Oct. 14, 1947. F. G. ALBIN 2,429,085

CONDENSER STRUCTURE

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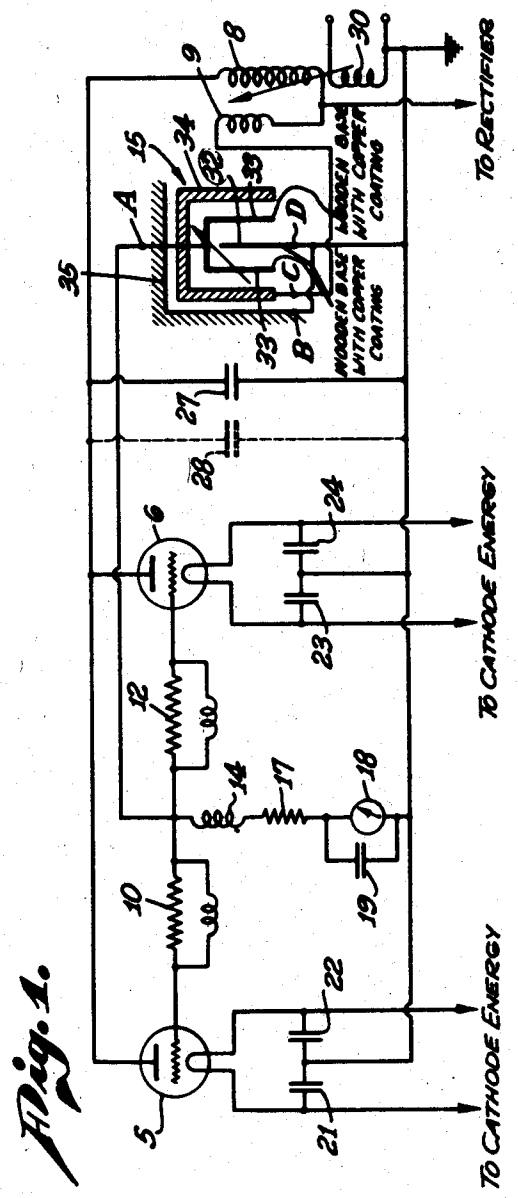



Fig. 1.

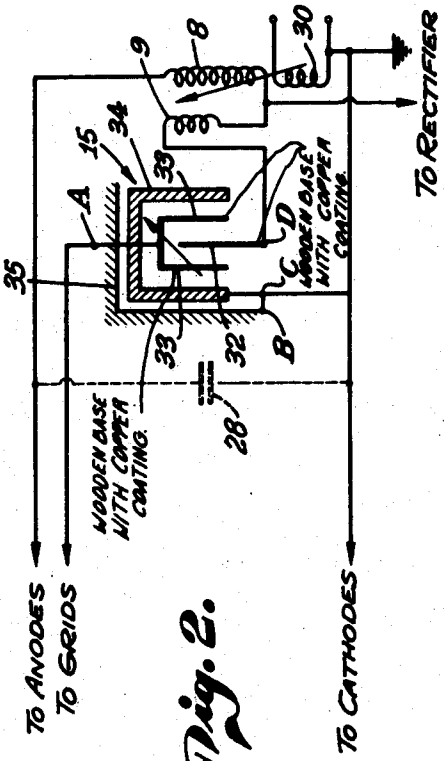



Fig. 2.

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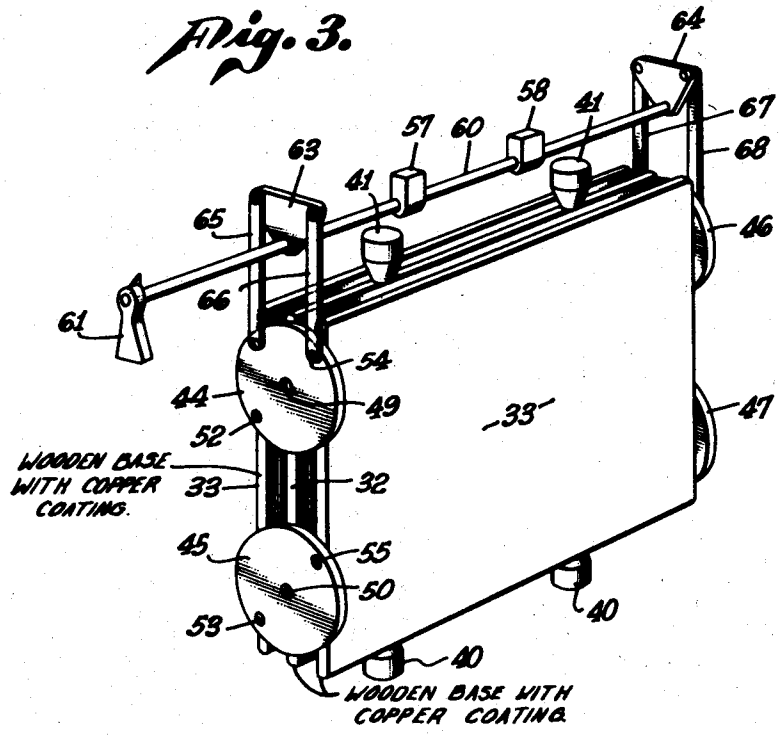
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CONDENSER STRUCTURE

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Fig. 3.



