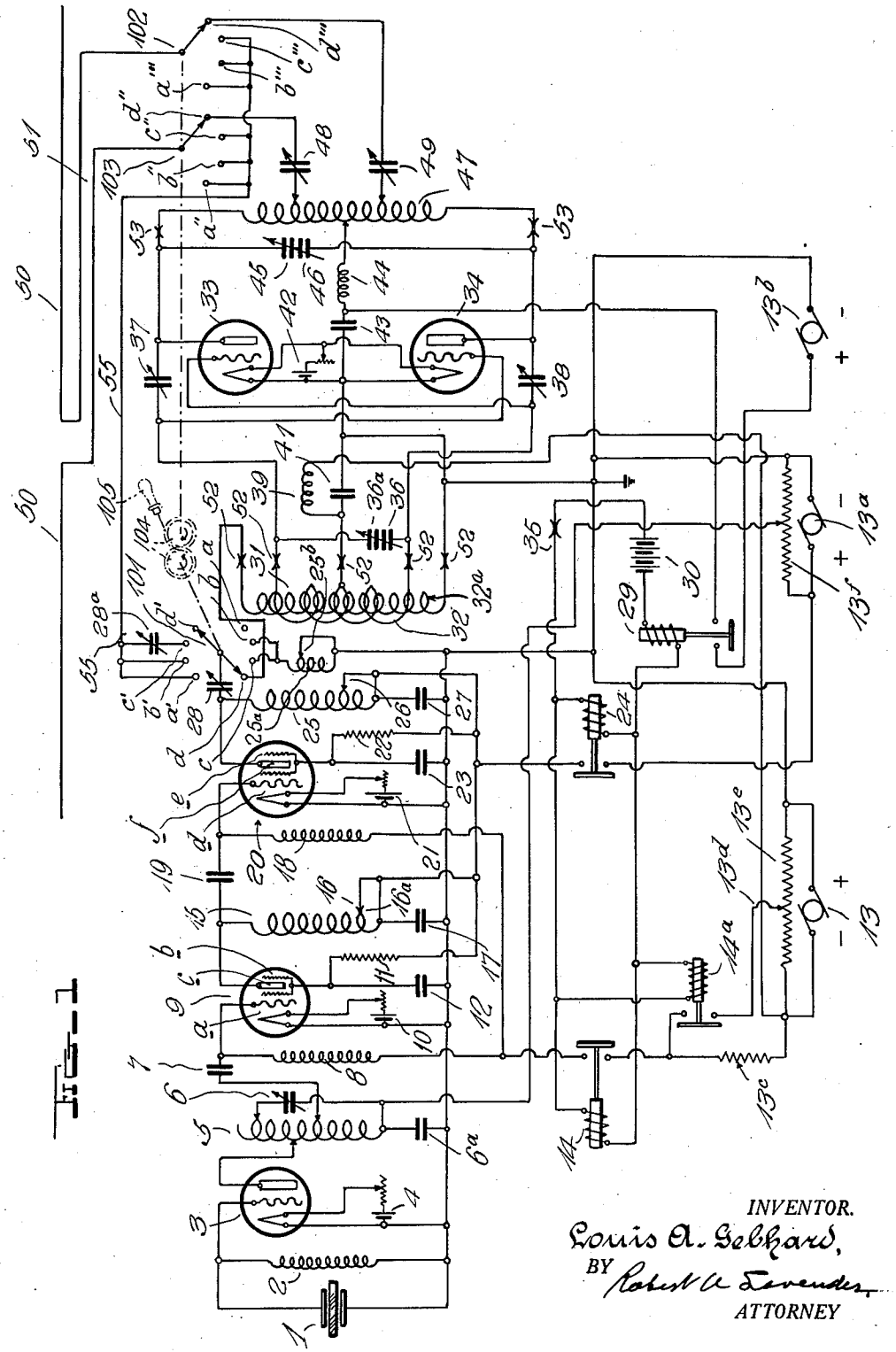
Aug. 22, 1933. L. A. GEBHARD 1,923,305

SIGNALING SYSTEM

Filed May 29, 1930 2 Sheets-Sheet 1



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SIGNALING SYSTEM

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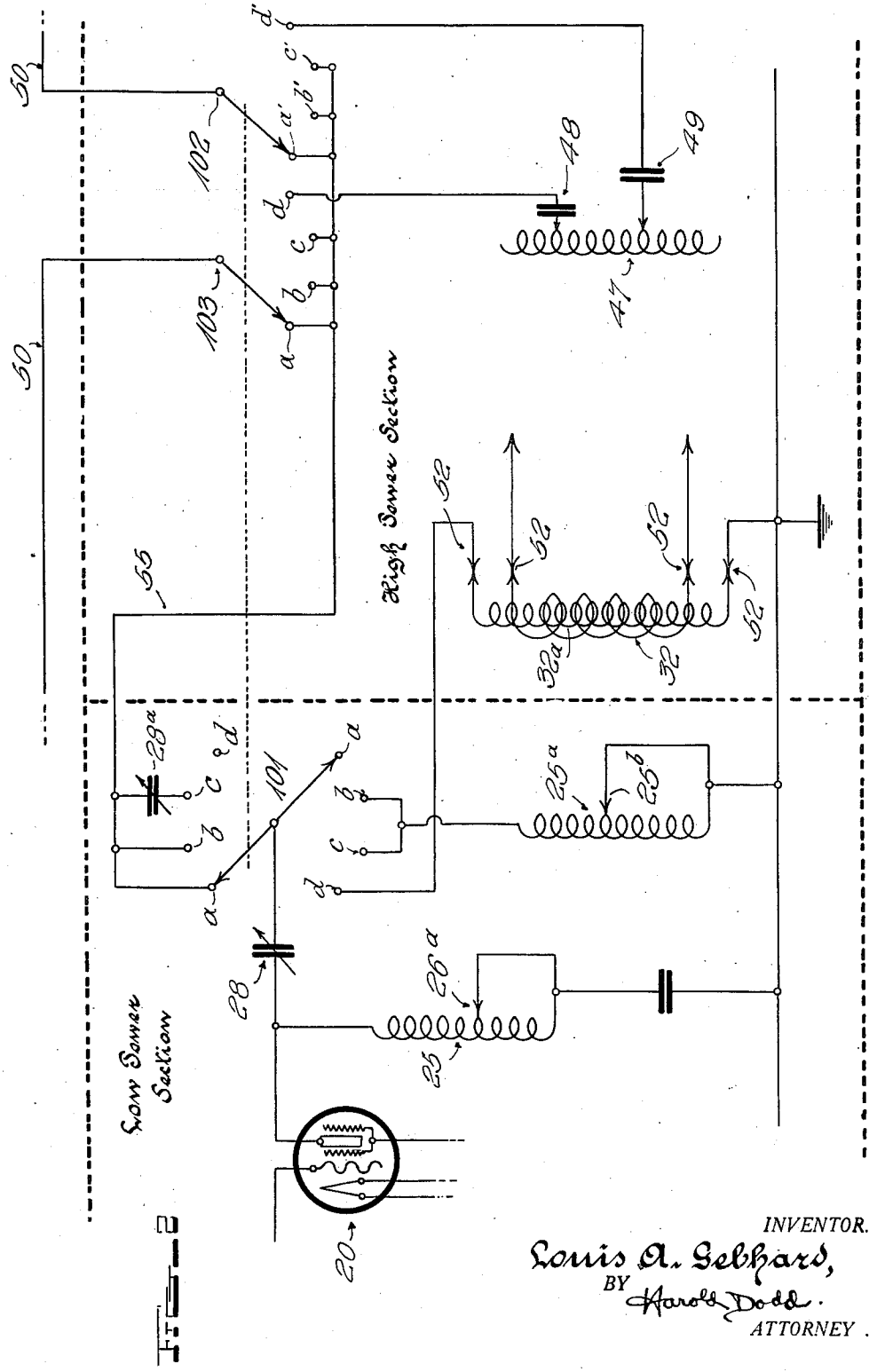


FIG. 2

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Patented Aug. 22, 1933 1,923,305

UNITED STATES PATENT OFFICE

1,923,305

SIGNALING SYSTEM

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Application May 29, 1930. Serial No. 457,445

14 Claims. (Cl. 250—17)

My invention relates broadly to high frequency signaling systems and more specifically to a radio frequency feed circuit in high frequency signaling systems of large power output.

One of the objects of my invention is to provide an arrangement in a high frequency signaling system operative over a number of different frequency channels with means for accurately adjusting the coupling between the power amplifier system and the radiating system.

Another object of my invention is to provide a transmission circuit arrangement including a high power symmetrical circuit section and a low power unsymmetrical circuit section with switching means for selectively controlling the connections between said sections with an antenna system.

Another object of my invention is to provide a circuit arrangement for a signaling system adapted for high power operation on any one of a number of different frequency channels in which a variable capacity element is interposed between portions of the power amplifier system for regulating the coupling between the several circuits of the transmitter.

Still another object of my invention is to provide an arrangement in a signaling system employing electron discharge devices of large power output by which substantially balanced operation of the high power electron discharge devices is obtained at high operating frequencies while modification in coupling between the power amplifier stages may be readily effected.

