PATENT SPECIFICATION

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Complete Accepted: Aug. 28, 1930.

COMPLETE SPECIFICATION.

Radio Receiving System.

We, ARCTURUS RADIO TUBE COMPANY, of 260, Sherman Avenue, Newark, New Jersey, United States of America, a corporation organized under the laws of the State of Delaware, United States of America (Assignees of WALTER LOUIS KRAHL, of No. 73, Orange Road, Montclair, New Jersey, United States of America, a citizen of the United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to radio receiving systems and particularly to a system in which a plurality of vacuum tubes are used.

One of the objects of the invention is to provide a circuit for a radio receiving set in which the vacuum tubes employed may be energized by current taken directly from a power supply main without the use of transformers, rectifiers, and the like.

Another object of the invention is to provide a radio receiving circuit in which a plurality of tubes may have their energizing circuits connected in series with each other and with a power supply source.

Another object of the invention is to provide a radio receiving circuit which may be directly connected to a power source and which is so designed as to utilize all of the voltage in said power source without the use of compensating devices such as resistances, transformers, and the like, whereby a high efficiency of the energizing circuit of the tubes in the set is maintained.

Other objects of the invention will be apparent as the description proceeds.

One embodiment of the invention has been illustrated in the accompanying drawings, in which

Fig. 1 is a perspective view partly in section of a radio tube adapted to be used in the invention;

Fig. 2 is a circuit diagram illustrating the connection necessary in the use of the invention; and

Fig. 3 is a portion of a modification of the tube shown in Fig. 1.

Referring more particularly to the drawings, we have shown in Fig. 1 a radio tube of the heater type corresponding in certain respects to the vacuum tube shown and described in my British patent No. 278,750 entitled "Improvements in Vacuum Tubes" dated October 8, 1926. This vacuum tube comprises an envelope 10 mounted on the usual base 11 and enclosing a press 12 which supports the elements of the tube. The said elements comprise a plate or anode 13 supported at two sides thereof by wires 14 and 15, respectively, which are sealed in the press 12; a grid or control electrode 16 supported at opposite sides thereof by means of the wires 17 and 18 which are sealed in the press 12; a tubular cathode 19, coated with a suitable electron-emitting substance, connected at its lower end to a short wire 20 sealed in the press 12, and at its upper end to a supporting wire 21 sealed in a glass bead 22 located at one side of the plate 13; and a filament 23 supported at its lower end by a wire 24 sealed in the press 12, and at its upper end by a spring 25 which is attached to an upright 26 passing down through the bead 22 and forming a support therefor, and bent inwardly and downwardly adjacent the top of the press 12 into which it is sealed. The upper and lower ends of the cathode 19 are attached to the wires 21 and 20, respectively, by strips 27 and 28 which surround the ends of the cathode and are welded thereto. The spring 25 attached to the upper end of the filament 23 forms a means to maintain the filament under tension to compensate for any variations in length due to temperature changes, and permits the use of a cathode which has a relatively small diameter, bringing the filament in close proximity thereto.

Connection is made to terminals mounted on the base 11 from the various elements through the press 12. Terminals 29 and 30 are connected respectively by wires 31 and 32 to supporting wires 24 and 26 which form the connection for the lower and upper ends of the filament 23. Terminals 33 and 34 are connected

respectively to the plate 13 and grid 16 by means of wires 35 and 36, which in turn are connected to supports 15 and 17 through the press 12. An additional terminal 37 is connected by means of the wire 38 to the lower supporting wire 20 of the cathode 19 and forms a connection for the cathode entirely independent of any of the other elements.

While Fig. 1 shows the tube with a five terminal base, it may be desirable to provide a tube which will fit in a four terminal socket, and if this is the case the ordinary four terminal base may be used with additional connections mounted on the side of the base. Such a construction is shown in Fig. 3 in which side terminals 29^1 and 30^1 are used for the filament circuit, these terminals being connected respectively by means of wires 31 and 32 to the filament inside of the tube. One of the terminals 29 and 30, which terminal in an ordinary four terminal tube would be used for the heater circuit, is used to make the connection to the cathode by means of the wire 38 which is shown in Fig. 1 as connected to the terminal 37. This construction of the tube base lends itself readily to the use of this type of tube in connection with circuits designed for battery operation with four terminal tubes.

The particular type of tube explained briefly above is adapted preferably to operate on a voltage in the neighbourhood of 15 volts, but for the present invention I have found it expedient to so design the tube that it will operate at approximately 18 volts so that when six tubes are connected in series in a circuit, as illustrated in Fig. 2, the voltage across the entire six tubes will be 108 volts, which is approximately the voltage output of the average power supply line circuit. The tube in question is so constructed that the possible variation of voltage for each tube, for efficient operation of the tube, is considerable, and hence a rise and fall of the voltage in the line circuit either below or above 108 or 110 volts is insufficient to lower the efficency of the tubes or to prevent their proper functioning.

