

April 22, 1947.

P. D. ZOTTU

2,419,307

HIGH FREQUENCY SWITCHING SYSTEM

Filed Aug. 30, 1943

3 Sheets-Sheet 1

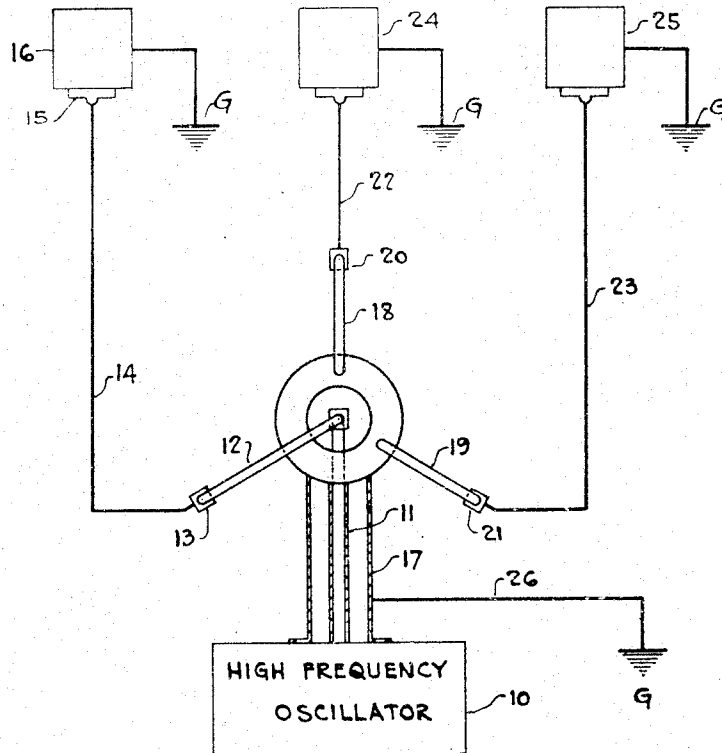


FIG. 1

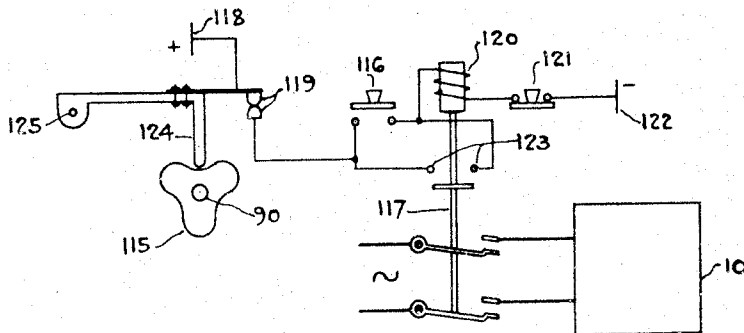


FIG. 4.

INVENTOR.

PAUL D. ZOTTU

BY

Virgil E. Woodcock
Attorney.

April 22, 1947.

