

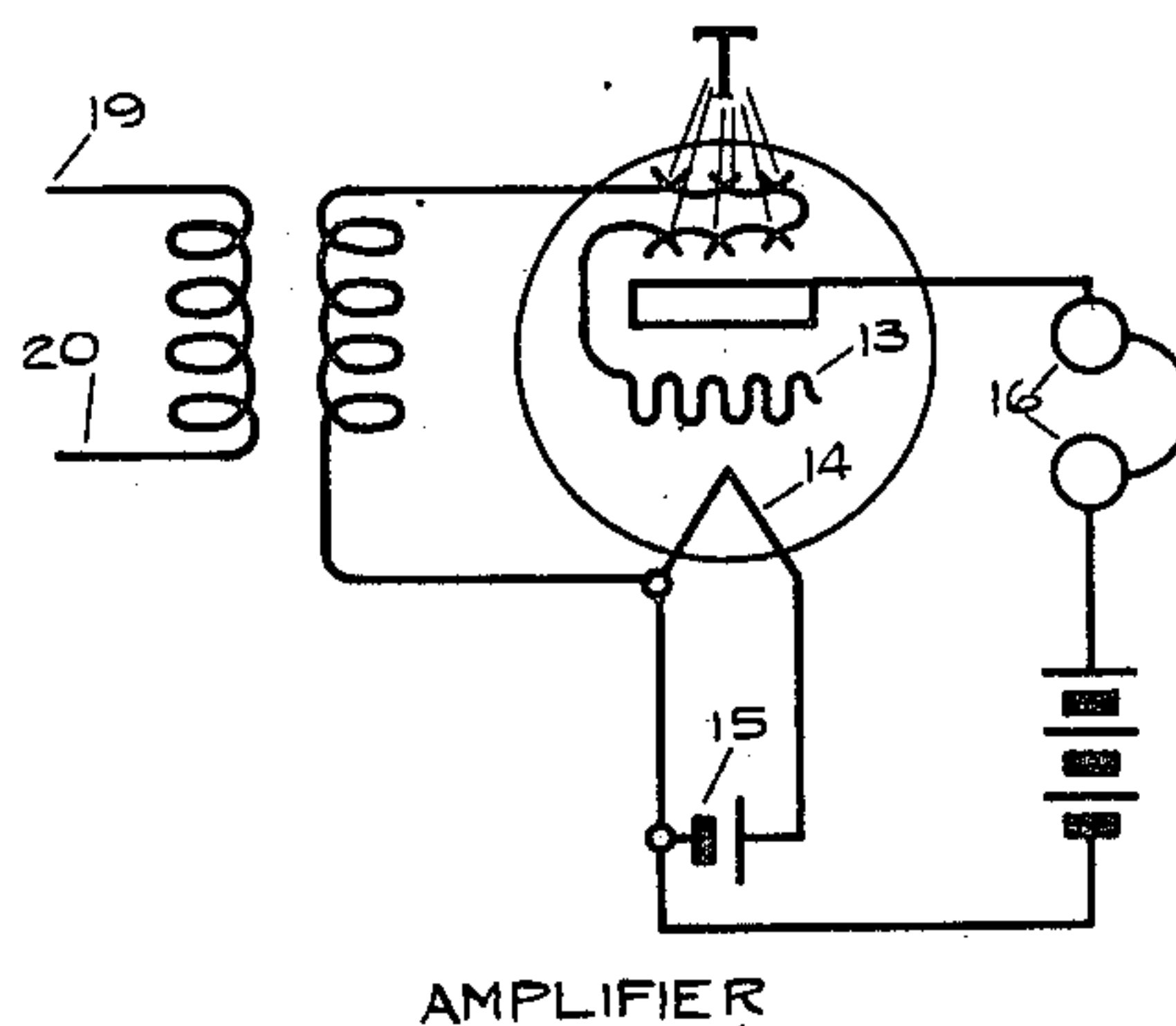