A further object of my invention is to provide a frequency control circuit for a signaling system employing a plurality of electron discharge devices of large power output in a balanced circuit arrangement which is adapted to operate readily in any of a plurality of frequency channels, and in which substantially balanced and stable operation is obtained in the large power output electron discharge devices at high operating frequencies while permitting various degrees of coupling to be obtained between the power amplifier stages.

Other and further objects of my invention will be apparent to those skilled in the art to which this invention pertains from the following specification by reference to the accompanying drawings, in which:

Figure 1 diagrammatically shows the transmitter circuit arrangement embodying my invention; and Fig. 2 shows certain details of the switching circuit illustrated in Fig. 1.

My invention is directed to a frequency control circuit for a transmitter wherein electrical oscillations generated by an electron discharge device, having associated therein a frequency stabilizing and controlling element of the piezo electric crystal or magnetostriction type, are impressed upon the circuits of frequency multiplying and power amplifying electron discharge devices, which are preferably of the shield grid type. In a radio transmitter operating over a wide band of frequencies a very flexible coupling system must be used. This is particularly true where the operation is from a low power stage to a high power stage employing water cooled tubes in a push-pull system. This coupling system must not only be flexible but it must be so designed as not to destroy the balance in the operation of the tubes in the push-pull system. Any unbalanced distributed capacities tend to unbalance the loads on the tubes in the push-pull system.

In a high power transmitter for high frequency signaling it is desirable to have the low power stages of the transmitter constructed of the "single-ended" or "unsymmetrical" type while the high power section or final stage or stages are constructed of the "double-ended", "push-pull" or "symmetrical" type for the following reasons:

(a) When crystal control is used in the transmitter a "push-pull" circuit requires isolating from ground both sides of the crystal which arrangement does not lend itself to accurate temperature control and therefore the accuracy of frequency is impaired. This isolation means that the lower plate of the crystal cannot be connected in common with the other lower plates of other crystals which are generally placed on a large plate having good thermal conductivity which prevents excessive temperature differences between crystals. This permits changing frequency by changing from one crystal to another quickly and still have good accuracy with respect to frequency. If a temperature control system having a number of crystals in a common plate is used in a "push-pull" system then the circuit will not have perfect symmetry. The common plate cannot be grounded and it will have large capacity to ground which does not exist on the other half of the circuit. The common plate usually carries a thermometer for indicating the temperature, which in this case would be subject to a radio frequency potential resulting in heating of the glass and therefore cause inaccuracies of measurement. A thermostat located on or inside the common plate would also be subject to this inaccuracy which is increased due to the fact

that the mercury inside the thermostat is electrically connected to the temperature control and heater circuits which are substantially at ground potential of radio frequencies.

(*b*) The changing of frequency of "single-ended" circuits is very much simpler and requires much less time than in the case of "push-pull" circuits. This is true for a crystal oscillator circuit as well as a screen grid amplifier circuit employing screen grid tubes.

(*c*) The construction of such circuits is simpler and the expense smaller and physical space occupied less, thus making for greater compactness in the apparatus. In "single-ended" circuits it is much easier, simpler and cheaper and more compact to obtain quick change between singling, doubling and tripling of frequency operations.

(*d*) In the final stage or stages of the transmitter it is more desirable to use "push-pull" circuits in that three-element high power tubes are the only ones generally available. The use of the push-pull circuit inherently reduces difficulties experienced from harmonics. Its use also permits improved stability of an amplifier due to improved "balance" of electric coupling on account of the inherent interelement capacities in the tubes. In addition the use of "push-pull" circuits enables the transmitter to be operated at higher frequencies since the inter-electrode capacities between the plate and filament as well as other stray capacities are in series instead of in parallel. In the circuits or stages of the transmitter near the oscillator the inter-element capacities are not sufficiently important as to overweigh the other advantages of "single-ended" circuits because, first, the inter-element capacities are smaller which permit paralleling of tubes if necessary to a limited degree, which may be required due to the lack of higher powered screen grid tubes, and still cover frequency range, and second, with the exception of the last stage feeding into the high power amplifier input circuit, the earlier stages do not have to cover as wide a frequency band since the crystal is generally in the 2000–5000 kilocycle band and higher output frequencies are obtained by doubling and tripling frequency operations.

From the above analysis it will be understood that "single-ended" circuits are better for earlier and lower power circuits of a transmitter and "push-pull" or "double-ended" circuits are better for the final and higher power circuits. My invention provides means for coupling the last unsymmetrical circuit of the line-up to the symmetrical circuit without interfering with the symmetry of the latter over a wide frequency band. The coupling provided is flexible enough to cover all requirements for proper excitation of the "push-pull" circuit.