P. D. ZOTTU

2,419,307

HIGH FREQUENCY SWITCHING SYSTEM

Filed Aug. 30, 1943

3 Sheets-Sheet 2

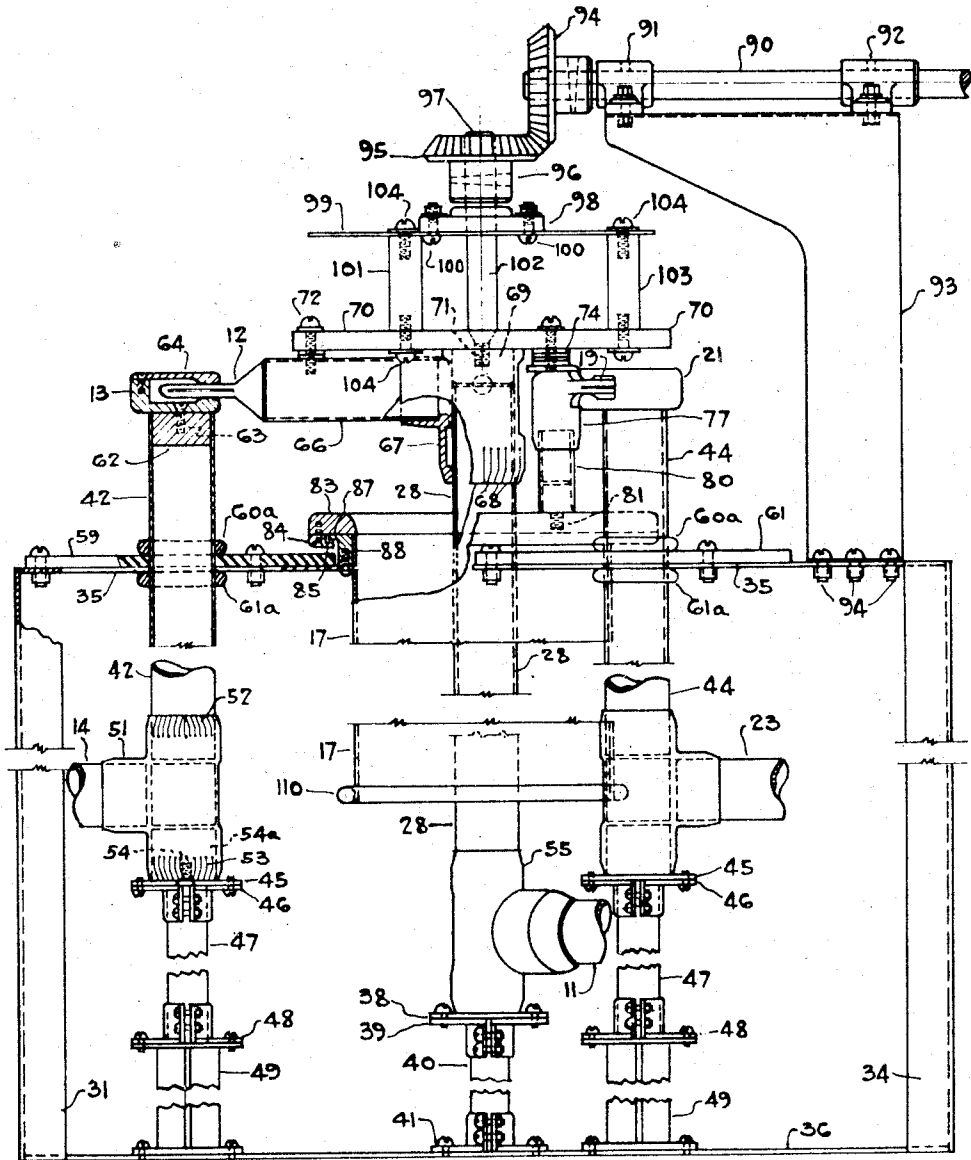


FIG. 2.

INVENTOR.

PAUL D. ZOTTU.

BY

Virgil E. Woodcock
Attorney.

April 22, 1947.

