

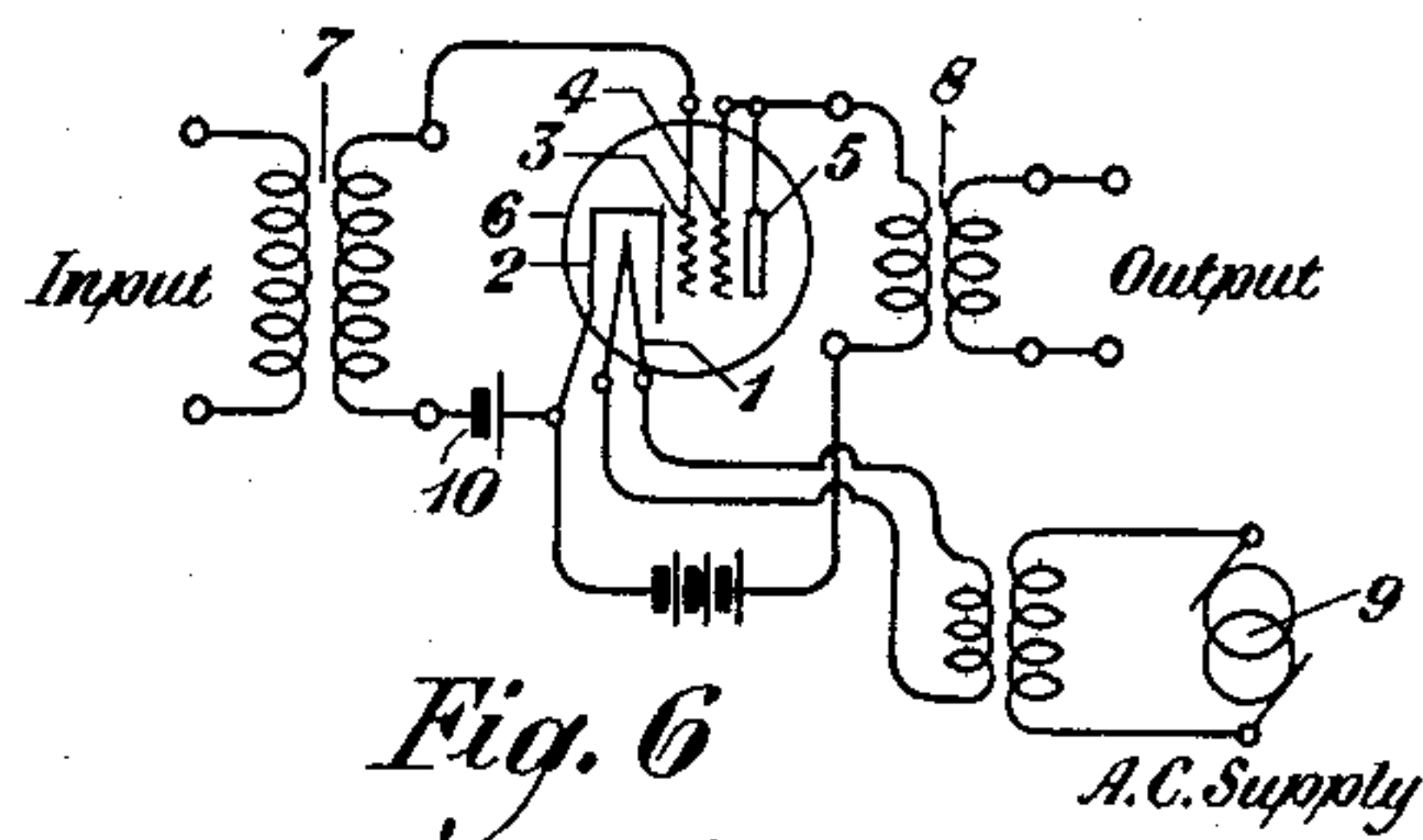
