March 31, 1942. R. F. GUY 2,278,371

HIGH FREQUENCY SWITCH

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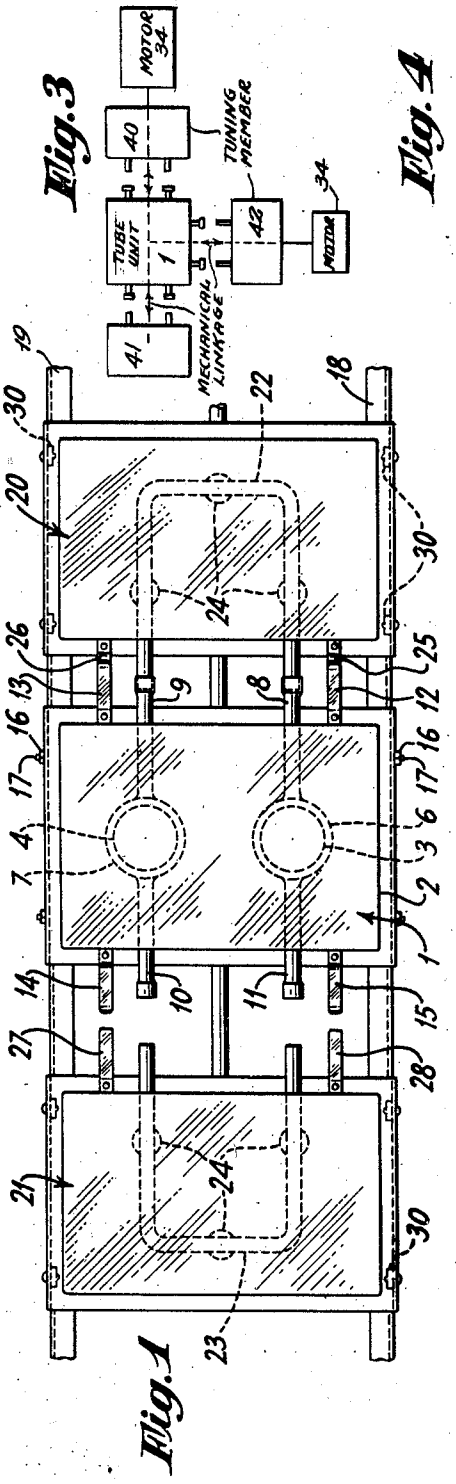