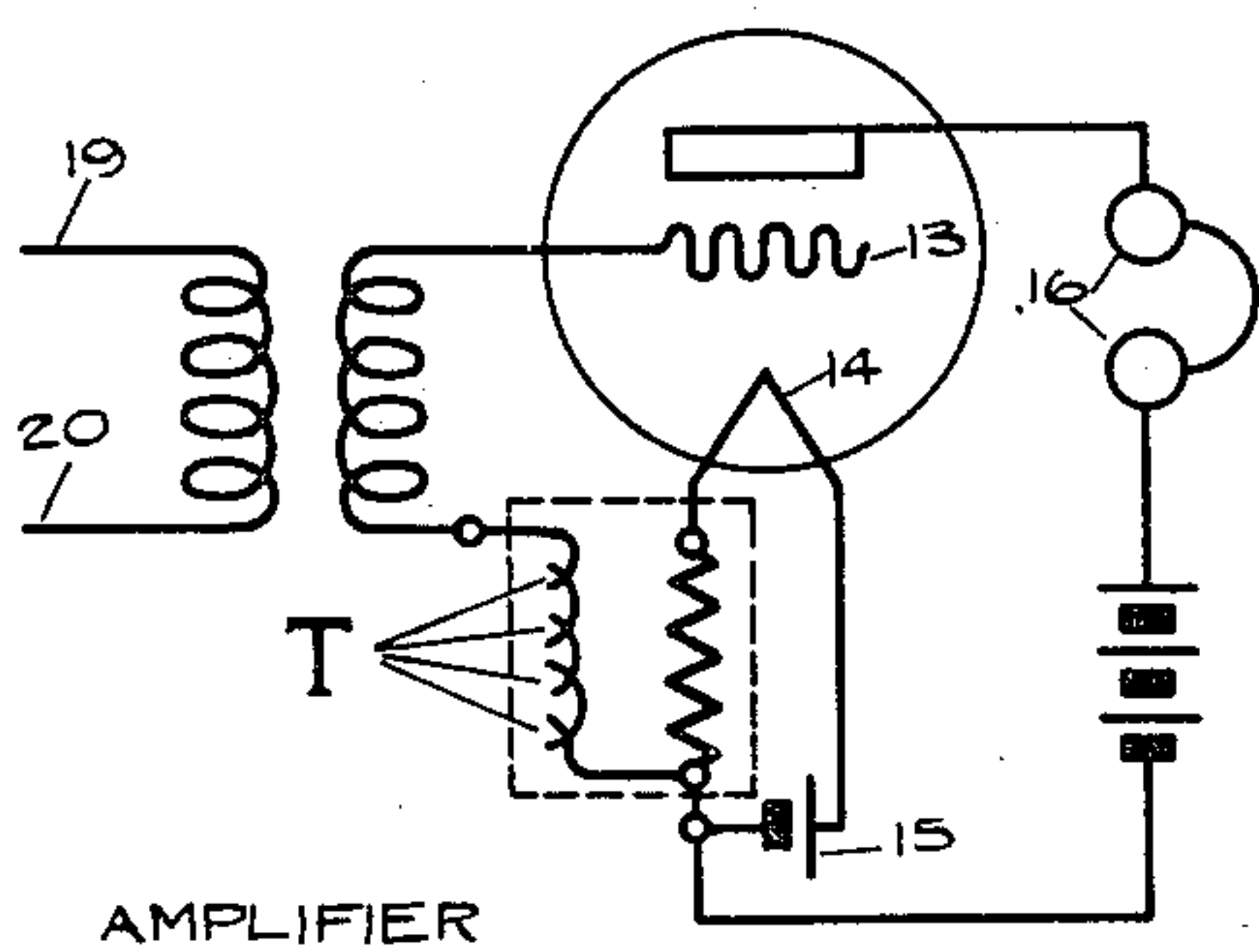
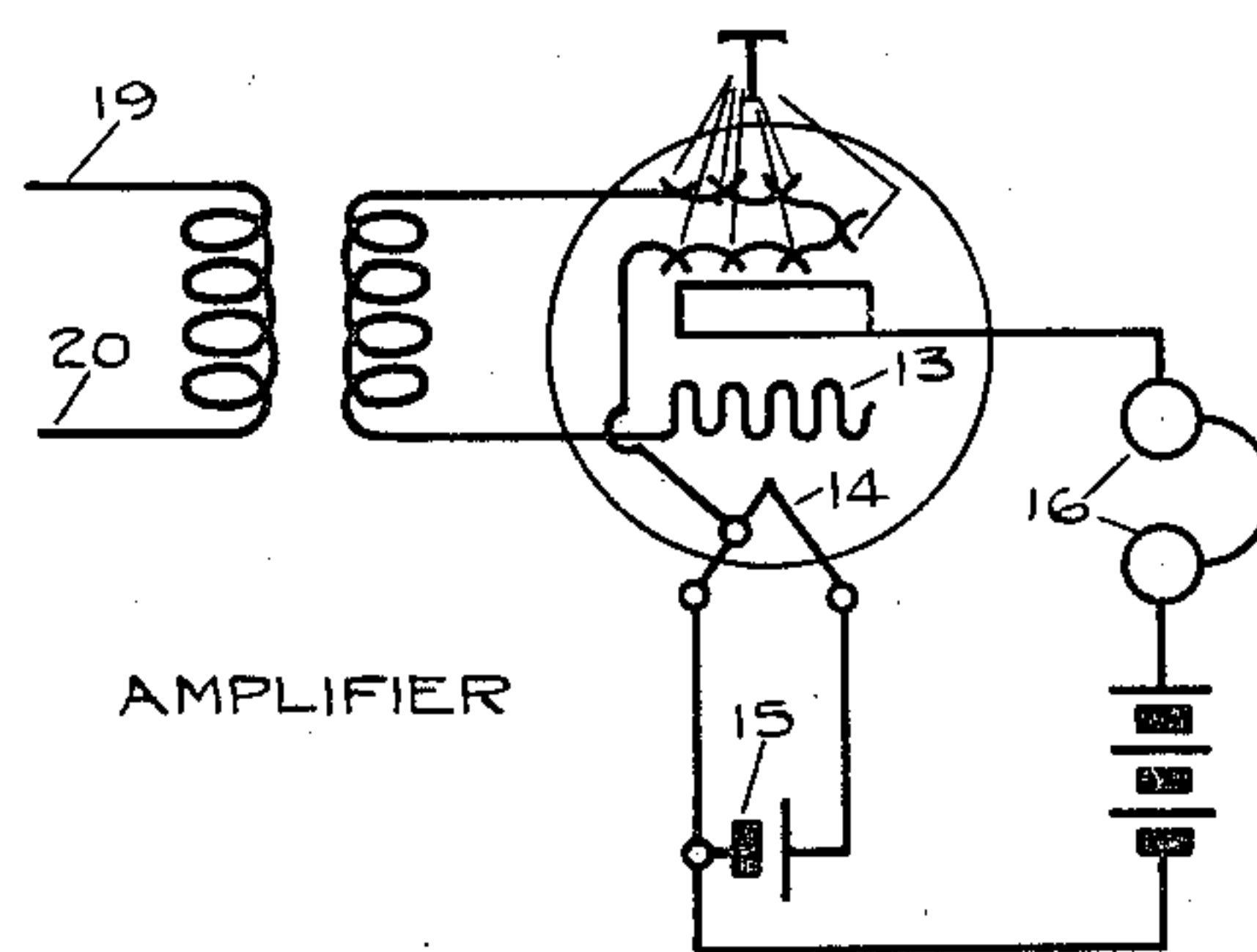