P. D. ZOTTU

2,419,307

HIGH FREQUENCY SWITCHING SYSTEM

Filed Aug. 30, 1943

3 Sheets-Sheet 3

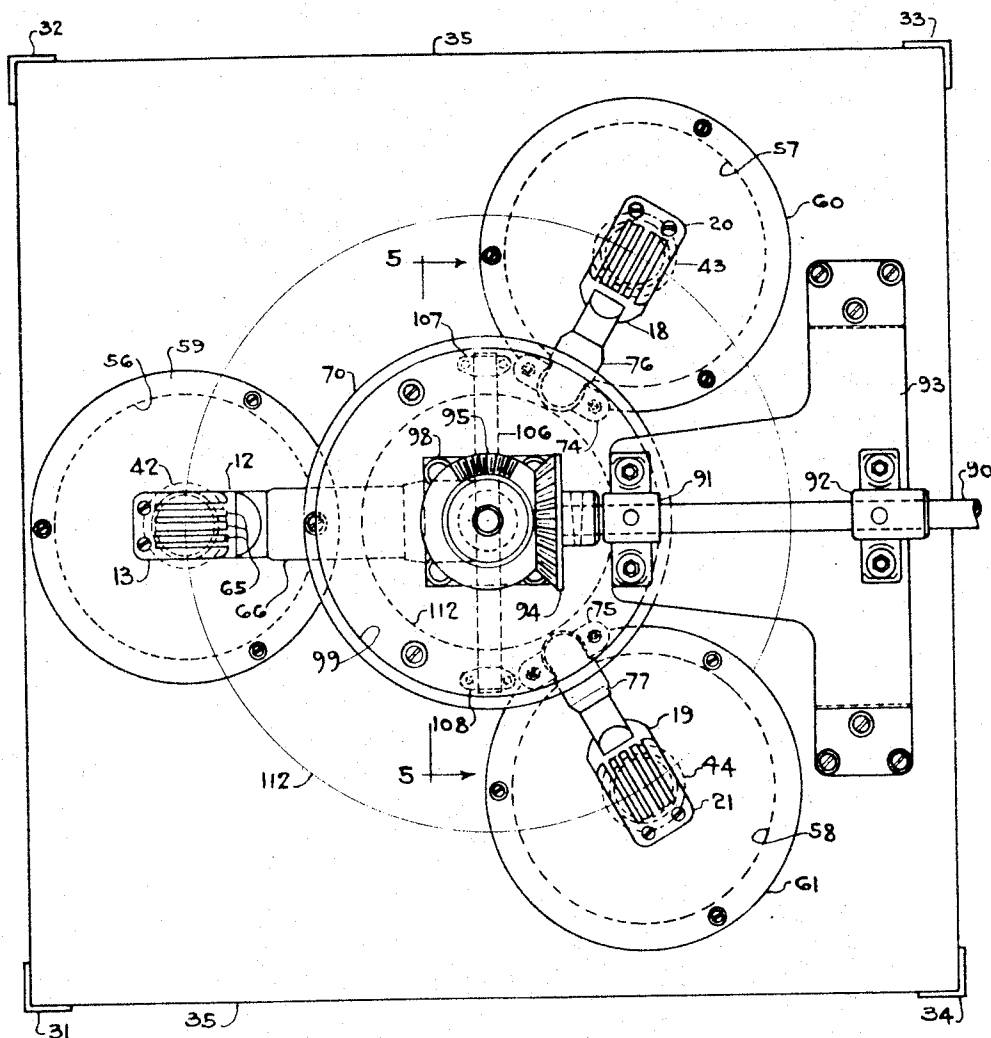


Fig. 3.

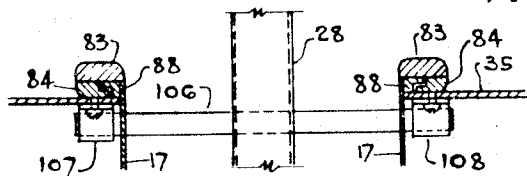


Fig. 5.

INVENTOR.

PAUL D. ZOTTU.

BY

Virgil E. Woodcock
Attorney.

UNITED STATES PATENT OFFICE

2,419,307

HIGH-FREQUENCY SWITCHING
SYSTEMPaul D. Zottu, Louisville, Ky., assignor to The
Girdler Corporation, Louisville, Ky., a corpora-
tion of Delaware

Application August 30, 1943, Serial No. 500,736

15 Claims. (Cl. 200—6)

1

This invention relates to heating or treating objects or materials by electrical energy and is particularly directed towards a system of switching by means of which a single oscillator or electrical generator of high-frequency, high-voltage, electrical energy may be used to supply a plurality of material heating or treating devices.

As explained in my Patent No. 2,307,344, dated January 5, 1943, and entitled "Electrical heating," presses are frequently used to apply pressure to material while such material is subjected to electrical diathermy which uniformly raises its temperature. In the manufacture of plywood panels, or other objects constructed of wood veneers, each veneer or thin sheet of wood is coated with a suitable adhesive material and arranged beneath the platens or pressure applying members of the press. An adequate period of time is always required in assembling each unit preparatory to the application of pressure and heat for the production of the final product. Heretofore this has meant that the high frequency oscillator or generator has been idle during these periods.

For application of electrical energy for the production of heat in materials generally considered as insulators, the generation of the heat is obtained by the energy loss in the dielectric or the electrical insulating material. Because the heating effect is proportional to the square of the voltage and directly to the frequency, it is desirable to utilize high, optimum, values of both. By way of example the voltage may be of the order of from 1,000 to 50,000 volts and the frequency of the order of from 100,000 cycles to 10,000,000 cycles per second. Preferably the voltage is maintained as high as possible for the particular application. This means that the voltages involved, without provision of safety features, are dangerously high. Corona discharges are likely to occur but these may be minimized by providing conductors of relatively large size and of proper design. These requirements give rise to additional problems if the physical connections of large size conductors are changed from one press to the other, and to quite a large extent renders impractical the transfer of large size conductors from one press to another and to the generator. With separate sets of conductors, there would be present the continual

2

hazard of incorrect connections and energization of conductors which were supposed to be de-energized.

In carrying out the invention in one form thereof a single high frequency oscillator or generator is provided to supply high frequency electrical energy to a plurality of material treating devices any one of which may be electrically connected to the high frequency oscillator while the remaining devices are electrically connected to ground. In this manner all hazard is removed and the efficiency of the system as a whole is greatly improved by reason of the fact the oscillator need be deenergized only during the operation of a transfer switch.