In Fig. 2 we have shown a diagram of the circuit embodying the invention and in which I have shown six tubes, I, II, III, IV, V and VI. The first three tubes are, in the present instance, adapted to amplify radio frequencies, the fourth tube acting as a rectifier, and the fifth and sixth tubes comprising audio frequency amplifiers. The cathode 19 of each tube is connected to a common lead 39, which is in turn connected to the neutral point of the circuit at the negative terminal of the B battery 40 by means of a wire 41; and the grip 16 of each tube is connected through the various radio frequency and audio frequency coils and through ground to a C battery or negative potential by means of the wire 42. The grid 16 of the last audio frequency tube VI is connected through the audio transformer and to a point 43 having a still larger negative C potential.

The plate circuits for the radio frequency tubes I, II, and III and one audio frequency tube V are connected together by means of the common lead 44 and to a positive potential 45 on the B battery 40, and the plate circuit of the detector tube IV is connected by means of the wire 46 to a positive point 47 on the battery 40 having a lower potential than the point 45. The plate circuit of the last audio frequency tube VI is connected through the translating device 48 to a positive potential 49 on the battery 40 having a higher potential than the point 45.

The tubes are connected in series, one terminal of tube I being connected to one side 50 of a power supply source 51 by means of the wire 52, and wires 53, 54, 55, 56 and 57, connect tubes I and II, II and III, III and IV, IV and V, and V and VI, respectively. The other heater terminal of tube VI is connected by means of the wire 58 to the other side 59 of the power supply source 51.

It will be understood that with six tubes in series operating on 18 volts each, the voltage of the line, approximating 110 volts, will be consumed by the tubes; but it is to be understood that, if desired, fewer tubes may be used with increased voltage per tube in order to use up all of the line voltage; or if it is desired to use a tube operating on less voltage, a resistance may be used in the circuit to cut down the total voltage across the tubes.

This circuit has been found particularly advantageous in connection with a direct current source of power for the heating circuit, inasmuch as heretofore it has been found necessary, where tubes are connected in parallel, to place large resistances in the heating circuit to bring the line voltage down to the voltage of the tube. With the present invention no such resistances are necessary and much greater efficiency is therefore obtained.

In using the circuit with alternating current power supply for the heating circuit it will be noted that no transformer is necessary, which greatly reduces the initial cost of a radio set embodying the invention, and at the same time the set may be attached directly to the lighting current.

Many modifications may be made of

the invention and various changes in the circuit diagram and construction of the tube without departing from the spirit of the invention, and we do not, therefore, desire to limit ourselves to the particular tube and circuit shown and described, but we do desire to interpret the invention broadly within the scope of the appended claims.

We do not claim the utilization of a single filament connected directly with the industrial supply mains as a heating element for a plurality of other elements in a single envelope.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A current amplifying circuit comprising a plurality of heater type vacuum tubes, and means to connect the heaters of said tubes in series with each other, and with a source of power supply.

2. A current amplifying circuit as claimed in claim 1 in which the sum of the operating voltages of all of the tubes is approximately equal to the voltage across the power supply source.

3. A current amplifying circuit as claimed in claim 1 having six vacuum tubes of the heater type, each tube adapted to operate on a voltage of approximately 18 volts, and means to connect the heaters of said tubes in series with each other and with a source of power supply of approximately 110 volts.

4. In a current amplifying circuit as claimed in claim 1 means to connect the cathodes of said tubes to a neutral point in the circuit, and means to give a negative bias to the grids of said tubes.

5. A current amplifying system as claimed in claim 1 in which each of the vacuum tubes comprises an anode, a control electrode, a cathode, and an independent heater for said cathode, said cathode being insulated from said heater.

6. In a current amplifying system as claimed in claim 5 means to connect the control electrodes of said tubes with a negative potenial.

Dated this 22nd day of June, 1929.