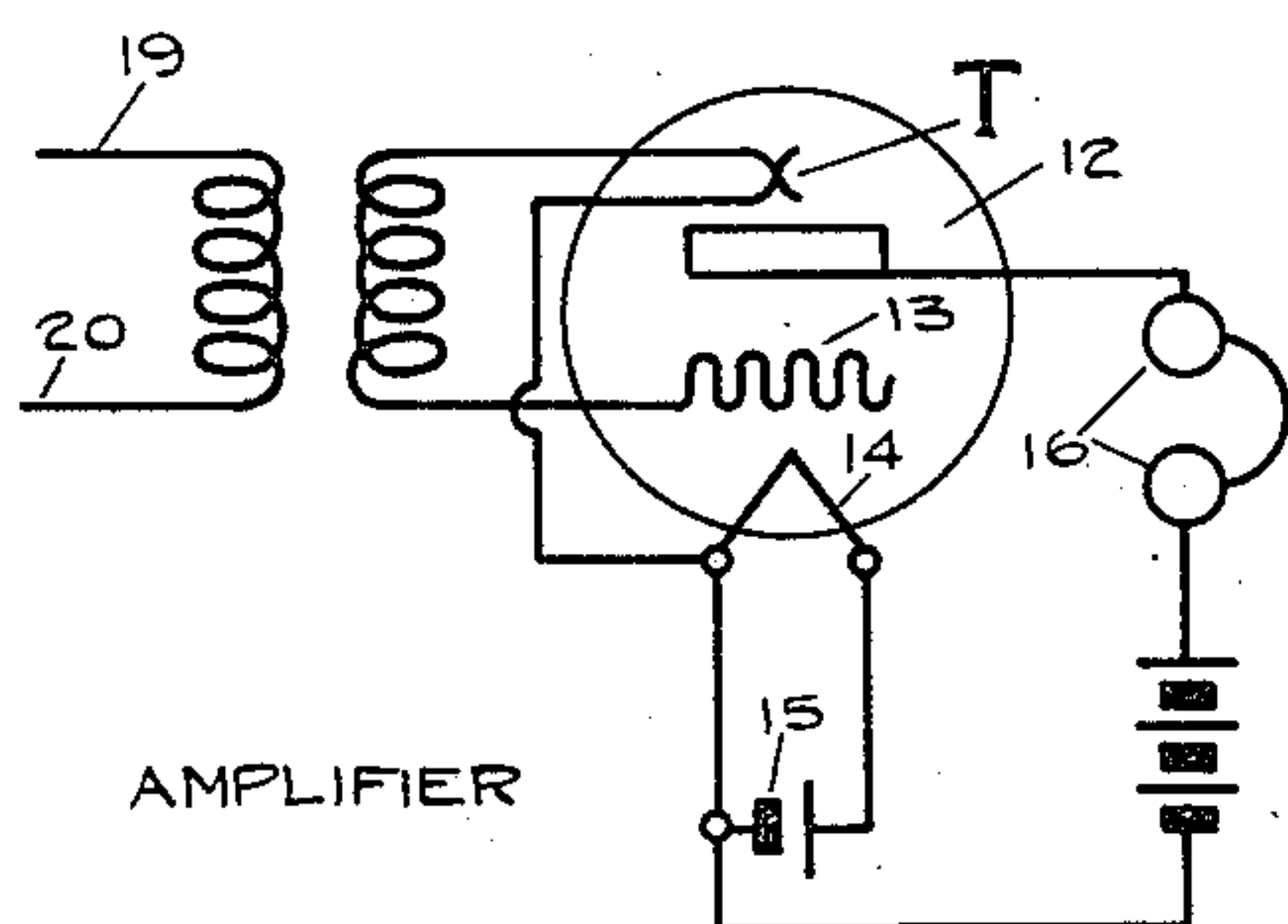