In accordance with the present invention the transfer switch itself embodies many features of invention a few of which may here be mentioned. A movable contact connected to the high frequency generator is arranged selectively to apply the output to cooperating contacts in turn connected to the respective material treating devices. Additional movable contacts are connected so that each device which is not receiving electrical energy from the oscillator is connected to ground. Each stationary contact structure is supported at the end of a tubular conductor which is itself supported on insulators bolted to the base of the switch. These tubular conductors add to the general ruggedness of the switch and provide a convenient means for mounting rotatable electrical conductors which extend therefrom. The movable input contact is supported at the end of a centrally located conductor around which there extends for a considerable distance a grounded tubular conductor of substantially greater diameter. The inner and outer conductors in effect form a short concentric line. The high voltage inner conductor is directly connected to the movable contact while the grounded outer conductor of the concentric line is directly connected through bearing structure to the remaining movable contacts.

For further details of construction and for a more detailed description of all features of the invention, reference is to be had to the accompanying drawings, in which:

Fig. 1 illustrates diagrammatically my invention as applied to a plurality of material treating devices;

Fig. 2 is a side elevation, partly in section, of the structure of Fig. 3;

Fig. 3 is a plan view of a switch structure embodying the invention;

Fig. 4 is a schematic illustration of a further safety feature in accordance with the invention; and

Fig. 5 is a fractional sectional view taken on the line 5—5 of Fig. 3 with certain of the parts omitted.

Referring to Fig. 1, a high frequency oscillator or generator 10 is shown connected by an inner conductor 11 of a concentric line to a movable contact 12 which through stationary contact 13 and a conductor 14 is connected to an electrode 15 of a material heating or treating device 16 and to ground G. Though the invention is applicable to material heating or treating devices of many kinds it will be assumed that the device 16 is a press generally of the type shown and described in the aforesaid Patent No. 2,307,344.

The aforesaid concentric line also includes an outer conductor 17 which is electrically connected to movable contacts 18 and 19 which through cooperating stationary contacts 20 and 21 connect to ground the conductors 22 and 23 leading to the electrodes of the additional presses 24 and 25. The connection of the outer conductor 17 to ground G is by way of conductor 26.

When the desired heating operations have been completed at the press 16 and are to be initiated at the press 24 it is only necessary to rotate the movable contact structures 12, 18, and 19 to bring the movable contact 12 into engagement with the stationary contact 20. When this is accomplished the movable contacts 18 and 19 connect the stationary contacts 13 and 21 to ground G. In this manner the presses 16 and 25 may be worked upon in perfect safety inasmuch as there is no possibility of the application of electrical energy thereto from the oscillator 10.

Referring to Figs. 2 and 3, the preferred form of my invention, it will be observed that the transfer switch as a whole is principally supported by means of four vertically extending angle irons 31—34 to which there is suitably secured, as by welding or by bolted brackets (not shown), a supporting plate 35. The angle irons 31—34 may be interconnected at their bases by steel plates 36, Fig. 2, or the angle irons 31—34 may be anchored to a suitable foundation, by flanges (not shown) welded to the bottom of each angle iron. By utilizing the angle irons, the switch as a whole may be readily enclosed by attaching side panels to the angle irons 31—34, the enclosure being omitted in the drawings. While the angle irons, with their bottom braces 36 and the central plate 35, provide a relatively rigid structure, additional ruggedness is obtained by the disposition of the conductors themselves.

As shown in Fig. 2, the central conductor 28 is of tubular shape and of substantial diameter. Its lower end is provided with a flange 38, bolted to a cooperating flange 39, mounted on an insulator 40, which is itself bolted to the base of the switch by means of the flange 41. Similarly, the tubular conductors 42, 43, and 44 are each provided with a flange 45, secured to a flange 46, carried by an insulator 47. Each of the insulators 47, by means of a bottom flange 48, is bolted to an upright support 49, which, in turn, is bolted to the base of the switch structure. In Fig. 2, only the tubular conductors 28, 42, and 44 are shown, the conductor 43, as will be seen from Fig. 3, being disposed directly behind the conductor

44. The triangular disposition of the conductors 42, 43, and 44 adds substantial stability to the structure as a whole and additional support is also provided by the centrally disposed conductor 28.

From the output conductors 42, 43, and 44, there extends individual tubular conductors 14, 22, and 23. For example, the tubular conductor 14 has one end solder-sweated into a T-fitting 51 rotatably mounted on the conductor 42, the upper and lower ends of the T-fitting having formed integrally therewith a plurality of resilient contact fingers 52 and 53 which provide a substantial area of contact as well as a wiping action throughout the circumferential area of the tubular conductor 42. Though two sets of these fingers 52 and 53 have been shown, in most cases only the fingers 52 need be provided. The lower end of the T-fitting may rest upon the upper smooth surface of the flange 45. The flange itself is secured to the end of the tubular conductor 42 by means of a screw 54 threaded into a plug 54a which is solder-sweated into the open end of the conductor 42. The conductors 22 and 23 are mechanically and electrically secured to the conductors 43 and 44 by identical structure, a description of which need not be repeated.