In the system embodied in my invention continuously variable inductance units, having an arrangement associated therewith for varying the number of turns operatively connected into circuit and for short circuiting the turns not in use, are employed for interstage coupling between the amplifying electron discharge devices. The tendency for interstage self-excited oscillations taking place in the circuits of the electron discharge device amplifying system is thus materially reduced and the flexibility of the amplifier is increased since the frequency characteristics of each of the electron discharge device units assumes a semiaperiodic character between certain limits. This is highly desirable especially where a multi-stage amplifier comprised of shield grid electron discharge devices is employed. Electrical oscillations of high frequency and large amplitude obtained from the multi-stage shield grid electron discharge device amplifier are impressed upon the circuits of high power electron discharge devices, preferably of the artificially cooled anode type, which are connected into a balanced or push-pull circuit arrangement, and further increased in amplitude. I provide a variable condenser interposed between the output circuit of the power amplifier and the coupling circuit to the input of the push-pull amplifier. By adjusting this variable condenser I am enabled to control the coupling between the power amplifier and the push-pull amplifier within the limits of the particular coupling device which connects the output circuit of the power amplifier with the input circuit of the push-pull amplifier.

In Figure 1, reference numeral 1 designates a frequency controlling element of the piezo electrical crystal type which is connected to the control electrode of the electron discharge device 3. A choke coil 2 is connected between the control electrode and the cathode of the electron discharge device 3. An oscillatory circuit comprising the inductance 5 and the capacity 6 is connected into the anode circuit of the device 3. Radio frequency bypass condenser 6*a* is provided between the inductance 5 and the cathode of the device 3. A source 4 of cathode heating current is associated with the cathode electrode of the electron discharge device 3. A second electron discharge device 9 of the screen grid type is associated with the output circuit of the device 3. Electrical oscillations are impressed upon the grid electrode *a* of the device 9 from the oscillatory circuit 5—6, through condenser 7. A resistance unit 11 is connected to the screen grid electrode *b*. An inductance 15 is connected into the output circuit of the device 9. A variable contact 16 which is connected to the variable tap 16*a* on the inductance 15 is provided for varying the effective number of turns of the inductance 15, that are operatively connected into the output circuit of device 9. The turns of the inductance which are not operatively connected into circuit are short circuited. A radio frequency bypass condenser 17 is provided between the tap 16*a* on the inductance 15 and the cathode electrode of device 9. Electron discharge device 20 which is also preferably of the screen grid type, is connected with the output circuit of device 9. A capacity 19 is connected between the grid electrode *d* and the output circuit of device 9. A resistance unit 22 is connected to the shield grid electrode *e*. An inductance 25 is connected to the anode electrode *f* of the electron discharge device 20.

A variable contact 26 is connected to the point 26*a* on the inductance 25 for varying the number of turns of the inductance that are operatively connected into the anode circuit of the device 20. Bypass condenser 23 is connected between the screen grid electrode *e* and the cathode of the electron discharge device 20. Another high frequency oscillation bypass condenser 27 is connected between the inductance 25 and the cathode. Sources 10 and 21 are connected with the cathodes of electron discharge devices 9 and 20, respectively. An inductance system 31 comprising the windings 32 and 32*a*, one of which is concentrically and symmetrically disposed

within the other, is employed to couple the output circuit of the electron discharge device 20 to the input circuits of the electron discharge devices 33 and 34 which are connected in balanced circuit arrangement. The inductance system 31 comprising the windings 32 and 32*a* is preferably of a readily variable type having contacts 52 by which the circuits are completed to the push-pull amplifier circuits of tubes 33—34. The coils 32 and 32*a* have very small capacities between them and the magnetic coupling predominates over the electric coupling. Independent contacts 35 leading to the power supply circuit are associated with the contacts 52 in such manner that the circuit between these contacts 35 is broken before the inductance circuits at contacts 52 are broken and established after the inductance circuits at contacts 52 are established in order to prevent disastrous effects of opening the inductance circuits while radio frequency oscillations of large amplitude are present therein. Relays 14, 14*a*, 24 and 29, which are connected to the source of power supply 30 and the contacts 35 are employed for controlling the connections to the sources of power supply 13, 13*a* and 13*b* which may be of any approved type, such as a battery, motor generator system or rectifier connected to an alternating current supply system.