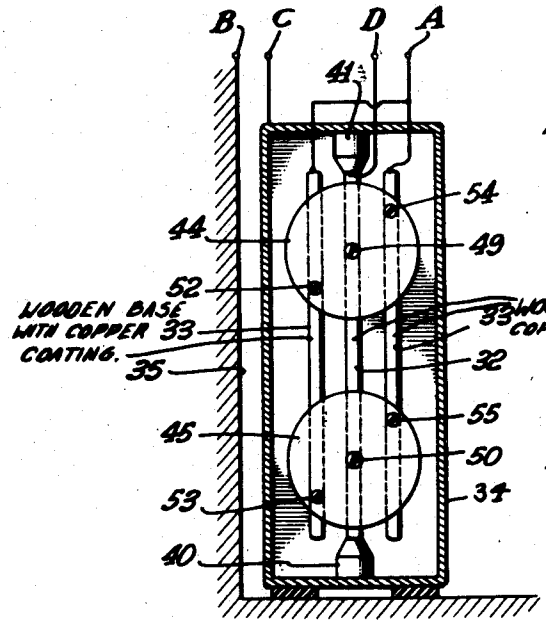




Fig. 4.

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Patented Oct. 14, 1947 2,429,085

# UNITED STATES PATENT OFFICE

2,429,085

## CONDENSER STRUCTURE

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Application June 25, 1943, Serial No. 492,249

5 Claims. (Cl. 175—41.5)

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This invention relates to electrical current oscillator power generators and particularly to a variable condenser structure used in the circuits of such generators.

High or radio frequency generators are well-known, particularly in broadcasting systems. Such generators are now being adapted to industrial uses wherein the power output therefrom is used for various purposes, such as wood gluing, drying, metal treating, and the like. The present invention is directed to the construction of the condenser used in the novel oscillator system disclosed and claimed in my copending application, Serial No. 492,248, filed June 25, 1943, which has matured into Patent No. 2,412,553, dated December 17, 1946.

The principal object of the invention is to facilitate the control of the feedback voltage in a radio frequency oscillator power generator.

Another object of the invention is to provide a capacitor which serves as a grid capacitance, a plate voltage blocking condenser, and as a variable voltage divider.

A further object of the invention is to provide an improved capacitor, the capacitance between portions of which is variable while maintaining the over-all capacitance constant.

A further object of the invention is to provide a capacitor for a high frequency oscillator generator whose over-all capacitance may be varied by varying the capacitance existing between various portions of the mechanical structure and support therefor.

A further object of the invention is to provide an improved large condenser structure for high frequencies and voltages wherein the electrodes thereof may be varied with respect to one another with a minimum of effort.

A further object of the invention is to provide an improved electrode for a condenser for high frequencies and high voltages.

Although the novel features which are believed to be characteristic of this invention will be pointed out with particularity in the appended claims, the manner of its organization and the mode of its operation will be better understood by referring to the following description read in conjunction with the accompanying drawings forming a part hereof, in which:

Fig. 1 is a combination schematic diagram of an oscillating circuit in which the invention is shown diagrammatically.

Fig. 2 is a diagrammatic view of a modification of the invention as shown in Fig. 1.

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Fig. 3 is a perspective view of the condenser structure of the invention, and,

Fig. 4 is an end view of the condenser structure of the invention.

Referring now to Fig. 1, one type of oscillator circuit in which the invention may be employed is shown as comprising two high frequency oscillator tubes 5 and 6 whose plates or anodes are connected in parallel to one end of an inductance coil 8, the other end of the coil 8 being connected to a coil 9 at the null voltage point in the combined inductance of the two coils, at which point the anode potential is impressed. The end of coil 9 is connected to the case 34 of the special condenser 15 at terminal C. The grids of tubes 5 and 6 are connected together through anti-parasitic oscillation circuits 10 and 12 and then to movable electrodes or plates 33 of the condenser 15 at terminal A. The grid biasing circuit for the tubes 5 and 6 includes a choke coil 14, a resistor 17, and a meter 18 shunted by a protective condenser 19. The alternating circuit of the oscillator is connected to the cathodes of tubes 5 and 6 over condensers 21, 22, 23, and 24, which, in turn, are connected to the fixed electrode or plate 32 of the condenser 15 at terminal D and to the frame portion 35 of the oscillator cabinet at terminal B. A fixed condenser 27 is shown connected between the anodes and cathodes of the tubes 5 and 6, this condenser supplementing the internal capacitance of the tubes shown represented by the dotted line condenser 28. An output coil 30 is shown variably coupled to the coil 8, one terminal of which is grounded along with the cathode conductor. Direct current potential is obtained from any suitable source, such as a battery or a rectifier, as disclosed in my above-mentioned copending application.