The input conductor 11 leading from the high frequency oscillator 10, Fig. 1, is disposed at a substantially lower level than the output conductors 14 and 23. It is mechanically and electrically attached to the central conductor 28 by a T-fitting 55 of construction identical with the fitting 51.

The supporting plate 35, Fig. 3, is provided with openings 56, 57, and 58 through which the tubular conductors 42, 43, and 44 extend. These openings are covered by insulating members 59, 60, and 61, suitably secured to plate 35, as by bolts or screws. Each insulating member has an opening corresponding in size with the outer diameter of the tubular conductors 42—44, and provides additional support therefor. To equalize, or more uniformly distribute the electrical field, voltage-gradient rings 60a and 61a, Fig. 2, are preferably provided around the conductors, and adjacent to the respective openings through which they extend.

The open, upper end of each of the tubular conductors 42, 43, and 44 is closed by means of a plug 62, solder-sweated therein. Stationary contact structure is secured to each conductor by means of threaded screws 63 extending into each plug 62. The stationary contact structure 13, Fig. 2, consists of a lower member secured by the screw 63 to the plug 62, and an upper member 64 which is provided with a plurality of resilient contact fingers 65, Fig. 3, which provide a wiping or self-cleaning contact with the movable contact structure, such as the movable contact 12. The stationary contact structures 20 and 21 are identical in construction with the one just described.

The movable contact structures are mechanically united but electrically separate. More particularly, the movable contact 12 is formed as an extension of one end of a tubular arm 66, the opposite end of which nests within one side of an L-shaped fitting 67, Fig. 2. The other side of the L-shaped fitting is rotatably mounted over the end of the tubular conductor 28. It is provided with a plurality of resilient contact fingers 68 which form a wiping or self-cleaning area of contact around the circumference of conductor 28. By means of a plug 69 solder-sweated within the fitting 67 this fitting may be secured to an

insulating member 70, as by a screw 71. The insulating member 70 is also secured to the conductor 66 by means of a threaded screw 72; and to flanges 74 and 75 extending upwardly from L-shaped fittings 76 and 77, which, in turn, support the movable contacts 18 and 19. Each of the L-shaped fittings 76 and 77, Fig. 3, is secured to a tubular conductor 80, Fig. 2, provided with plugs in opposite ends, each of the lower plugs having a threaded stub 81 by means of which each of conductors 80 is secured to an annular bearing structure, the rotatable part of which is in the form of a ring 82. In this manner, the insulating member 70 is supported at a plurality of points, and it also serves mechanically to interconnect the movable contact arms and the movable contacts 12, 18, and 19, although electrically insulating them one from the other. The rotatable ring 83, of the bearing structure, is shown to consist of two parts, the lower part 84 having an interned end 85 forming an annular channel, into which extends a flange 87 extending from a stationary ring 88.

The rotatable contact structure may be operated through an actuating mechanism including a shaft 90, journaled at 91 and 92, and supported from a bracket 93 secured to the plate 35, as by the bolts 94. On the end of the shaft 90 is a beveled gear 94 which meshes with a beveled gear 95, secured by a tapered pin 96 to a stub shaft 97. The stub shaft 97 is carried by a flange 98 secured to an upper steel plate 99, as by the bolts 100. The plate 99 is spaced from the plate 70 by means of three or more insulators 101, 102, and 103, respectively held in position by the threaded screws 104. A bar or rod 106, of insulating material, Figs. 3 and 5, is clamped to the plate 35 as indicated at 107 and 108 and it extends through and closely fits within openings provided in conductors 28 and 17. The function of this rod 106, Fig. 3, is to mechanically interlock the conductors. It resists any torque resulting from rotation of the movable contact 12, particularly the fitting 67, on conductor 28.

Further, to make more uniform the distribution of the electric field surrounding the input conductor 28, the outer conductor 17 is solder-sweated to the stationary ring 88 and depends therefrom to form a short section of a concentric line. The outer conductor 17, terminating above the T-fitting 55, is provided with a rounded, open end 110 which may be a ring of seamless tubing soldered thereto. The ring 88 has its inner edge flush with the central opening 112 Fig. 3, provided in the plate 35.