Fig. 3

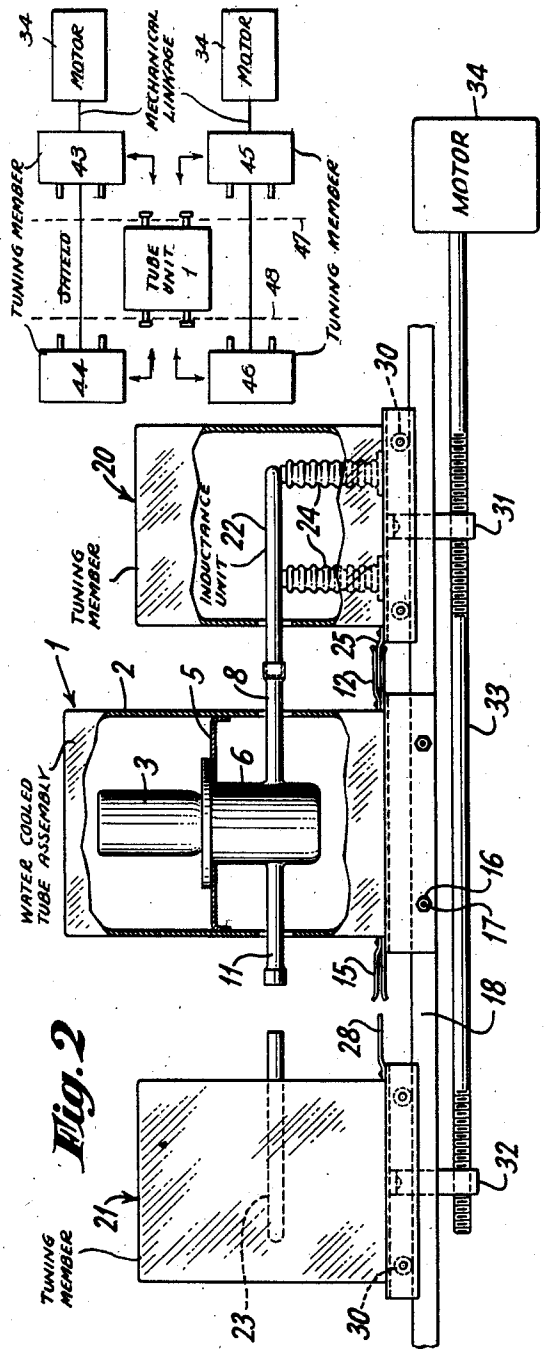


Fig. 4

Fig. 1

Fig. 2

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HIGH FREQUENCY SWITCH

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This invention relates to a new and useful means of high frequency switching and is particularly adapted to the method of switching high powered radio frequency transmitters which operate on any one of a different number of frequencies.

An object of this invention is to provide a system wherein a transmitter is divided into a plurality of units, of which one unit is fixed and other units are movable, the mechanical and electrical circuit arrangement being such that when one of the movable units is mechanically and electrically connected to the fixed unit, the other movable unit will be simultaneously disconnected from the circuit and physically moved away from the fixed unit.

Another object of this invention is to provide an economical system wherein the frequency of a transmitter may be quickly changed as required from one frequency to another.

A feature of this invention is the arrangement of a fixed unit on a platform supported by a plurality of guide rails and a plurality of movable units riding on the rails and making contact with the fixed unit, the movable units being so arranged that when one makes contact the other is pushed away and its electrical contacts disconnected. Frequency switching means are old in the art, but it has always been a problem to make a high powered high frequency radio transmitter operate on any one of a number of frequencies without the necessity of having complicated mechanical and electrical linkage devices. In the present radio communication of international point-to-point or broadcast service, it has been found necessary to switch frequencies several times during the day. From the standpoint of practical international point-to-point service, it is not practical to have a special high powered transmitter for each frequency; therefore, it is desirable to have one transmitter so arranged that its frequency can be quickly changed as required. The switching system of my invention is a simplified method of switching operation which consists of a plurality of mechanical and electrical units with connection or disconnection means operated by an actuating mechanism which may be motor-driven or hydraulically operated. The arrangement of the units is such that a fixed mechanical electric unit, which may be in the form of a power amplifier tube assembly, is mounted in the center of guide rails. Located each side of the tube assembly and mounted on the guide rails by means of rollers or other suitable mechanism, is a movable tank assembly, each separate tank assembly being tuned for a different frequency and actuated by suitable mechanism so that the electrical connections line up perfectly and when one of the movable units is in operation, the unit will be disconnected.

This invention will best be understood by the accompanying drawing, in which:

Fig. 1 is a plan view of a power amplifier of a radio transmitter;

Fig. 2 is a side elevation partly in section, of Fig. 1;

Fig. 3 is a schematic plan view showing one fixed unit and three movable units; and

Fig. 4 is another schematic diagram indicating the use of one fixed unit and four movable units.