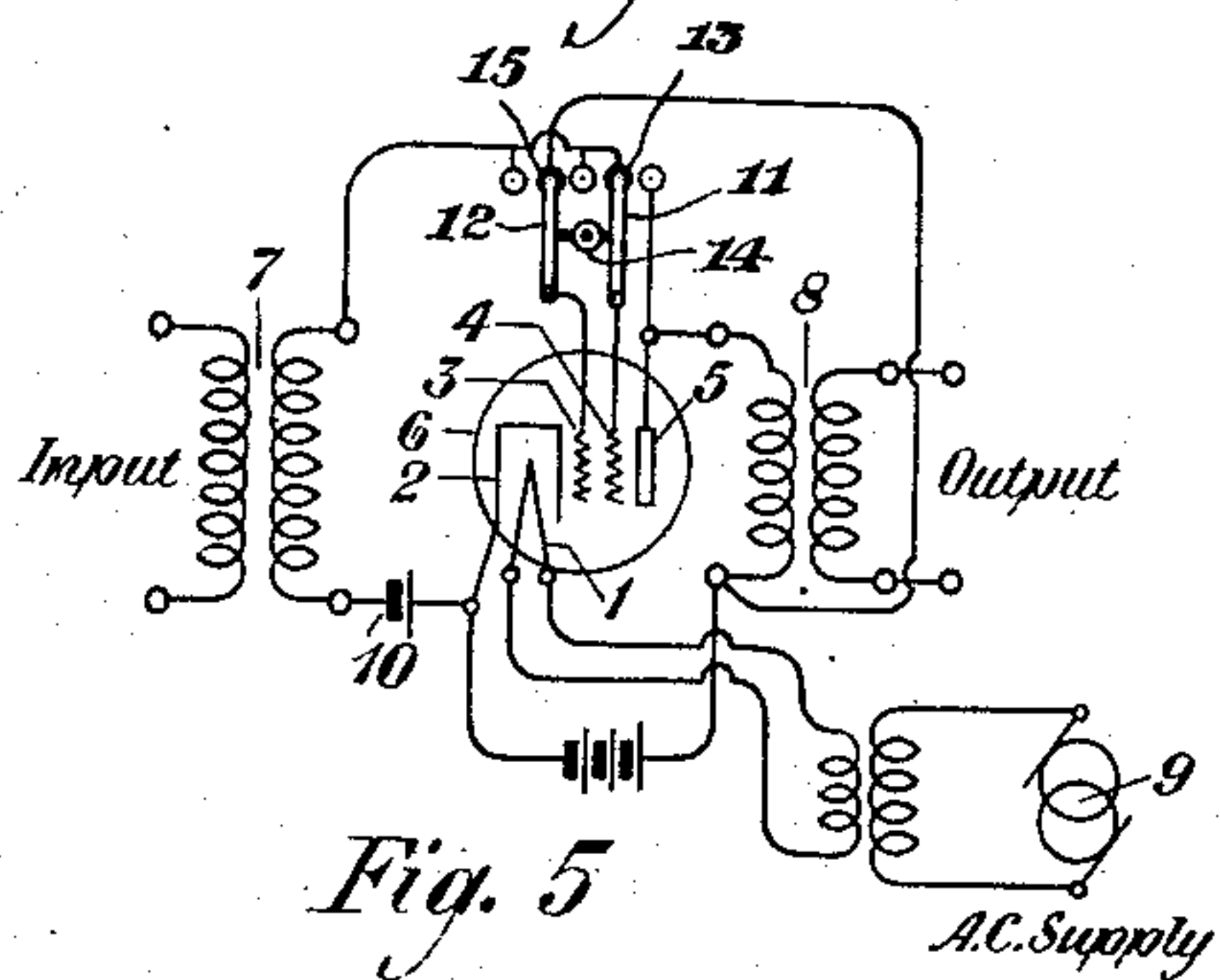
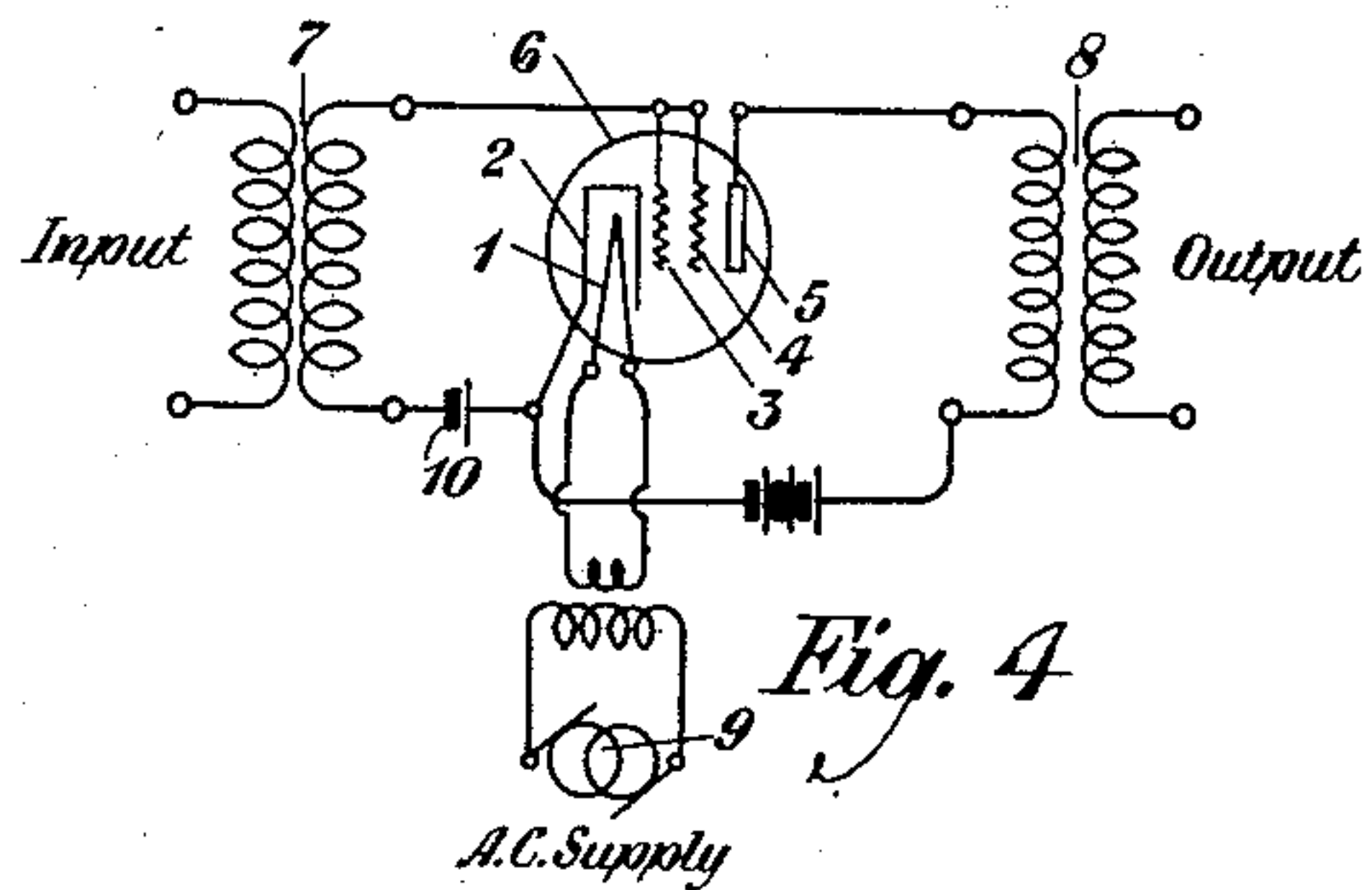