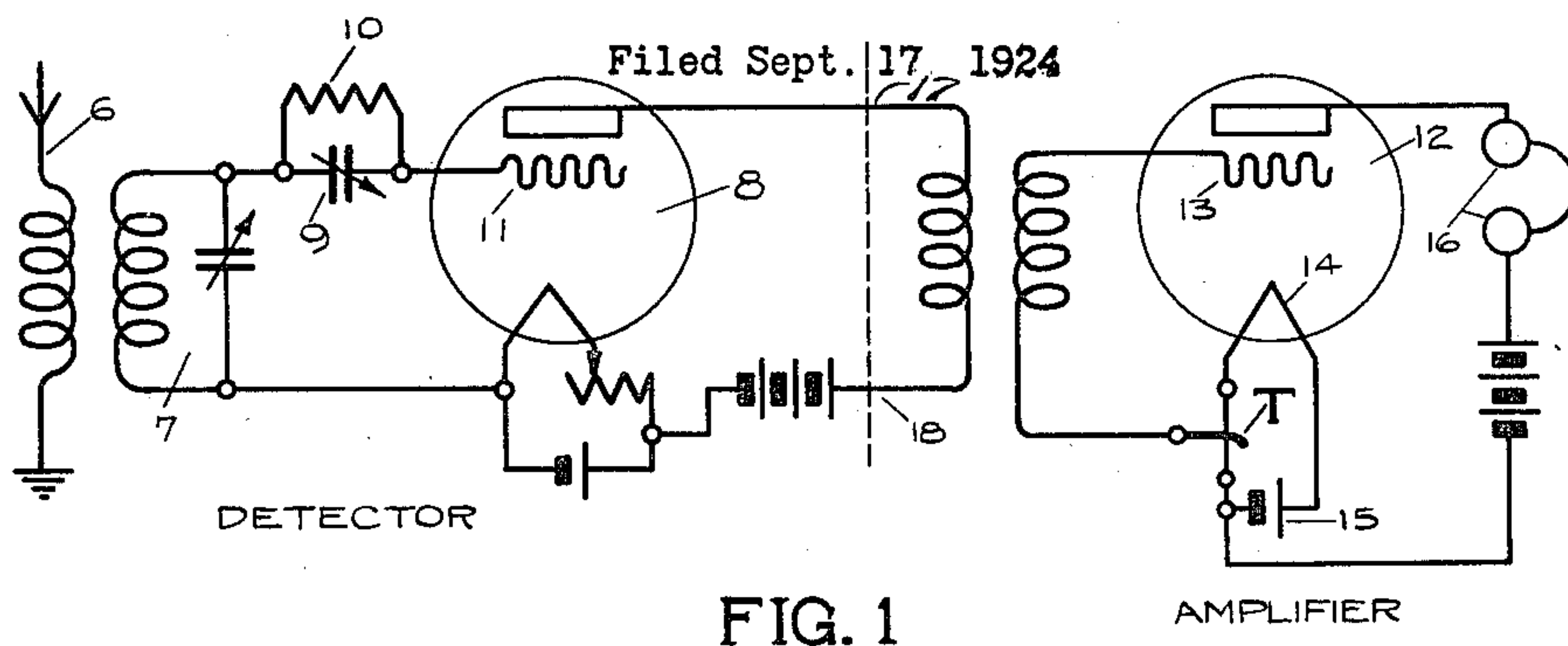
Dec. 6, 1927.