Referring now in detail to Figs. 1 and 2 of the drawing, there is shown a high powered amplifier employing the features of my invention which comprise a fixed assembly unit 1 which may be either a tube assembly or a tank assembly, although because of the various interlocks and methods of water cooling of tubes, I prefer to maintain the tube assembly as the fixed unit, but it is to be understood that either a tube assembly or tank circuit may be employed. Within the metallic protective casing 2 of the fixed unit there is shown a plurality of tubes 3 and 4, insulatingly supported by means of a member 5 and having their anodes 6 and 7 provided with high voltage contacting elements 8, 9, 10 and 11. Other electrical connections for switching other parts of the circuit comprise contacts 12, 13, 14 and 15. Located on the lower portion of unit 1 and secured by means of a plurality of nuts 16 and bolts 17 or other suitable support means are guide rails 18 and 19. To the right and the left of member 1 are movable units 20 and 21 which are preferably that of a tank circuit, each one of which is tuned to a different frequency and contains tuning inductance elements 22 and 23 mounted on suitable insulators 24 at a suitable height to engage the fixed contacts 8 to 11, inclusive. The base portion of members 20 and 21 contain a plurality of low voltage switches 25, 26, 27 and 28. The movable units are provided with a plurality of guide rollers 30, also worm nuts 31 and 32, the units being spaced apart from each other by worm shaft 33 which is rotated by actuating mechanism 34, such as hydraulic, motor-driven or similar devices.

By this arrangement, one or more tubes are provided with input and output connections of a type which enable quick but positive connections to associated circuits which are also equipped with quick but positive connections to

the tube or tubes. By means of the rails or guides **18** or by means of manually remotely controlled or automatic actuating devices, input or output circuits tuned to different frequencies may be quickly changed at the tube or tubes. The input and/or output circuits may be mechanically or electrically interlocked so that only the desired circuits may be connected to the tube or tubes at any time. The same connecting and disconnecting system may be used to switch power supply voltages simultaneously. This system may be arranged so that the unused input and/or output circuits may be changed to prepare for a pending change to another frequency, while the used circuits are in operation. By automatic means for removing dangerous voltages from unused circuits and by providing a barrier to protect the operators, the methods described may be used to switch complete pre-tuned circuits, or circuit elements forming a part of a complete circuit or parts of complete circuits. The tubes may be equipped with a multiplicity of contact elements other than those of **8** to **11**, inclusive, also, tank circuits may be connected to it from opposite sides or from more than two directions. The circuits so connected may be coupled to their drivers or loads in the system described, by electro-magnetic, electrostatic or capacity coupling by proper arrangement of circuit elements. The complete input and/or output circuits may be mechanically moved into or out of contact, or they may be fixed and the connections completed or broken by connections so interlocked with each other that more than the desired elements could not be connected at one time.

Referring now to Fig. 3, there is shown a three-sided arrangement for switching into and out of circuit one of three tank circuits, that is, each tank circuit being tuned to its separate or different frequency. Although this figure shows only a diagrammatic arrangement, it is to be understood that in each case the tank assembly moves toward the tube assembly in a cradle, bed or track, and actuated by shafts **33** and motors **34**, so that the connections line up perfectly with each other. The tank circuits should be arranged so that while either unit **40** or **41** is in operation an additional unit **42** may be mounted in a position for the next switching operation.

Fig. 4 of the drawing shows an arrangement similar to that of Figs. 1 to 3, inclusive, except that there is shown a method of switching four tank circuits **43**, **44**, **45** and **46**, and as mentioned above, tank circuits **43** and **44** could be arranged so that while either one or two of the units are in operation, tuning units **45** and **46** could be mounted in a position for the next switching operation. The tank circuits **43**, **44**, **45** and **46** are actuated by shafts **33** and motors **34**, as mentioned above in connection with Figs. 1 and 2. The operating personnel would be protected by metal screens or shielding **47** and **48** (shown by the dotted lines) and although Figs. 3 and 4 show the use of three and four tank circuits, it is to be understood that the number of tank circuits which may be connected to the tube assembly has no limit beyond a practical and economical consideration. Therefore, the invention should not be limited to the precise arrangements shown.

What is claimed is:

1. A radio frequency changing system comprising a transmitter divided into a fixed tube assembly portion and a plurality of movable tuning assemblies arranged to surround said fixed tube assembly portion, each one of said tuning assemblies having separate shielded containers, each one of said movable tuning assemblies being tuned to a different predetermined frequency, means for spacing said tuning assemblies a predetermined distance apart and for moving at least one of said tuning assemblies and establishing electrical connection between it and said fixed tube assembly portion, and means adapted to cause another tuning assembly to be simultaneously moved and disconnected from said fixed tube assembly when said first mentioned electrical connection is established.