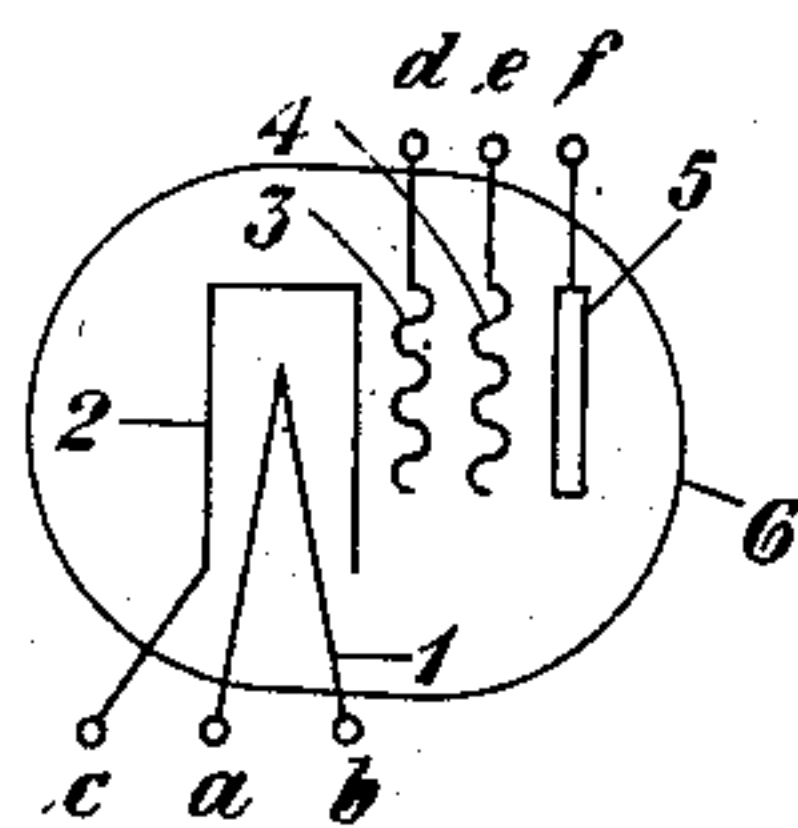
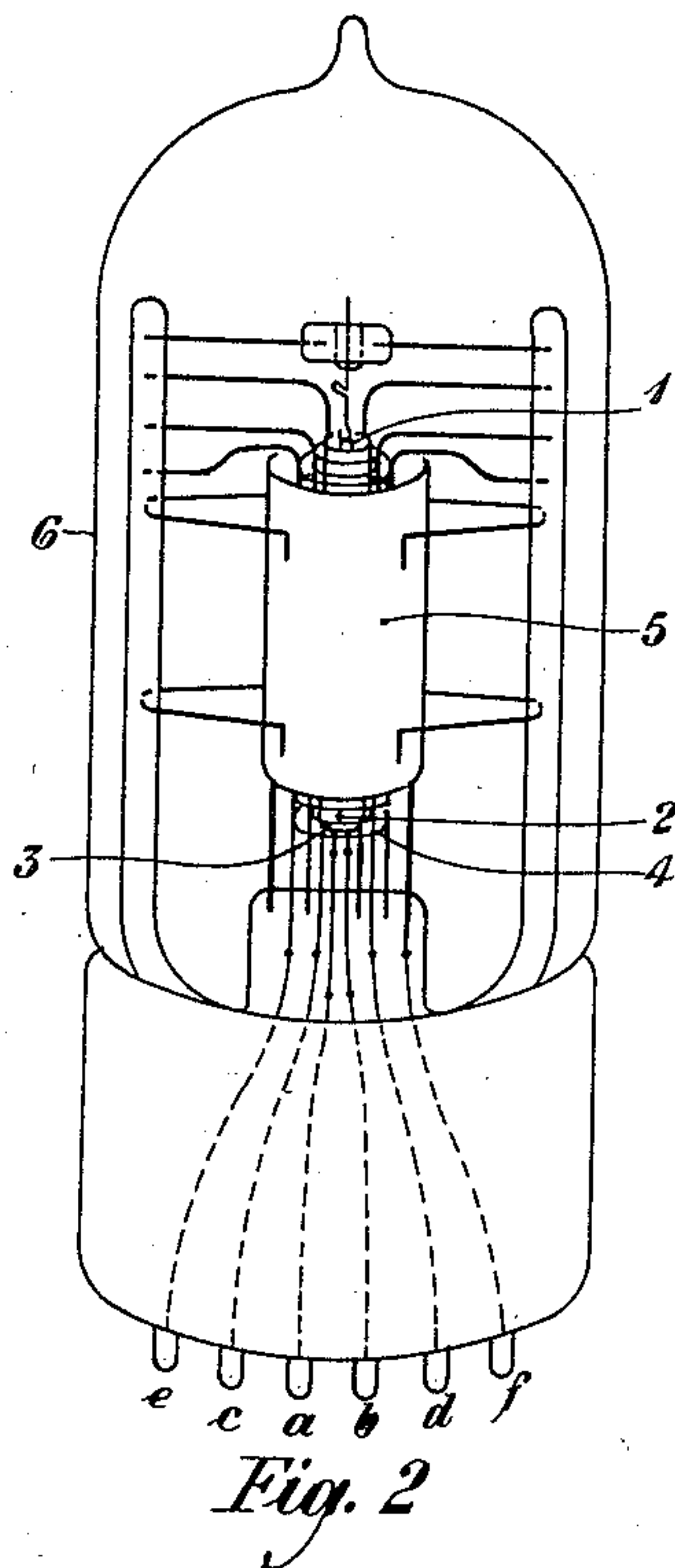