The switch structure as a whole, Fig. 3, is concentric or symmetrical with respect to a central axis. A circle 112 drawn about the central axis intersects the centers of the triangularly disposed stationary contact structures 13, 20, and 21. If more than three stationary contacts are desired it will, of course, be understood that additional stationary structures may readily be provided. For example, for six stationary contacts, additional assemblies would be provided intermediate the contact structures 13, 20, and 21. If desired, the switch may be constructed with only two stationary contacts disposed diametrically opposite each other. In all forms of the invention, the shaft 90 is rotated to shift the movable contact structure from one circuit closing position to another selected circuit closing position. For example, if the shaft 90 be rotated in a clockwise direction, as viewed in Fig. 3, the movable contacts 12, 18, and 19 likewise rotate in a clockwise

direction. As soon as the contact 12 is moved between the resilient contact fingers of the stationary contact 20 the contacts 18 and 19 will occupy corresponding positions with respect to the stationary contacts 13 and 21.

Electrical energy from the oscillator, Fig. 1, may then flow by way of conductor 11, and the fittings 55 to the centrally disposed conductor 28; thence by way of the L-fitting 67, the conductor 66, contact 12, and from the stationary contact 20 to the conductor 43; thence by a T-fitting and conductor 22, Fig. 1, to the press 24 or to another desired material heating or treating apparatus. At the same time, the conductors 14 and 23, Figs. 1 and 2, are, by the contacts 18 and 19, their fittings 76 and 77, the tubular conductors 80, the bearing ring 83, and the supporting ring 88, connected to ground through the plate 35 and the angle irons 31-34. The electrical field surrounding the high-tension high-frequency conductor 28 is uniformly distributed throughout its length by reason of the provision of the depending tubular conductor 17. Conductors 17 and 28 form a concentric line of relatively short length.

The transfer switch is not intended to make and break the high-voltage high-frequency current supplied by the oscillator 10. To insure that it does not, and also as an additional safety feature, a cam, shown in Fig. 4 as a star wheel 115, is secured to the shaft 90. Assuming the parts are all in the positions as shown in the drawings and it is desired to energize the oscillator 10, the starting switch 116 is momentarily depressed. Thereupon a contactor 117 which controls the supply of energy to the oscillator 10 is closed through an energizing circuit which may be traced from a positive supply line 118 through normally closed contacts 119, the starting switch 116, the operating coil 120 of the contactor 117 and through a normally closed stop switch 121 to the negative supply line 122. Upon closure of the contactor 117, the high frequency oscillator 10 is energized for the supply of high-voltage high-frequency electrical energy to the central conductor 28 and thence by movable contact 12, stationary contact 13, and the conductor 14 to the press 16. The closure of the contactor 117 also completes a holding circuit for the operating coil 23 through the contacts 123. The oscillator 10 may be de-energized by momentarily operating the stop button 121 which, it will be seen, interrupts the holding circuit for the operating coil 120.

If, during operation of the oscillator 10, the shaft 90 is rotated a slight amount, a cam follower 124 is moved upwardly by a curved surface on the star wheel 115 to interrupt the circuit traced through the contacts 119, the cam follower 124 forming a part of a lever pivoted at 125. This means that at any time movement of the rotatable contact structure is initiated, the oscillator 10 is immediately deenergized and prior to the disengagement of the movable contact structures with their respective stationary contact structures.

While a preferred embodiment of the invention has been described, it is to be understood the appended claims are intended to cover all modifications which fall within the spirit and scope of the present invention.

What is claimed is:

1. A transfer switch comprising a frame member provided with an opening at the center and with additional openings symmetrically disposed with respect thereto, bearing means supported from said frame at said central opening, an in-

put conductor extending through said central opening in spaced relation with respect thereto and with said bearing structure, stationary contact structure extending through each of said symmetrically disposed openings, electrically insulating means for supporting each said stationary contact structure from said frame member, a contact arm pivoted on said input conductor for rotation into and out of engagement with any one of said stationary structures, and additional contact arms supported from said bearing means for engagement with each of said stationary contact structures not engaged by said pivoted contact arm.

2. A transfer switch comprising a frame member provided with an opening at the center and with additional openings symmetrically disposed with respect thereto, bearing means supported from said frame at said central opening, an input conductor extending through said central opening in spaced relation with respect thereto and with said bearing structure, stationary contact structure extending through each of said symmetrically disposed openings, electrically insulating means for supporting each said stationary contact structure from said frame member, a contact arm pivoted on said input conductor for rotation into and out of engagement with any one of said stationary structures, additional contact arms supported from said bearing means for engagement with each of said stationary contact structures not engaged by said pivoted contact arm, and insulating means mechanically locking together said contact arms.

3. A transfer switch comprising a plurality of stationary contact structures, means supporting said structures at equal distances from an axis, an input contact arm, means rotatably supporting said arm for rotation about said axis for selective engagement with any one of said structures, bearing means concentric with said axis and spaced a substantial distance therefrom, contact arms supported by said bearing means for movement into and out of engagement with the structures not engaged by said input contact arm, electrical insulating means interconnecting said input arm and said contact arms, and switch actuating means connected to said electrical insulating means for operating said input arm and said contact arms for simultaneous movement from one to the other of their respective positions.