The negative terminal of the source 13 is preferably connected to the choke coils 8 and 18 through a resistance unit 13*c*, for impressing a negative biasing potential upon the grid electrodes *a* and *d* of devices 9 and 20, respectively. Connection 13*d* is provided between a variable tap on resistance unit 13*e*, which is connected across the source 13 and the common cathode connection of devices 3, 9 and 20. Relay 14*a* is provided to complete the connection from tap 13*d* to the grids of tubes 9 and 20. The resistance units 11 and 22 and the inductance units 5, 15 and 25 are connected together to the positive terminal of the source 13*a*. The value of the resistance units 11 and 22 must be carefully chosen in order that the proper potential is impressed upon the screen grid electrodes *b* and *e* of the devices 9 and 20. Where it is desired the resistance units 11 and 22 may be eliminated and connections between the screen grid electrodes *b* and *e* and the proper points of the resistance 13*f*, which is connected across the source of supply 13*a*, made directly. Relay 24 is employed to complete the plate and shield grid circuit connections to the positive terminal of the source of supply 13*a*. When the circuit of relay 24 is broken the anode circuits of the electron discharge devices 9 and 20 are deenergized and the circuit between the source 13*a* and the shield grid electrodes *b* and *e* is interrupted. Relay 29 is connected to the positive terminal of the source of supply 13*b* to control the energization of the anode circuits of electron discharge devices 33 and 34. A source of cathode heating current 42 is provided for the electron discharge devices 33 and 34.

In a high power transmitter it is desirable to be able to cut off the final high power circuit and use the power in the circuit just previous, for output in the antenna. Full power is not required under all conditions of transmission so this feature in the transmitter of my invention permits great economy. Again if some part in the high power circuit should fail in the emergency the lower power circuit could be used. The higher power circuit can be isolated so that it is possible to repair it even with the low power section in operation. Suitable switches may be provided to cut off the supply sources to the high power section to permit repairs thereon. In order to provide for this operation the coupling system between last "unsymmetrical" circuit and final "symmetrical" circuit must be arranged so that in addition to aforesaid coupling requirements proper antenna coupling facilities may be provided.

Variable condenser 23 is connected between the output circuit of device 20 and the inductance 32*a* for varying the coupling between the output circuit of the device 20 and the balanced input circuit of the devices 33 and 34. By adjusting variable condenser 23 various degrees of coupling between amplifier 20 and push-pull amplifiers 33 and 34 are obtained. This adjustment, however, is limited by the range of the coupling between coils 32*a* and 32. If it is desired to extend this range beyond the point afforded by condenser 23 and when the frequency is carried beyond the limits of the combination of coil 32 and condensers 36 and 36*a*, coils 32*a* and 32 may be changed so as to be either larger or smaller as required. The contacts 52 are provided so that the coils 32*a* and 32 may be arranged in a single unit and quickly interchangeable. Variable capacities 36*a* and 36 are connected in series across the winding 32 of the inductance system 31. Variable condensers 37 and 38 are connected between the winding 32 and the anode electrodes of electron discharge devices 33 and 34, respectively, for neutralizing the effect of the interelectrode capacities of the electron discharge devices 33 and 34. The electrostatic capacities 45, 46, 37 and 38 are preferably of the type disclosed in my copending application Serial No. 327,990 for Condenser systems, filed December 22, 1928. Connections are provided between the capacity 37 and the grid electrode of the electron discharge device 34. Similar connections are provided between the capacity 38 and the grid electrode of the electron discharge 33. Substantially balanced operation is thus obtained in the circuits of the circuits of the electron discharge devices 33 and 34. The loads taken by each of the electron discharge devices may thus be made equal in magnitude. This is highly desirable in the operation of high power systems of this character since the possibility of the occurrence of disastrous effects caused by overloading by reason of unbalanced circuit operation is practically eliminated.

The source 13 of grid electrode biasing potential for the electron discharge devices 33 and 34 is connected to the approximate electrical center of the inductance 32 through the choke coil 39. A high frequency oscillation bypass condenser 41 is connected across the choke coil 39 and the source 13. An inductance 47 is connected between the anode electrodes of the electron discharge devices 33 and 34. The electrical center or approximate electrical center of the inductance 47 is connected to the cathodes of the devices 33 and 34 through the choke coil 44 and the condenser 43. The choke coil 44 is employed to provide a path for the direct current anode supply from the source 13*b* and to reduce the high frequency voltage across this source. Variable condensers 45 and 46 are connected across the inductance 47 and form an oscillatory circuit in combination therewith. Condensers 48 and 49 are connected into the high frequency transmission line 51 which is connected to the inductance

47 for energizing the antenna doublet 50. Contacts 53 may be made to inductance 47 in such manner that an inductance unit of different frequency range may be readily substituted for the inductance shown when the transmitter is to be adjusted outside of the range of any particular inductance.