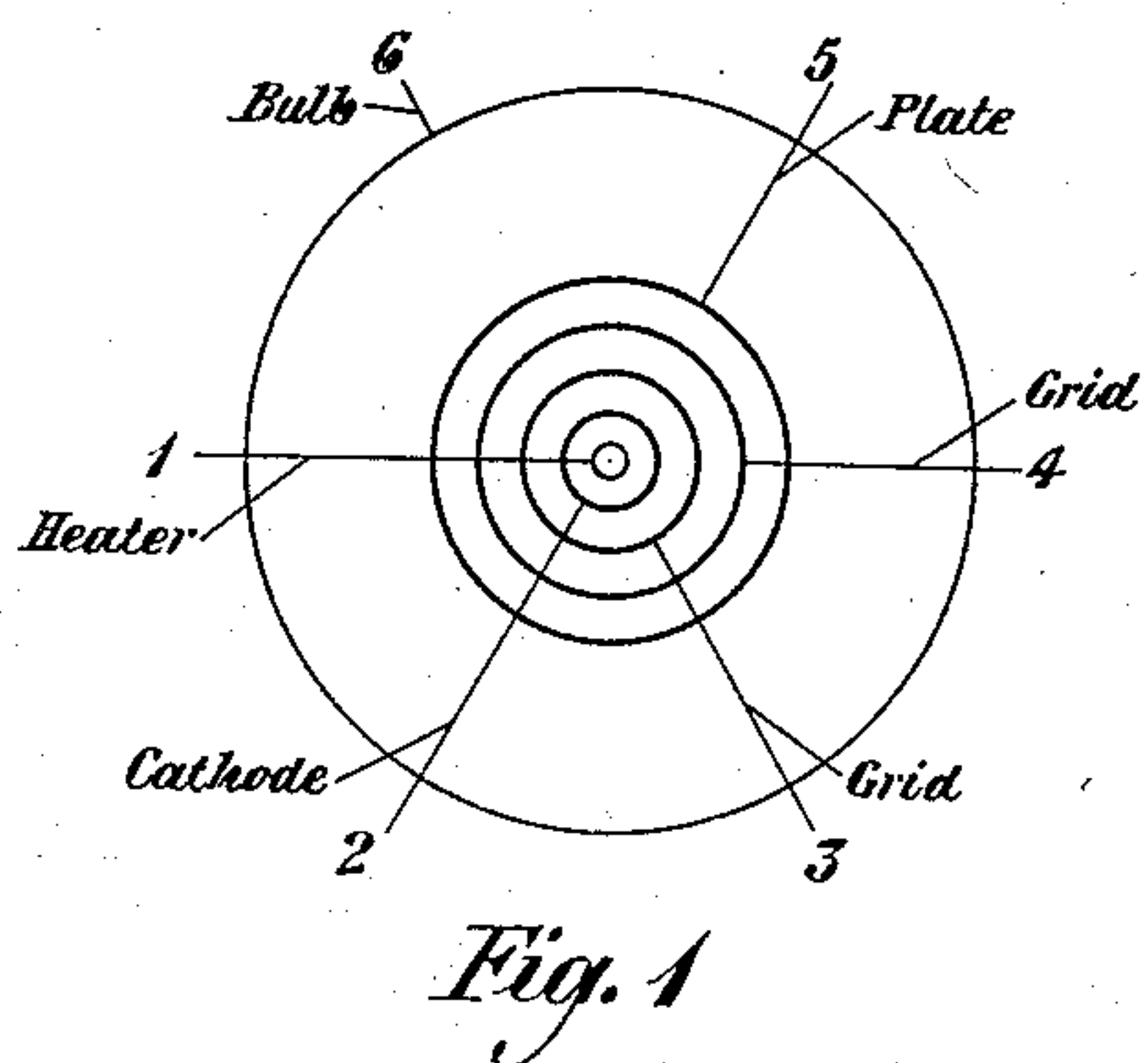
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1,745,369