As described above, the condenser 15 comprises a stationary plate 32, a pair of variable plates 33, and a casing 34. The casing 34 is located adjacent but not in contact with two sides of the metal cabinet housing the oscillator circuit. As shown in Fig. 1, the oscillator circuit is of the Colpitts type wherein the frequency of oscillation is determined by the inductance of the coils 8 and 9 and the capacitance of the condensers 27 and 28 in series with the over-all capacitance of condenser 15, which is determined by that existing between the center plate 32 and frame 35 at one potential and the casing 34. In this manner, a high capacitance is obtained since that between the casing 34 and frame 35 is utilized to supplement the capacity between the stationary plate 32 and casing. In order to maintain the proper

voltage ratio between anodes and cathode, with respect to that between grids and cathode, the condenser **27** is connected between the anodes and cathodes to supplement the stray tube capacitance **28**.

As mentioned above, this condenser has three functions; namely, (1) it serves as a grid capacitance, (2) it serves as a plate voltage blocking condenser blocking the direct current anode voltage from the grids, and (3) it serves as a variable voltage divider to regulate the amplitude of the voltage feedback from the tank circuit to the grids. This feedback is accomplished by the adjustment of the movable plates **33** which simultaneously either move away from the center plate **32** toward the sides of the casing **34** or toward the center plate away from the sides of the casing. Since the electrostatic capacitance is inversely proportional to the separation between electrodes, the capacitance from the center electrode **32** to the casing **34** remains constant, while the capacitances between the movable plates **33** to the center plate **32** and the casing **34** vary in opposite directions.

To obtain a higher oscillating frequency, a lower capacitance of condenser **15** is necessary and this is obtained by interconnecting terminals B, C, and D, as illustrated in Fig. 2, wherein the movable plates **33** remain connected to the grids at terminal A, as in Fig. 1, but the stationary central plate **32** is now connected to the end of coil **9** at terminal D, and the casing **34** and frame **35** are now connected together and to the cathodes at terminals B and C. By this connection, the capacitance between casing and frame is eliminated and the internal capacitances of the tubes provide the proper anode-to-cathode to grid-to-cathode voltage ratio.

Referring now to Figs. 3 and 4 wherein the specific structure of the condenser is shown and in which the same numerals are given to like elements in Figs. 1 and 2, it will be noted that the center plate **32** is mounted on bottom insulators **40** and top insulators **41**. Mounted for rotation on the ends of fixed plate **32** are circular insulating discs **44**, **45**, **46**, and **47**, these discs being pivoted at the center thereof adjacent the upper and lower edges of the fixed plate **32**, as shown at **49** and **50**, for discs **44** and **45**. The discs **46** and **47** are similarly mounted. The movable plates **33** are mounted on the discs **44**, **45**, **46**, and **47** on opposite sides of the fixed plate **32**, the distances between the respective bearing points **52** and **53** and the points **49** and **50** for the left-hand plate **33**, and the distance between the respective bearing points **54** and the points **49** and **50** for the right-hand plate **33** being exactly equal in each instance. By this type of mounting, each of the movable plates will always be the same distance from the center plate at all times.

Mounted above the condenser plates **32** and **33** on bearings **57** and **58**, is a shaft **60** adapted to be rotated by a hand lever **61**. Attached to the shaft **60** and adapted to be rotated therewith, are V-shaped sector elements **63** and **64** on which are mounted a rod **65** attached to the left side of disc **44**, a rod **66** attached to the right side of disc **44**, a rod **67** attached to the left side of disc **46**, and a rod **68** attached to the right side of disc **46**. Both sectors **63** and **64** are the same size and the rods **65**, **66**, **67**, and **68** are the same length and connected to points on the discs **44** and **46** of equal distance from the pivots points, such as **49** on disc **44**. By rotation of the shaft **60** by the hand lever **61**, the movable plates **33** will either be simultaneously moved away from the center plate **32** or simultaneously moved toward the center plate, each of plates **33** being moved the same distance as the other but in opposite directions. In a large condenser of this type, the plates are heavy, but by balancing the weight of one plate against that of the other by the particular structure shown, adjustment of the condenser is obtained with a minimum of effort.