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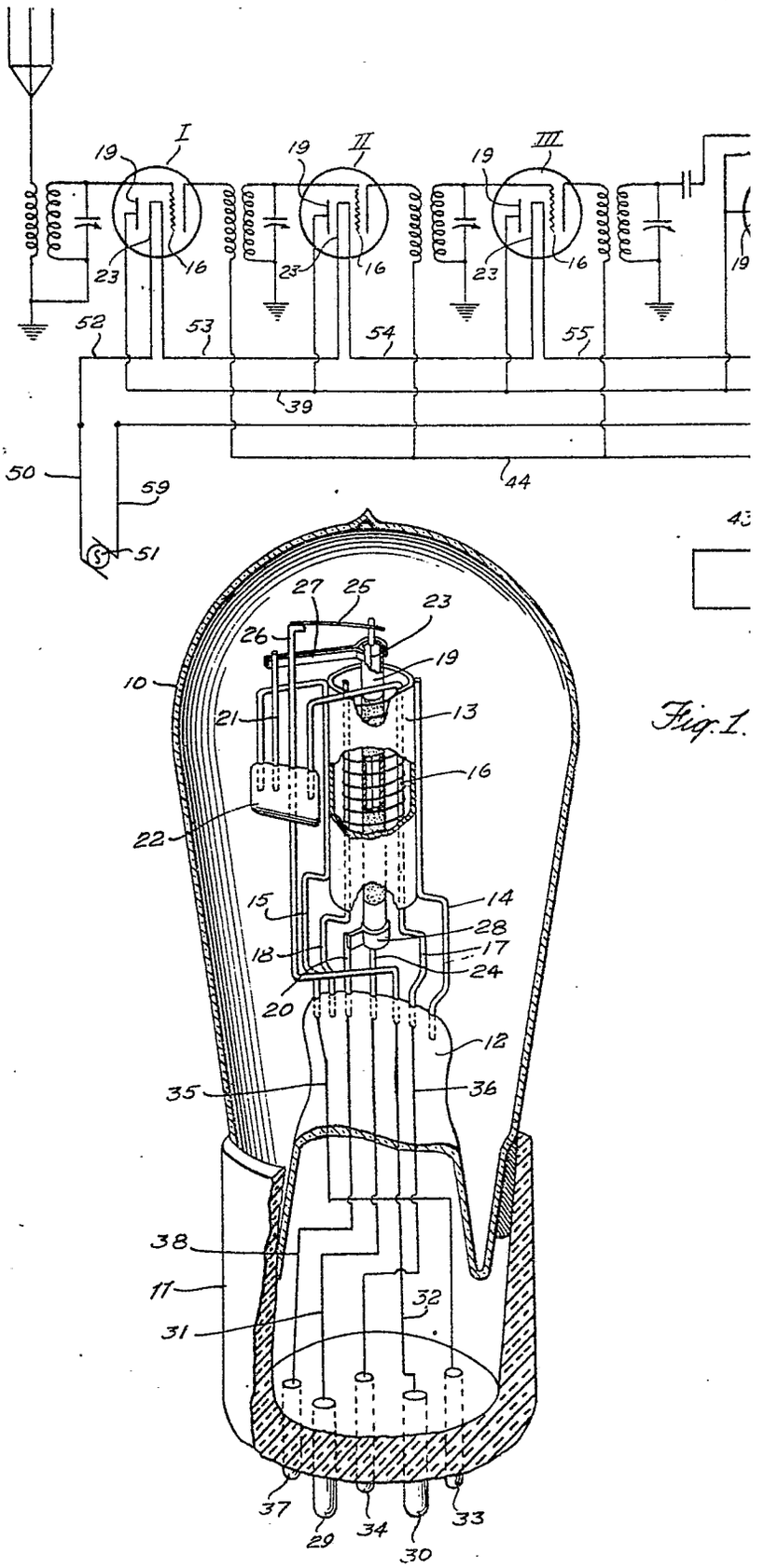


Fig. 1.

Fig. 2.

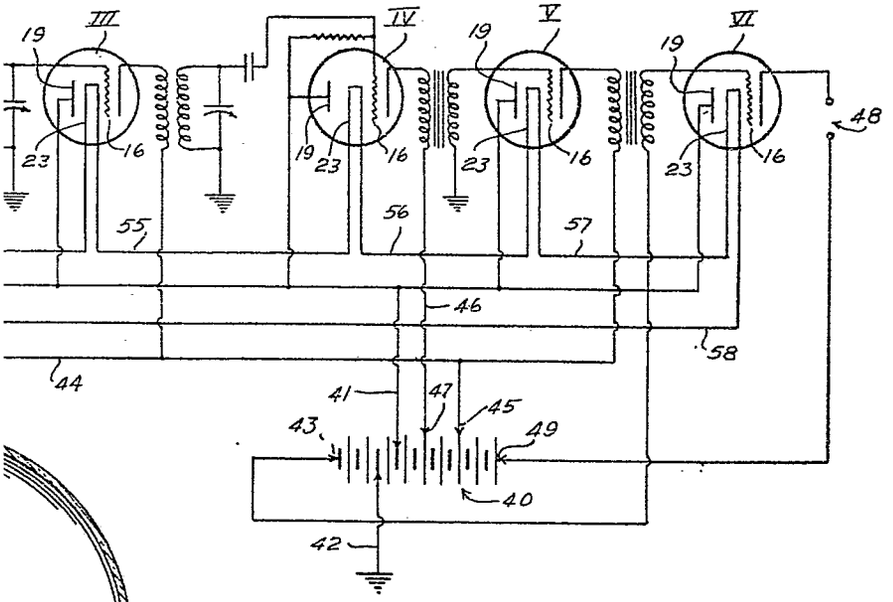


Fig. 1.