UNIPOTENTIAL CATHODE VACUUM TUBE

Filed Dec. 19, 1924



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UNIPOTENTIAL-CATHODE VACUUM TUBE

Application filed December 19, 1924. Serial No. 757,017.

This invention relates to unipotential cathode vacuum tubes and particularly to a tube of that type having a plurality of grid electrodes between the cathode and the plate electrode.

In the type of vacuum tube now widely used, the cathode which is of the filament type is rendered electron-emitting by the conduction of a current therethrough. This method of rendering the cathode active, causes a drop in potential along the cathode which makes it difficult to satisfactorily employ alternating current for heating the cathode, and has other disadvantages. There has accordingly been developed what is known as a unipotential cathode tube in which the electron-emitting cathode is rendered active by an element separate and distinct from the cathode itself. This element may, for example, be a heater or it may be an electron-emitting device, rendering the cathode active by bombardment. The cost of producing unipotential cathode tubes is appreciably higher than tubes of the type heretofore employed and it is accordingly desirable to employ them in a highly efficient manner in order to compete with the simpler and less expensive tube heretofore employed.

One of the objects of this invention consists in the provision of a plurality of grids in a vacuum tube of the unipotential cathode type whereby a single tube of that type may be applied in a variety of different ways to perform the function heretofore attainable only through the use of a plurality of tubes of the type heretofore employed.

Other objects of this invention will be apparent from the following description when read in connection with the attached drawing, of which Figure 1 is a cross-sectional view and Fig. 2 is a vertical view of the tube in which the invention is embodied. Fig. 3 is a schematic drawing of the electrodes of the tube, and Figs. 4, 5 and 6 show various modes of application of a tube of the form shown in Figs. 1 to 3.

