one of said sources is connected to said line, said section of line having a surge impedance equal to the surge impedance of the idle portion of the line at the point of connection, the electrical length of said section, together with the electrical length of said idle portion, being substantially equal to an odd integral multiple of one-half the operating wave.

9. A switching system having, in combination, a first and second source of high frequency oscillations, a load including a line connected to said load, switches for connecting said first and second sources to different points on said line, and a section of line for compensating for the idle portion of said line when only one of said sources is connected to said line, said section of line having a surge impedance equal to the surge impedance of the idle portion of the line at the point of connection, the electrical length of said section, together with the electrical length of said idle portion, being substantially equal to an odd integral multiple of one-quarter the operating wave, at least one end of either said idle portion or said section of line being open.