1,652,148

B. OLNEY

THERMIONIC TUBE CIRCUITS

Filed Sept. 17, 1924



INVENTOR
BENJAMIN OLNEY

BY *D Clyde Jones.*
ATTORNEY

UNITED STATES PATENT OFFICE.

BENJAMIN OLNEY, OF ROCHESTER, NEW YORK, ASSIGNOR TO THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK.

THERMIONIC-TUBE CIRCUITS.

Application filed September 17, 1924. Serial No. 738,207.

This invention relates to amplifier devices and more particularly to such devices in which thermionic tubes are employed.

It has been noted that amplifier devices operate more satisfactorily if the control element or grid is maintained at a certain potential with respect to its filament. In obtaining this result, small size batteries, have been employed, which are known in the telephone art as "C" batteries. These batteries are not only a source of expense due to the fact that they must be frequently replaced, but their voltage varies during the life of the battery.

One feature of the present invention is the use of a thermoelectric element to replace certain of the batteries now employed in radio sets. More specifically this invention resides in the use of a thermo-couple for maintaining the proper difference of potential on one of the elements of a thermionic device.

Other specific features of this invention will appear from the description and appended claims.

In the drawings Fig. 1 represents a radio receiving set including an antenna, a detector device with its control circuits and an amplifier device equipped with a thermo-couple for applying a definite difference of potential to the amplifier grid. Fig. 2 shows modified form of the invention in which a thermo-couple is included within the glass envelope and is heated by the filament of the thermionic device. Fig. 3 shows another form of the amplifier in which several thermo-couples in series are included within the envelope of the thermionic device and are similarly heated by the filament. In this instance the connection of the thermo-couple with the filament is all enclosed within the evacuated envelope. Fig. 4 shows an additional form of amplifier in which several thermo-couples in series are heated by a resistance element in the filament circuit, which resistance may be the well known rheostat for controlling the supply of "A" battery through the filament. Fig. 5 shows a still further modification in which several thermo-couples in series are included within the evacuated envelope and are also heated by the filament of the thermionic device.