2. A radio frequency changing system comprising a transmitter divided into a tube assembly portion and a plurality of tuning assemblies arranged to surround said tube assembly portion, each one of said tuning assemblies having separate shielded containers, each one of said tuning assemblies being tuned to a different predetermined frequency, means for establishing electrical connection between said tube assembly portion and at least one of said tuning assemblies, said means including a motor, a rotatable shaft coupled to said motor, said shaft being arranged to space said tuning assemblies a predetermined distance apart and to simultaneously move and disconnect a tuning assembly from said tube assembly portion when said first mentioned electrical connection is established therewith.

3. A radio frequency changing system comprising a transmitter divided into a tube assembly portion and a plurality of tuning assemblies arranged to surround said tube assembly portion, each one of said tuning assemblies having separate shielded containers, each one of said tuning assemblies being tuned to a different predetermined frequency, means for establishing electrical connection between said tube assembly portion and at least one of said tuning assemblies, said means including a track, a plurality of rollers arranged to run on said track, a rotatable shaft linked to said tuning assemblies and spacing them apart a predetermined distance, an actuating means coupled to said shaft to cause at least one of said tuning units to be simultaneously moved and disconnected from said tube assembly portion when said first mentioned electrical connection is established therewith.

4. A radio frequency changing system comprising a transmitter divided into a tube assembly portion and a plurality of tuning assemblies arranged to surround said tube assembly portion, each one of said tuning assemblies having separate shielded containers, each one of said tuning assemblies being tuned to a different predetermined frequency, a plurality of contacts supported by insulators secured to said tuning assemblies, means for establishing electrical connection between the contacts of said tube assembly portion and at least one of said tuning assemblies, said means including a track, a rotatable shaft linked to said tuning assemblies and spacing them apart a predetermined distance, and actuating means coupled to said shaft to cause at least one of said tuning units to be simultaneously disconnected from said tube assembly portion when said first mentioned electric connection is established by a plurality of contacts supported by insulators.

5. A radio frequency changing system comprising a transmitter divided into a tube assembly portion and a plurality of tuning assemblies, said tube assembly having an electron discharge device with at least an anode, said tube being

insulatedly supported and provided with fixed high voltage contacting portions connected to said anode, said plurality of tuning assemblies located each side of said tube assembly portion and linked together a predetermined distance apart, an inductance unit mounted upon a plurality of insulators located on each tuning unit, the inductance of each tuning unit being tuned to a different predetermined frequency, and actuating means for making connection between the anode of the tube assembly portion and the inductance of the tuning assembly means adapted to cause the inductance of one tuning assembly to be simultaneously disconnected from said tube assembly portion when said first mentioned electrical connection is established with another one of said tuning assemblies.

6. A radio frequency changing system comprising a transmitter divided into a plurality of units including a water-cooled tube assembly, a fixed portion forming an input circuit for said transmitter, a plurality of output circuits surrounding said tube assembly each one of said output circuits being spaced apart a predetermined distance from said tube assembly and tuned to a different predetermined frequency, a protective metal screen interposed between said tube assembly and each one of said output circuits, means for moving and establishing electrical connection between said input and at least one of the output circuits and adapted to cause movement of said one output circuit which simultaneously moves and disconnects another output circuit from said input circuit, and a plurality of interlocking electrical connections for controlling auxiliary apparatus in said input circuit.

7. A radio frequency changing system comprising a transmitter divided into a plurality of units including a tube assembly portion, said tube assembly with an electron discharge device having at least an anode, said tube being insulatedly supported and provided with fixed high voltage contacting portions connected to said anode, a plurality of other contacts located below said high voltage contacting portions, a plurality of tuning assemblies located each side of said tube assembly portion and spaced apart from one another a predetermined distance, an inductance unit mounted upon a plurality of insulators located on each tuning unit, the inductance of each tuning unit being tuned to a different predetermined frequency, and actuating means for making connection between the anode of the tube assembly portion and the inductance of the tuning assembly, means adapted to cause the inductance of one tuning assembly to be simultaneously disconnected from said tube assembly portion when said first mentioned electrical connection is established with another one of said tuning assemblies.