In Fig. 2, I have shown an enlarged detailed wiring diagram of the transmitter circuit in which the antenna characteristics may be changed with a change in coupling. A plurality of simultaneously operative switch members 101, 102 and 103 are provided each movable over a set of contacts under control of manual adjustment device 105 and gearing 104 in opposite directions as shown. That is to say, switch 101 is driven over contacts *a*, *b*, *c*, *d* and *a'*, *b'*, *c'* and *d'* in one direction while switches 103 and 102 are driven over contacts *a''*, *b''*, *c''*, *d''* and *a'''*, *b'''*, *d'''*, and *c'''* in the opposite direction. Quick shift switches 101, 103, 102 may be provided so that the proper antenna coupling system may be selected and so that coupling of the low power unit may be shifted from the high power section to the antenna circuit, and the high power unit may be connected and disconnected from the antenna respectively. When the low power section is used on the antenna the doublet is arranged as a T type antenna and when the high power section is used the antenna is used as a doublet system with its advantages for high power operation. Switch 101 is located in the low power section of the transmitter and switches 102 and 103 are located in the high power section of the transmitter. The contacts of switch 101 connect as shown. That is contact *d* connects to the end of the inductance 32*a* while contacts *c* and *b* connect to the end of the auxiliary inductance 25*a* as shown. The turns of inductance 25*a* are selectively fixed by the movement of contact member 25*b*. The contact *a* in the lower group of contacts is left free. In the upper group of contacts *a'* and *b'* are connected together and connect through lead 55 with contacts *a''*, *b''*, *c''* of switch 103 and *a'''*, *b'''*, *c'''* of switch 102, as shown. Contact *c'* of switch 101 is connected in series through lead 55 through condenser 28*a*. Contact *d'* is left free. The high power section of the transmitter has been illustrated in a fragmentary manner in Fig. 2 it being understood that the push-pull amplifier is arranged in the high power section in the manner set forth in Fig. 1, the output of the push-pull amplifier including inductance 47. The coupling condensers 48 and 49 however, instead of connecting directly to the doublet 50 extend to contacts *d''* and *d'''* over which the switches 103 and 102 sweep in interlocked relationship with the movement of switch 101. By the switching arrangement illustrated the doublet antenna 50 may be changed into a simple T antenna and connected directly to the low power section of the transmitter through lead 55, the high power section being wholly isolated. This effect is obtained with the switches 102 and 103 on contacts *a'''*, *b'''*, *c'''* or *a''*, *b''*, *c''*, with the switch 101 on corresponding contacts. This permits operation of the transmitter on low power without operation of the high power unit under conditions where it is unnecessary to radiate excessive power or where breakdown occurs in the high power unit. Various positions of switch 101 on contacts *a*, *b*, and *c*, give different combinations of antenna coupling and tuning with the aid of auxiliary inductances 25*a* and condenser 28*a*. In the position *a* of switch 101, only the condenser 28 is in circuit and the antenna is simply capacitatively coupled to the low power unit. Thus condenser 28 may perform the function of coupling the set to the antenna when switch 101 is in position *a*, *b* or *c* while condenser 28 serves to couple the low power section to the high power section when switch 101 is in position *d*. I may provide switches coordinated with the movement of switches 101, 102 and 103 for cutting off the plate voltage to the high powered tubes 33 and 34 and opening the filament circuits to these tubes when the switches are on positions *a*, *b* or *c*. In this way the high power section is rendered ineffective when the low power unit is used alone. In the position *d* for switch 101 and position *d''* for switch 103, and position *d'''* for switch 102, the circuit is identical with the circuit explained in connection with Fig. 1. The arrangement of the other parts of the circuit supplementary to those illustrated in Fig. 1 enable the system to be more effectively utilized for the control of coupling, the desired characteristics of the antenna used with the transmitter, and it enables the power which is radiated to be more definitely selected.

The system of my invention has proven highly effective in operation. A frequency band of 4,000 to 21,000 kilocycles has been successfully covered and a smooth variation of coupling obtained throughout the range. The coupling between the output of the power amplifier 20 and the input of the push-pull amplifiers 33—34 is wholly controlled throughout the tuning range or period of the coupling transformer 31 by micrometer adjustments of the variable condenser 28.

While I have described my invention in a certain preferred embodiment it is understood that modifications thereof may be made without departing from the spirit of my invention and that therefore I do not desire to confine my invention to the exact details as described except insofar as these details are defined by the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A signal transmission system comprising in combination a source of substantially constant frequency oscillations, an amplifying system for increasing the amplitude of said oscillations, a pair of electron discharge devices connected into a balanced circuit arrangement, and means coupling the output circuit of said first mentioned amplifying system with the input circuits of said pair of electron discharge devices comprising a variable impedance device, an ouput circuit connected with said pair of electron discharge devices, a radiating system connectible with said output circuit, and switching means for selectively connecting said first mentioned amplifying system directly with said radiating system or through the circuits of said pair of electron discharge devices and simultaneously changing the transmission characteristics of said radiating system.