Referring more particularly to Fig. 1, 6 designates an antenna which is inductively

coupled to the tuned input circuit 7, of a detector or thermionic tube 8. This input circuit also includes a grid condenser 9 with the well known grid leak 10, in series with the control element or grid 11. The output circuit of the detector is inductively coupled to the input circuit of an amplifier thermionic tube 12. It has been noted that if the grid element 13 of such a thermionic tube is not maintained at the proper potential with respect to the filament 14, signals which are repeated and amplified in its output circuit are distorted. In order to apply the proper potential, preferably negative, to the grid 13 a thermo-couple T or any heat-controlled device which produces a difference of potential, is connected to it. In Fig. 1 this thermo-couple has one of its elements connected in series with the filament 14 of the amplifier tube and is heated from the "A" battery 15. The output or plate circuit of the amplifier of Fig. 1 includes a telephone receiver or loud speaker 16, although it will be understood that a primary winding of a transformer such as that shown in the output circuit of the detector, may be used to inductively couple the amplifier to an additional amplifying device in the well known manner.

Referring to Fig. 2 it will be understood that the amplifier of this figure may replace the amplifier of Fig. 1, by connecting the conductors 19 and 20 at points 17 and 18 of the output circuit of the detector and omitting the apparatus appearing at the right of the dotted line of that figure. In this modification the thermo-couple T is formed of a single unit and is included within the evacuated envelope of the thermionic tube 12, so that it is heated by the filament 14.

In Fig. 3 several thermo-couples in series within the envelope of the thermionic tube are included in the circuit connecting one side of the filament 14 with the grid 13. It will be understood that the circle represents the evacuated envelope which encloses the several elements of the thermionic tube. In this modification, the thermo-couples are sufficiently close to the filament 14 to be heated by it so that an electromotive force, preferably negative, is applied to the grid 13.

Fig. 4 represents an amplifier which will function with the detector of Fig. 1, when the amplifier shown at the right of the dot-

ted line is omitted and when the conductors 19 and 20 are connected with the conductors 17 and 18. In the arrangement of this figure several thermo-couples are connected in series and are heated by a resistance such as a filament rheostat in the "A" battery circuit 15 which heats the filament 14.

The modification shown in Fig. 5 is similar to that appearing in Fig. 3 except that the connection of the filament to the thermo-couples T is without the envelope, whereas in the mentioned arrangement this connection is entirely enclosed by the envelope. In other words in Fig. 5, there are but four terminals extending from the elements within the envelope, whereas in Fig. 3 there are five terminals.

A thermo-couple suitable for use in the present arrangement, is described on pages 54 and 55 of Radio Communication, pamphlet #40, (second edition), of the Bureau of Standards, entitled "The principles underlying radio communication".

While the amplifier devices of this disclosure have been shown to be of the type for amplifying audio frequencies it will be understood that the present arrangement is equally effective in devices for amplifying radio frequencies. It will also be readily understood by those skilled in the art that the thermoelement devices may be used to replace the so-called "B" batteries in the output circuits of the detector and amplifier devices.

What I claim is:

1. In an amplifier device, a thermionic tube including a filament, heating current for said filament, a plate element and a controlling element, an input circuit connecting said filament and controlling element, an output circuit connecting said filament and plate element, and a thermoelectric unit for developing a difference of potential between one of the elements of said thermionic tube and said filament proportional to said heating current.

2. In an amplifier device, a thermionic tube including a filament, a controlling element and a plate element, a current source for heating said filament, an incoming circuit connecting said filament and said controlling element, an output circuit including said plate element and said filament, and a thermoelectric element heated by said filament for developing a difference of potential between one of the elements of said thermionic tube and said filament which is proportional to said heating current.