Referring now to Fig. 4 in which an end view of the condenser structure shown in Fig. 3 is illustrated, it will be noted that the condenser plates are enclosed within the casing or housing **34** which has terminal C connected thereto. Furthermore, two sides of the cabinet housing the entire oscillator is shown at **35** to which terminal B is connected. The movable plates are connected together and to terminal A, while the fixed plate **32** is connected to terminal D. These terminals correspond to the terminals A, B, C, and D in Figs. 1 and 2. Thus, in connecting terminal B to terminal D, the capacitance between the case **34** and the frame **35** is utilized to obtain an additional capacity without actually increasing the size of the adjustable condenser structure.

The plates **32** and **33** of the above-described condenser are constructed of a combination of wood and copper. To obtain these large size plates, the wood base or core of the proper size is first planed and sandpapered to as smooth a surface as possible. To increase the surface smoothness, a wood filler is applied and the plates again smoothed and then lacquered. After the first lacquer has dried, a second application of lacquer is given the plates, the second lacquer, however, containing 25% of metallic powder, such as bronze or copper. In order to provide mounting points and bearing points for the adjustment of the condenser, threaded brass sleeves are inserted in the wood plate at points on the plates corresponding to mounting points **40** and **41**, and bearing points **49**, **50**, **52**, **53**, **54**, and **55**, and corresponding bearing points on the back edges of the plates. These points serve for making the electrical connections when the electrodes are placed in a copper plating bath, the plates serving as the cathodes. After 24 hours in the plating bath, a coating of approximately $\frac{1}{32}$ of an inch of copper is obtained over the wood core. The plates are then removed and sanded smooth. Since an excess of plating is always obtained on the edges of plates being electroplated, the edges of the wooden plate are deliberately made narrower so that after plating, the entire plate will have a uniform thickness. Such plates or electrodes, when mounted in the manner shown, provide an exceptionally rugged and easily controllable large capacitance for a high frequency and high power oscillator generator.

I claim as my invention:

1. A high frequency, high voltage variable condenser comprising a fixed central electrode positioned in a vertical plane, two movable electrodes, one positioned on each side of said fixed electrode in respective vertical planes, a horizontal shaft extending parallel with the upper edge of said fixed plate, insulating means for supporting said movable electrodes, said insulating means being connected to said shaft, means for rotating said shaft and said insulating means for varying the separation between said fixed electrode and said movable electrodes, and a casing surrounding said electrodes, the capacity between said movable electrodes and said casing being varied as the capacity between said fixed central electrode and said movable electrodes is varied by

varying the separation between said fixed electrode and said movable electrodes.

2. A high frequency, high voltage variable condenser structure comprising a fixed electrode positioned in a vertical plane, a plurality of insulating elements pivotally mounted on the vertical edges of said fixed electrode, an electrode positioned on each side of said fixed electrode in respective vertical planes, said last mentioned electrodes being pivotally mounted on said insulating elements and adapted to be moved when said insulating elements are rotated, a shaft extending parallel to the upper edge of said fixed electrode, means interconnecting said shaft and said plurality of insulating elements, means for rotating said shaft and said insulating elements for adjusting the distance between said fixed electrode and said other electrodes, and a casing surrounding said electrodes, the capacity between said other electrodes and said casing being varied as the capacity between said fixed electrode and said other electrodes is varied by adjusting the distance between said fixed electrode and said other electrodes.

3. A condenser structure for an oscillator, a casing having vertical sides for said condenser, a fixed electrode positioned in a vertical plane within said casing, a plurality of movable electrodes positioned in respective vertical planes within said casing, said movable electrodes being mounted intermediate said fixed electrode and the vertical sides of said casing, a horizontal shaft parallel with the upper edge of said fixed electrode, and insulating means interconnecting said shaft and said movable electrodes for adjusting said movable electrodes between said fixed electrode and the vertical sides of said casing for increasing the capacity between said casing and said movable electrodes as the capacity between said fixed electrode and said movable electrodes is decreased.

4. A condenser structure for an oscillator in accordance with claim 3 in which a cabinet is provided adjacent said casing and insulated therefrom, a connection between said cabinet and said fixed electrode increasing the capacity between said fixed electrode and said casing, said cabinet being of conducting material.



5. A condenser structure for a high frequency oscillator, comprising a single fixed plate and two movable plates in respective vertical planes, one of which is positioned on each side of said fixed plate, a horizontal rotatable rod parallel with the edges of said plates, a plurality of rotatable insulating members for supporting said movable plates on and parallel with said fixed plate, means for interconnecting said rotatable rod with said plurality of insulating members, means for rotating said rod and said rotatable members to vary the parallel position of said movable plates with respect to said fixed plate, and a casing for all of said plates, said casing being electrically conducting and connected to ground the capacity between said movable plates and said casing being varied as the capacity between said fixed plate and said movable plates is varied.

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