In Fig. 1, a heating element 1 is supported preferably at the center of the tube and is surrounded by the electron-emitting cathode 2. This cathode may be in the form of a cyl-

inder, either closed or open at the top, and having its outer surface coated with electron-emitting material. Surrounding the cathode and concentric therewith are the grids 3 and 4, grid 3 being spaced a definite interval from the cathode, and grid 4 a definite distance from the grid 3. A plate electrode 5 surrounds all of the other electrodes and is spaced a definite distance from the grid 4. All of the electrodes are enclosed within an evacuated vessel 6. The various electrodes may be supported by means of glass arbors mounted upon the stem at the base of the tube, and may be terminated in the base of the tube so as to be readily connected with the conductors of the circuit in which tube is to be used.

The structure of the tube should be such that the voltage amplification of the inner grid with respect to the plate, is smaller than that of the outer grid with respect to the plate. This may be accomplished in several ways known to those skilled in the art to which this invention belongs.

The manner in which the tube may be used is shown in Figs. 4 to 6 inclusive. In Fig. 4 the tube is connected with an input circuit by means of a transformer 7 and with the output circuit by means of a transformer 8. A source 9 of alternating current is connected with the heating element 1 of the tube in order to energize this element so that it in turn will cause the emission of electrons by the cathode tube. The grids 3 and 4 are strapped together and connected with the input circuit. The plate 5 is connected with the output circuit. The strapping together of the grids causes them to act as a single electrode. Such an arrangement produces high amplification, but also causes a high impedance between the plate and the cathode of the output circuit. The degree of amplification attainable by a tube having a plurality of grids connected in the manner shown is greater than that attainable by a tube of the type heretofore employed and consequently serves to reduce the number of tubes required for high amplification.

The manner of using a double grid tube for medium amplification and medium plate-

cathode impedance is shown in Fig. 5. In this arrangement the outermost grid 4 is connected by the switch arm 11 with the input circuit through contact 13 of switch 14 and the innermost grid 3 is connected by the switch arm 12 with the source of plate voltage through contact 15. In such an arrangement the inner grid, to which a positive potential is applied, serves to reduce the tube impedance by reducing the negative space charge around the cathode. The outer grid, to which a negative charge is applied by the battery 10, operates to control the space current in the normal way. An arrangement such as shown also permits operation at relatively low plate voltages. The purpose of the switch 14 will be fully explained hereinafter.

The circuit shown in Fig 6 illustrates the manner of using the double grid tube when low amplification and low output impedance are desired. In this figure the inner grid 3 is connected with the input circuit and the outer grid 4 is connected in parallel with the plate 5. This mode of use increases the plate area and therefore tends to increase the cathode emission. The inner grid is maintained at the negative potential by means of the battery 10. The low impedance of the output circuit, which is attained by connecting the electrodes 4 and 5 in parallel, results in a fairly large current output at low amplification.

It will be seen, therefore, that by means of a tube of the type shown in Figs. 1 to 3, various degrees of amplification may be attained. By using the simple switching mechanism shown in Fig. 5 the several circuit connections shown in Figs. 4, 5, and 6 may readily be established. When the switch 14 is thrown to the left the grids are connected as in Fig. 4 and when the switch is operated to the right the grids are connected as in Fig. 6. It will be apparent that various degrees of amplification may be obtained by varying the setting of the switch.

The arrangements shown in the figures illustrate schematically certain embodiments of the invention but it is obvious that the invention is not so limited but is capable of embodiment in other forms without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In an electrical translating system, the combination with a vacuum tube comprising a unipotential cathode, two grids and a plate, a heating element for the said cathode having a source of energy connected therewith, an input circuit connected with the cathode, an output circuit also connected with the said cathode and with the said plate, and switching means to connect the said input circuit and the said output circuit with the said grids in a predetermined manner.

2. An amplifier comprising a vacuum tube having an electron emitting cathode, a plate, and two grids interposed between said cathode and said plate, an input circuit and an output circuit, and switching means to control the connection of the said circuits with either of the said grids whereby the character of the amplifier may be determined.

In testimony whereof, I have signed my name to this specification this 17th day of December, 1924.

WILLIAM H. T. HOLDEN.