2. A signal transmission system comprising in combination a source of substantially constant frequency oscillations, an amplifying system for increasing the amplitude of said oscillations, the output unit of said amplifying system comprising a pair of electron discharge devices of large power output connected into a substantially symmetrical circuit arrangement, a variable impedance element for selectively coupling the output circuit of said amplifying system and the input

circuit of said pair of electron discharge devices, an oscillatory circuit connected to the output electrodes of said electron discharge devices, an antenna system, and means connected between said antenna system, the output circuit of said electron discharge devices and the output circuit of said amplifying system for controlling the transfer of high frequency energy to said antenna system directly from the output of said amplifying system or through said pair of electron discharge devices and selectively fixing the transmission characteristics of said antenna system.

3. A signal transmission system comprising in combination, a source of substantially constant frequency oscillations, a first amplifier for increasing the amplitude of said oscillations, a second amplifier comprising a pair of electron discharge devices connected into a substantially symetrical circuit arrangement, a variable condenser disposed between the output circuit of the first amplifier and the input circuit of the second amplifier for controlling the coupling therebetween, circuits interconnecting the control electrode and anode of said electron discharge devices, an antenna system, means connected between the anode of one of said electron discharge devices and the control electrode of the other of said electron discharge devices for controling the operation of said electron discharge devices, and switching means for establishing connections between said antenna system and the output circuit of either of said amplifiers while simultaneously changing the transmission characteristics of said antenna system.

4. A signal transmission system comprising in combination a source of substantially constant high frequency oscillations, an amplifying system for increasing the amplitude of said oscillations, a unit coupled to said amplifying system comprising a pair of electron discharge devices connected into a substantially symmetrical circuit arrangement, a variable condenser interconnecting the output circuit of said amplifying system with the input circuit of said unit for varying the coupling therebetween, oscillatory circuits interconnecting the grid and anode electrodes of said electron discharge devices, an antenna system, and means for selectively connecting the output of said amplifying system directly with said antenna system or through the circuits of said pair of electron discharge devices and simultaneously fixing the transmission characteristics of said antenna system.

5. A signal transmission system comprising in combination, a source of substantially constant frequency oscillations, three interconnected amplifier stages of which the first stage comprises means for increasing the amplitude of said oscillations and multiplying the frequency thereof, the second stage comprises a shield grid electron discharge device, while the third stage comprises a balanced pair of electron discharge devices having means associated therewith for controlling and maintaining the balanced operation thereof, a variable inductance interconnecting the output circuit of said shield grid electron discharge device with the input circuit of said third stage for transferring energy thereto, a variable impedance connected in series with said inductance for adjusting the coupling between the second and third stages, an antenna system and means for selectively connecting said antenna system directly with the output circuit of either the second or the third stage while simultaneously fixing the transmission characteristics of said antenna system.

6. A signal transmission system comprising in combination a source of substantially constant frequency oscillations, a first amplifying system for amplifying selected harmonic frequencies of said oscillations and multiplying the frequency thereof, a second amplifying system comprising a shield grid electron discharge device, a variable inductance connected into the output circuit of said shield grid electron discharge device, said inductance having means connected therewith for rendering ineffective that portion of the inductance which is not operatively associated with the circuits of said electron discharge device, a third amplifying system comprising a pair of discharge devices connected into a symmetrical circuit arrangement having means connected therewith for maintaining balanced operation thereof, a variable impedance device disposed in series with said inductance and the output circuit of said shield grid electron discharge device for adjusting the coupling between said device and said pair of discharge devices, an antenna system, and means for fixing the transmission characteristics of said antenna system while selectively connecting said antenna system directly to the output circuit of either the second or the third amplifying system.

7. A signal transmission system comprising in combination a source of substantially constant frequency oscillations, an amplifying system for increasing the amplitude of selected harmonic frequency oscillations of said substantially constant frequency oscillations, a unit coupled to said amplifying system comprising shield grid electron discharge devices, a second unit comprising a pair of electron discharge devices connected into a symmetrical balanced circuit arrangement, a variable capacity element connecting the output circuit of the first said unit with the input circuit of the second said unit for adjusting the coupling therebetween, variable means interconnecting the electrodes of said pair of electron discharge devices for maintaining balanced operation of said pair of electron discharge devices, an antenna system and means for fixing the transmission characteristics of said antenna system while selectively connecting said antenna system directly to either of said units.