4. A transfer switch comprising a plurality of stationary contact structures, means supporting said structures at equal distances from an axis, an input contact arm, means including a tubular conductor for rotatably supporting said arm for rotation about said axis for selective engagement with any one of said structures, bearing means concentric with said axis and spaced a substantial distance therefrom, contact arms supported by said bearing means for movement into and out of engagement with the structures not engaged by said input contact arm, electrical insulating means interconnecting said input arm and said contact arms, switch actuating means connected to said electrical insulating means for operating said input arm and said contact arms for simultaneous movement from one to the other of their respective positions, and a grounded tubular conductor concentric with said axis electrically connected to said bearing means and said contact arms.

5. A transfer switch comprising a centrally disposed plate having a plurality of openings, a plu-

rality of conductors extending through said openings and each terminating in contact structure spaced from said plate, relatively movable contact arms for opening and closing a plurality of circuits, an insulating member mechanically interconnecting said contact arms, a plurality of insulators secured at one end to said member, an actuating member secured to the opposite ends of said insulators, and means for moving said actuating member to produce said relative movement of said contact arms.

6. A transfer switch comprising a centrally disposed plate having a plurality of openings, a plurality of tubular conductors extending through said openings and each terminating in contact structure spaced from said plate, a voltage gradient ring disposed about each conductor near said plate, relatively movable arms for engaging said structures to open and close a plurality of circuits, an insulating member mechanically interconnecting the movable arms, a plurality of insulators secured at one end to said member, an actuating member secured to the opposite ends of said insulators, and means for moving said actuating member to produce said relative movement between said arms and said contact structures.

7. A transfer switch for high-voltage high-frequency electrical energy comprising, a central tubular conductor for said energy, an input contact arm rotatably mounted on the end of said conductor, a plurality of tubular conductors symmetrically spaced outwardly from said central conductor, stationary switch structure mounted on the ends of each of said outer conductors for selective engagement by said input contact arm, bearing means spaced from but concentric with said central conductor, means including an insulating member interconnecting said input arm and said bearing means to provide additional support therefor, and means including additional insulating members for rotating said input arm for engagement with a selected stationary contact structure.

8. A transfer switch for high-voltage high-frequency electrical energy comprising, a central tubular conductor for said energy, an input contact arm rotatably mounted at an end portion of said conductor, a plurality of tubular conductors symmetrically spaced outwardly from said central conductor, stationary switch structure mounted on the ends of each of said outer conductors for selective engagement by said input contact arm, bearing means spaced from but concentric with said central conductor, means including an insulating member interconnecting said input arm and said bearing means to provide additional support therefor, means including additional insulating members for rotating said input arm for engagement with a selected stationary contact structure, and means including electrical insulation for mechanically interconnecting said outer conductors.

9. A transfer switch for high-voltage high-frequency electrical energy comprising, a centrally located input conductor, an input contact arm rotatably mounted on said conductor, said arm having a plurality of resilient contact fingers producing a wiping contact around the circumference of said central conductor, a plurality of additional conductors symmetrically spaced outwardly from said central conductor, stationary contact structure carried by each of said outer conductors, each said structure including a plurality of resilient contact fingers for producing

a wiping engagement with said input arm as it is moved into and out of contact engagement therewith, bearing means concentric with and spaced from said central conductor, a grounded tubular conductor concentric with said central conductor and enclosing it to form a concentric line, means connecting said outer conductor to said bearing means, separate contact arms, means supporting said separate contact arms from said bearing means for movement into engagement with each stationary contact structure not engaged by said input arm, insulating means interconnecting said input arm and said separate contact arms at points beyond the plane of said contact structures, and means operable upon rotation of said insulating means for imparting simultaneous movement to said input arm and to said separate arms for connecting a selected stationary contact structure to said input conductor while simultaneously connecting each of the remaining conductors to said grounded conductor.