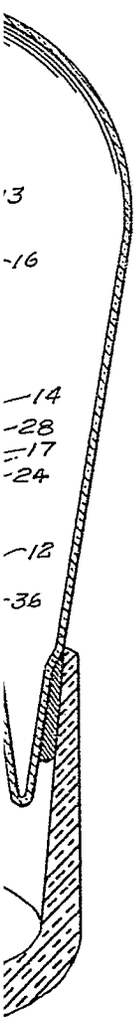


Fig. 3.

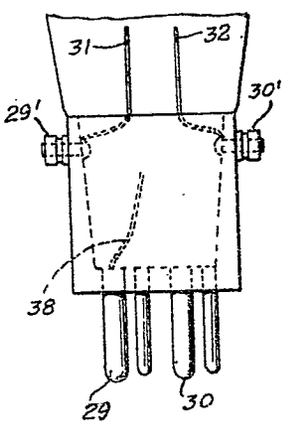


Fig. 2.

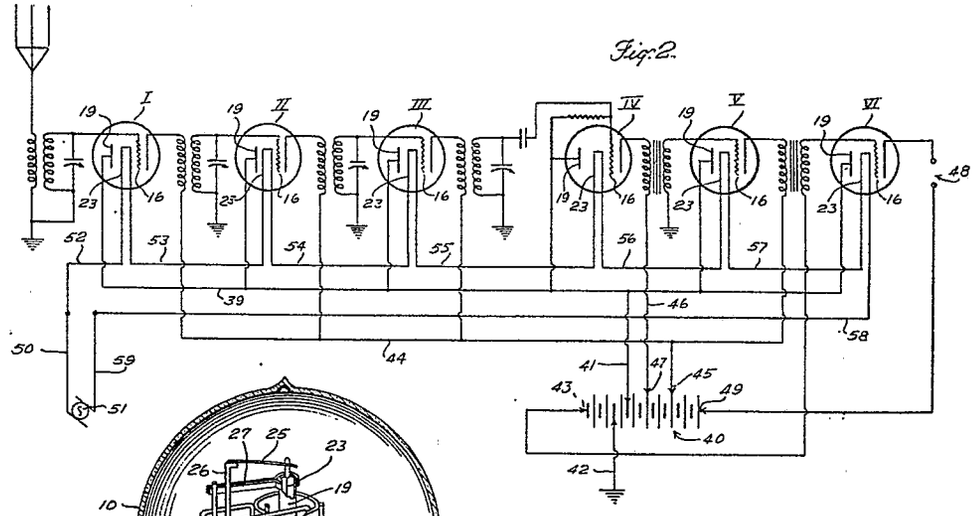


Fig. 1.

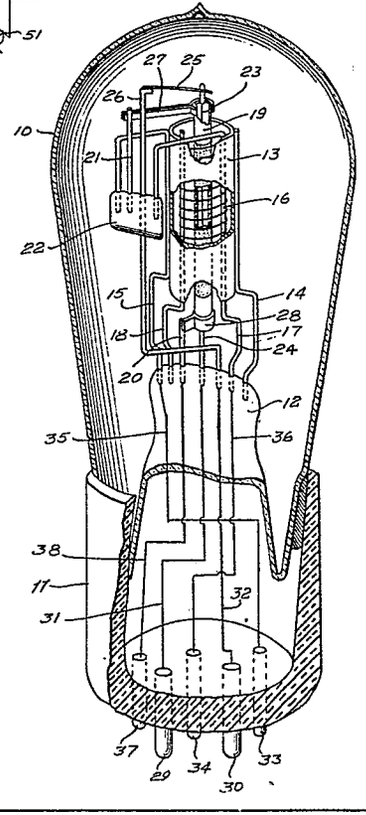
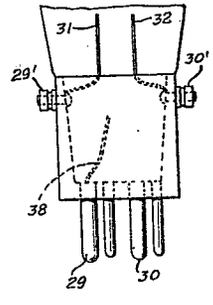


Fig. 3.



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