8. In a radio frequency changing system, a fixed transmitter portion including a plurality of electron discharge tubes, said transmitter portion centrally mounted on a plurality of rails, a plurality of tuning members arranged each side of said fixed transmitter portion and to move on said rails, an actuating member linking said tuning members together at a predetermined distance apart on said rails, means adapted to cause movement of said actuating member to connect one of said tuning members to said fixed transmitter portion and to simultaneously disconnect another tuning member.

9. In a radio frequency changing system, a fixed transmitter portion centrally mounted on a plurality of rails, a plurality of tuning members arranged each side of said fixed transmitter portion and to move on said rails, fixed contacts on said transmitter portion, fixed contacts on said tuning members and arranged to contact the contacts on said transmitter portion, an actuating member coupling said tuning members together at a predetermined distance apart on said rails, said actuating member adapted to cause movement of one of said tuning members to have its contacts connect said contacts of the fixed transmitter portion and simultaneously disconnect the contacts of another tuning member.

10. In a radio frequency changing system, a transmitter divided into a plurality of units including a tube assembly portion and a plurality of tuning assemblies, said tube assembly portion being centrally mounted upon a fixed platform, each one of said tuning assemblies being mounted upon a movable platform and located each side of said transmitter tube assembly portion, a group of electrical contacts mounted on said fixed platform, a group of electrical contacts mounted on said movable platforms and arranged to make contact with said first mentioned group of electrical contacts, means for spacing said tuning assemblies a predetermined distance apart and for moving said movable platforms with respect to said fixed platform, said actuating member adapted to cause the group of contacts on at least one of said movable platforms to connect with the contacts on said fixed platform and disconnect a group of contacts on another movable platform from said fixed platform.

11. In a radio frequency changing system, a fixed transmitter portion centrally mounted on a plurality of rails, a plurality of tuning members having inductive elements supported each side of said fixed transmitter by a plurality of insulating members, said tuning members arranged to move on said rails, an actuating member linking said tuning members together a predetermined distance apart on said rails, said actuating member adapted to cause movement of said tuning members and to connect one of them with said fixed transmitter portion and simultaneously disconnect another tuning member, and a shielding member interposed between said fixed transmitter portion and said tuning members.

12. A radio frequency changing system comprising a transmitter divided into a water-cooled tube assembly and a plurality of inductive tank circuits, said tube assembly centrally mounted on a plurality of rails, said tank circuits arranged to move on said rails, an actuating member for moving and linking said tank circuits and said water cooled tube assembly together at a predetermined distance apart on said rails, said actuating member adapted to move one tank circuit to the contacts on said tube assembly and simultaneously disconnect contacts of another tank circuit.

13. A radio frequency changing system comprising a transmitter divided into a plurality of units including a water-cooled tube assembly, a fixed portion forming an input circuit for said transmitter, a plurality of output circuits adjacent said tube assembly, each one of said output circuits being tuned to a different predetermined frequency, means for linking said output circuits at a predetermined distance apart and for establishing electrical connection between said input and at least one of the output circuits, means adapted to cause movement of said one output

circuit and to simultaneously move it to disconnect another output circuit from said tube circuit.

14. A radio frequency changing system comprising a transmitter divided into a plurality of units including a fluid-cooled tube assembly, a fixed portion forming an input circuit for said transmitter, a plurality of output circuits surrounding said tube assembly, each one of said output circuits being tuned to a different predetermined frequency, means for linking said output circuits a predetermined distance apart and for establishing electrical connection between said input and at least one of the output circuits, means adapted to cause movement of said one output circuit and to simultaneously move it to disconnect another output circuit from said input circuit, and a plurality of interlocking electrical connections for controlling auxiliary apparatus in said input circuit.

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