10. A transfer switch for high-voltage high-frequency electrical energy comprising, a centrally located tubular input conductor, an input contact arm rotatably mounted on the end of said conductor, said arm having a plurality of resilient contact fingers producing a wiping contact throughout the circumference of said conductor, a plurality of additional conductors symmetrically spaced outwardly from said central conductor, stationary contact structure mounted on the ends of each of said outer conductors, each said structure including a plurality of resilient contact fingers for producing a wiping engagement with said input arm as it is moved into and out of contact engagement, bearing means concentric with and spaced from said central conductor, a grounded tubular conductor concentric with said central conductor and enclosing it to form a concentric line, means connecting said outer conductor to said bearing means, separate contact arms, means supporting said separate contact arms from said bearing means for movement into engagement with each stationary contact structure not engaged by said input arm, insulating means interconnecting said input arm and said separate arms at points beyond the ends of said conductors and their contact structures, and means spaced from said contact structures for rotating said insulating means for imparting simultaneous movement to said input arm and to said separate contact arms for connecting a selected stationary contact structure to said input conductor while simultaneously connecting each of the remaining conductors to said grounded conductor.

11. A high voltage transfer switch comprising a plurality of stationary contacts and a single movable contact, means for supporting and moving said movable contact into and out of engagement with any one of said stationary contacts, additional means including other movable contacts for connecting to ground each of the stationary contacts not engaged by said movable contact, means including a rigid conductor and an insulator for supporting each of said stationary contacts, and means including rotatable structure disposed between each stationary contact and each said insulator for connecting each of said rigid conductors to separate electrical loads and rotatable with respect to said rigid conductors.

12. A transfer switch for high-voltage, high-frequency electrical energy, comprising a tubular

input conductor, rotatable input contact structure having a central portion provided with a series of resilient contact fingers disposed around said input conductor for establishing an electrical connection thereto, said input structure having an elongated arm supported by, and extending outwardly from, said central portion, means for rotating said arm about an axis common to said central portion and said input conductor, output contacts disposed in coplanar relation with the plane in which said arm is rotated and spaced one from the other for successive engagement by said contact arms, means including separate supporting insulators for said input and output contacts whereby substantial air spacings are provided between them, and means for connecting to ground each output contact not engaged by said input contact comprising contact arms insulated from said input contact structure and rotatable about said axis by said means for rotating said input contact structure.

13. A transfer switch for high-voltage, high-frequency electrical energy, comprising a centrally disposed tubular input conductor forming the inner conductor of a high-frequency electrical concentric line, centrally disposed contact supporting structure rotatable about the axis of said conductor and having axially elongated terminal means adjacent one end thereof in telescopic relatively rotatable conductive engagement with said conductor, actuating means adjacent but spaced from said one end of said conductor for rotating said supporting structure about said axis, contact means electrically connected to, and mechanically carried by, said supporting structure intermediate said terminal means and said actuating means, a portion of which contact means projects radially outward a substantial distance beyond the periphery of said supporting structure, means electrically insulating said contact means from said actuating means, a plurality of output contacts spaced outwardly from said supporting structure and symmetrically arranged around the axis thereof for selective engagement by said contact means, and means arranged to engage and electrically connect to ground each one of said output contacts that is not engaged by said contact means comprising conductive means carried by and projecting outwardly from said supporting structure in insulated spaced relation with respect to said contact means.

14. A transfer switch comprising a rigid conductor, a rotatable conducting arm having a hub portion which resiliently fits over an end portion of said conductor for good electrical contact therewith and for rotation with respect thereto, at least two stationary contacts spaced one from the other for selective engagement by said arm, rotatable structure axially spaced from the end portion of, and mounted concentric with, said conductor, a contact arm carried by said structure and connected thereby to ground for engagement with each stationary contact not engaged by said rotatable arm, an actuating member axially and outwardly spaced from said end portion, and means including insulators interconnecting said actuating member and said arms for moving said rotatable arm from one stationary contact position to another and for simultaneously moving each said contact arm into engagement with another of said stationary contacts.

15. A transfer switch comprising a rigid con-

11

ductor, a rotatable conducting arm having a hub portion which resiliently fits over an end portion of said conductor for electrical contact therewith and for supporting it for rotation with respect thereto, a plurality of stationary contacts spaced one from the other for selective engagement by said arm, rotatable structure, means mounting said structure concentrically of said conductor and axially spaced from the end thereof, a grounded contact arm carried by said structure for engagement with each stationary contact not engaged by said rotatable arm, means rotatable about the axis of said rigid conductor and spaced axially thereof and outwardly from the side of said rotatable arm opposite said hub portion, means including insulators spaced from each other and connected to said rotatable means and to said rotatable arm for moving it from one stationary contact position to another,

12

means for simultaneously moving each said contact arm into engagement with each of said stationary contact not engaged by said rotatable arm, and an outer conductor concentric with said rigid conductor connected to ground and to each of said contact arms.

PAUL D. ZOTTU.

REFERENCES CITED

- 10 The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
15 2,360,219	Goodard	Oct. 10, 1944

FOREIGN PATENTS

Number	Country	Date
598,330	French	May 16, 1925