3. In an amplifier device, a thermionic tube including a filament, heating current for said filament, a plate element and a controlling element, an input circuit connecting said filament and controlling element, an output circuit connecting said filament and plate, and a plurality of thermoelectric units

in series for developing a difference of potential between one of the elements of said thermionic tube and said filament, said potential being proportional to said heating current.

4. In an amplifier device, a thermionic tube including a filament, a controlling element and a plate element, means for heating said filament, an incoming circuit connecting said filament and said controlling element, an output circuit connecting said plate element and said filament, and a thermoelectric element for developing a difference of potential between one of the elements of said thermionic tube and said filament, said thermionic device serving to heat said thermoelectric element.

5. In an amplifier device, a thermionic tube including a filament, a plate element and a controlling element enclosed within an evacuated envelope, an input circuit connecting said filament and controlling element, an output circuit connecting said filament and plate, and a thermoelectric unit within the envelope of said thermionic tube for developing a difference of potential between one of the elements of said thermionic tube and said filament.

6. In an amplifier device, a thermionic tube including a filament, a controlling element and a plate element enclosed within an evacuated envelope, means for heating said filament, an incoming circuit connecting said filament and said controlling element, an output circuit connecting said plate element and said filament, a plurality of thermoelectric elements within the envelope heated by said filament for developing a difference of potential between one of the elements of said thermionic tube and said filament.

7. In an amplifier device, a thermionic tube including a filament, heating current for said filament, a plate element and a controlling element, an input circuit connecting said filament and controlling element, an output circuit connecting said filament and said plate element, and a thermoelectric unit for impressing a potential upon one of the elements of said thermionic tube more negative than said filament, said potential being proportional to said heating current.

8. In an amplifier device, a thermionic tube including a filament, heating current for said filament, a plate element and a controlling element, an input circuit connecting said filament and controlling element, an output circuit connecting said filament and said plate element, and a thermoelectric unit for impressing a potential upon the controlling element of said thermionic tube more negative than said filament, said potential being proportional to said heating current.

9. In an amplifier device, a thermionic tube including a filament, means including a

source of current for heating said filament, an incoming circuit connecting said filament and said controlling element, an output circuit including said plate element and said filament, and a thermoelectric element heated by said source of current for developing a difference of potential between one of the elements of said thermionic tube and said filament, said potential being proportional to said heating current.

10. In an amplifier device, a thermionic tube including a filament, a source of current for heating said filament, a plate element and a controlling element, an input circuit connecting said filament and controlling element, an output circuit connecting said filament and plate, and a plurality of thermoelectric units in series heated by said source of current for developing a difference of potential between one of the elements of said thermionic tube and said filament, said potential being proportional to said heating current.

11. In an amplifier device, a thermionic tube including a filament, a source of current for heating said filament, a plate element and a controlling element, an input circuit connecting said filament and controlling element, an output circuit connecting said filament and said plate element, and a thermoelectric unit heated by said source of current for impressing a potential upon one of the elements of said thermionic tube more negative than said filament, said potential being proportional to said heating current.

12. In an amplifier device, a thermionic tube including a filament, a source of current

for heating said filament, a plate element and a controlling element, an input circuit connecting said filament and controlling element, an output circuit connecting said filament and said plate element, and a thermoelectric unit heated by said source of current for impressing a potential upon the controlling element of said thermionic tube more negative than said filament, said potential being proportional to said heating current.

13. In an amplifier device, a thermionic tube including a filament, a plate element and a controlling element, an input circuit connecting said filament and controlling element, an output circuit connecting said filament and plate element, and a thermoelectric unit for developing a difference of potential between one of the elements of said thermionic tube and said filament, said thermionic unit being rendered active by heat radiated from said filament.

14. In an amplifier device, a thermionic tube including a filament, heating current for said filament, a plate element and a controlling element, an input circuit connecting said filament and controlling element, an output circuit connecting said filament and plate element, and a thermoelectric unit in series with said input circuit for developing a difference of potential between one of the elements of said thermionic tube and said filament, said potential being proportional to said heating current.

In witness whereof, I hereunto subscribe my name this 12th day of September, A. D. 1924.

BENJAMIN OLNEY.