8. In a signaling transmission system, a source of high frequency energy, a power amplifier, a radiating circuit, a push-pull power amplifier system connectible with said radiating circuit and a connection between said first mentioned power amplifier and said push-pull power amplifier including a variable capacity element for controlling the coupling between said amplifiers and switching means connected with said radiating circuit for establishing connection selectively with the output of said first mentioned power amplifier or the output of said push-pull power amplifier and simultaneously fixing the transmission characteristics of said radiation system.

9. In a high frequency signaling system, a source of high frequency oscillations, a power amplifier connected with said source, a radiating system, a push-pull amplifier connectable with said radiating system, a coupling circuit including a pair of windings, one of said windings being connected through a variable condenser element to the output circuit of said first mentioned power amplifier and the other of said windings being connected to the input circuit of said push-pull amplifier, said variable condenser element operating to vary the coupling between said amplifiers within the frequency limits covered by said coupling system and switching means connected with

said radiating circuit for establishing connection selectively with the output of said first mentioned power amplifier or the output of said push-pull power amplifier and simultaneously fixing the transmission characteristics of said radiation system.

10. In a radio transmission system, a high frequency oscillator, a low power unsymmetrical amplification circuit connected with said oscillator, a high power symmetrical amplification circuit connectible with the output of said unsymmetrical amplification circuit, a radiation circuit including a doublet antenna, switching means arranged for selectively connecting the doublet antenna of said radiation circuit to the output of said symmetrical amplification circuit or selectively connecting the parts of said doublet antenna to one side of the output of said unsymmetrical amplification circuit, the other side of said unsymmetrical amplification circuit being connected to ground.

11. A signaling system comprising a high frequency oscillator, an unsymmetrical amplification circuit connected with said oscillator and having one side thereof connected to ground, a symmetrical amplification circuit connectible with said unsymmetrical amplification circuit, a doublet antenna, switching means for connecting said doublet antenna to the output of said symmetrical amplification circuit said switching means being operative for disconnecting said doublet antenna from said symmetrical amplification circuit and converting said doublet antenna to a capacity antenna and establishing connection with the ungrounded side of the output of said unsymmetrical amplification circuit, and means operated by said switching means for disconnecting said unsymmetrical amplification circuit from said symmetrical amplification circuit when said unsymmetrical amplification circuit is directly connected with said converted capacity antenna.

12. In a signaling system, a high frequency oscillator, an unsymmetrical amplification circuit connected with said oscillator and having one side thereof connected to ground, a symmetrical amplification circuit, a radiation system, switching means for connecting said unsymmetrical amplification circuit with the input of said symmetrical amplification circuit and establishing connection between the output of said symmetrical amplification circuit and said radiation circuit, and means for disconnecting the aforesaid connections and modifying the connections of said radiation circuit and establishing connection between said modified radiation circuit and the ungrounded side of the output of said unsymmetrical amplification circuit.

13. In a signaling system, a radiation circuit, including a doublet antenna, a selector switch having a pair of arms operative over a set of contacts, a connection between one portion of said doublet antenna and one of said switch arms, a connection between the other portion of said doublet antenna and the other of said switch arms, a high frequency oscillator, an unsymmetrical power amplifier connected with said high frequency oscillator, switching means for establishing connection between the output of said unsymmetrical power amplifier and selected sets of the contacts adjacent said switch arms, a symmetrical power amplifier coupled with the output of said unsymmetrical power amplifier, a coupling inductance in the output of said symmetrical amplifier, and connections between taps on said coupling inductance and selected contacts adjacent said switch arms whereby movement of said switch arms over said sets of contacts establish connections between the portions of said doublet antenna and the taps on said coupling inductance, or establish a shunt path between the portions of said doublet antenna and an electrical connection therebetween with one side of said unsymmetrical power amplifier.

14. In a signal transmission system, a radiation circuit comprising a doublet antenna having two independent portions, a pair of switch arms, one of said switch arms being connected with one portion of said doublet antenna, the other of said switch arms being connected with the other portion of said doublet antenna, sets of contacts individual to each of said switch arms, a high frequency transmission circuit including an unsymmetrical power amplifier and a symmetrical power amplifier, a connection to ground from one side of said unsymmetrical power amplifier means coupling the output of said unsymmetrical power amplifier with the input of said symmetrical power amplifier, switching means between one side of the output of said unsymmetrical power amplifier and selected sets of contacts adjacent each of said switch arms, connections between said sets of contacts whereby the portions of said doublet antenna are electrically connected when said switch arms are moved to positions on the said sets of contacts, a coupling inductance in the output of said symmetrical amplifier, an independent contact individual to each of said switch arms and a tap extending between each of the independent contacts and points on said coupling inductance whereby said antenna portions operate as a doublet in connection with said symmetrical amplifier or as a capacity antenna in connection with said unsymmetrical amplifier.

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