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GAS FILLED DISCHARGE TUBE

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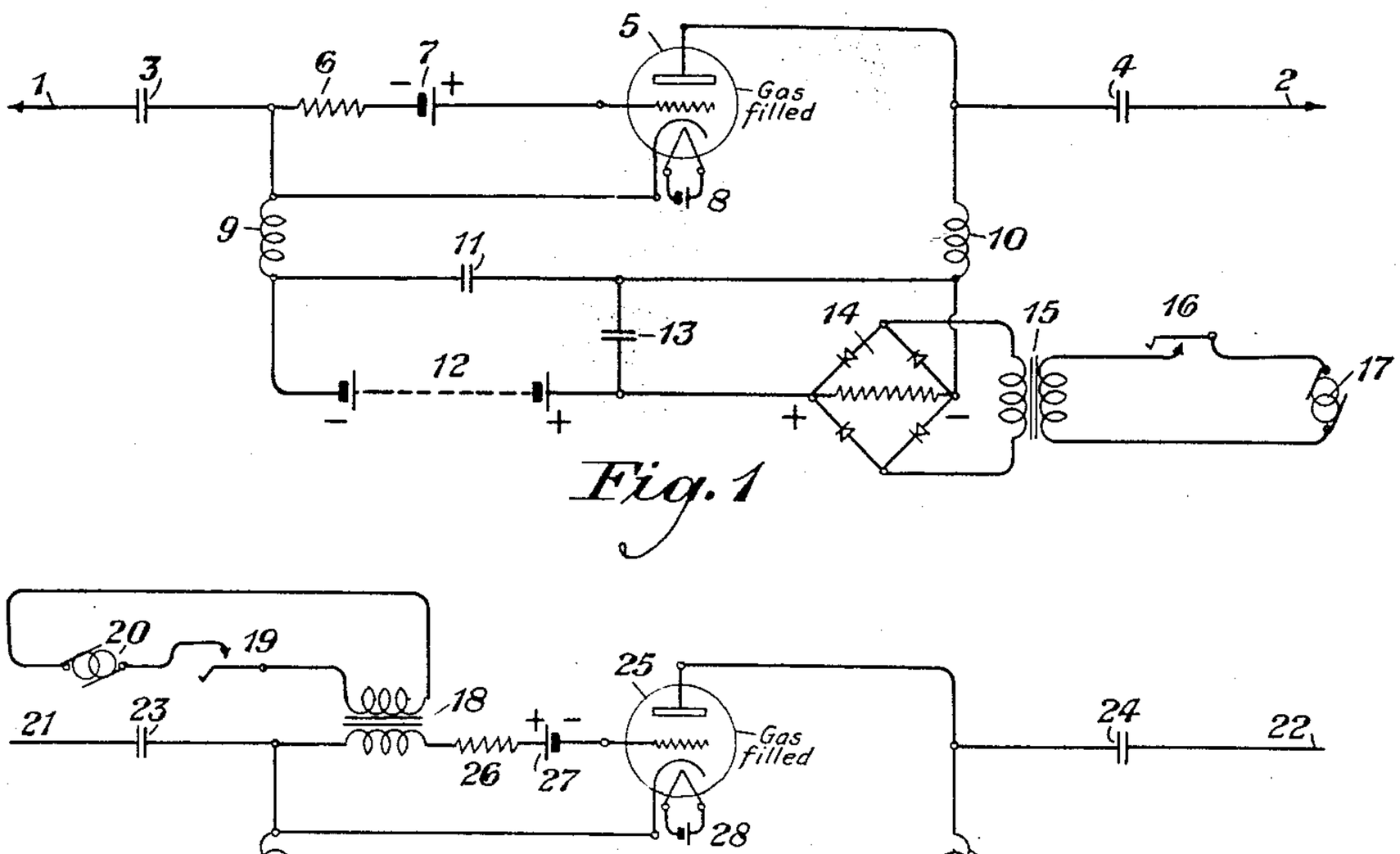

Fig. 1

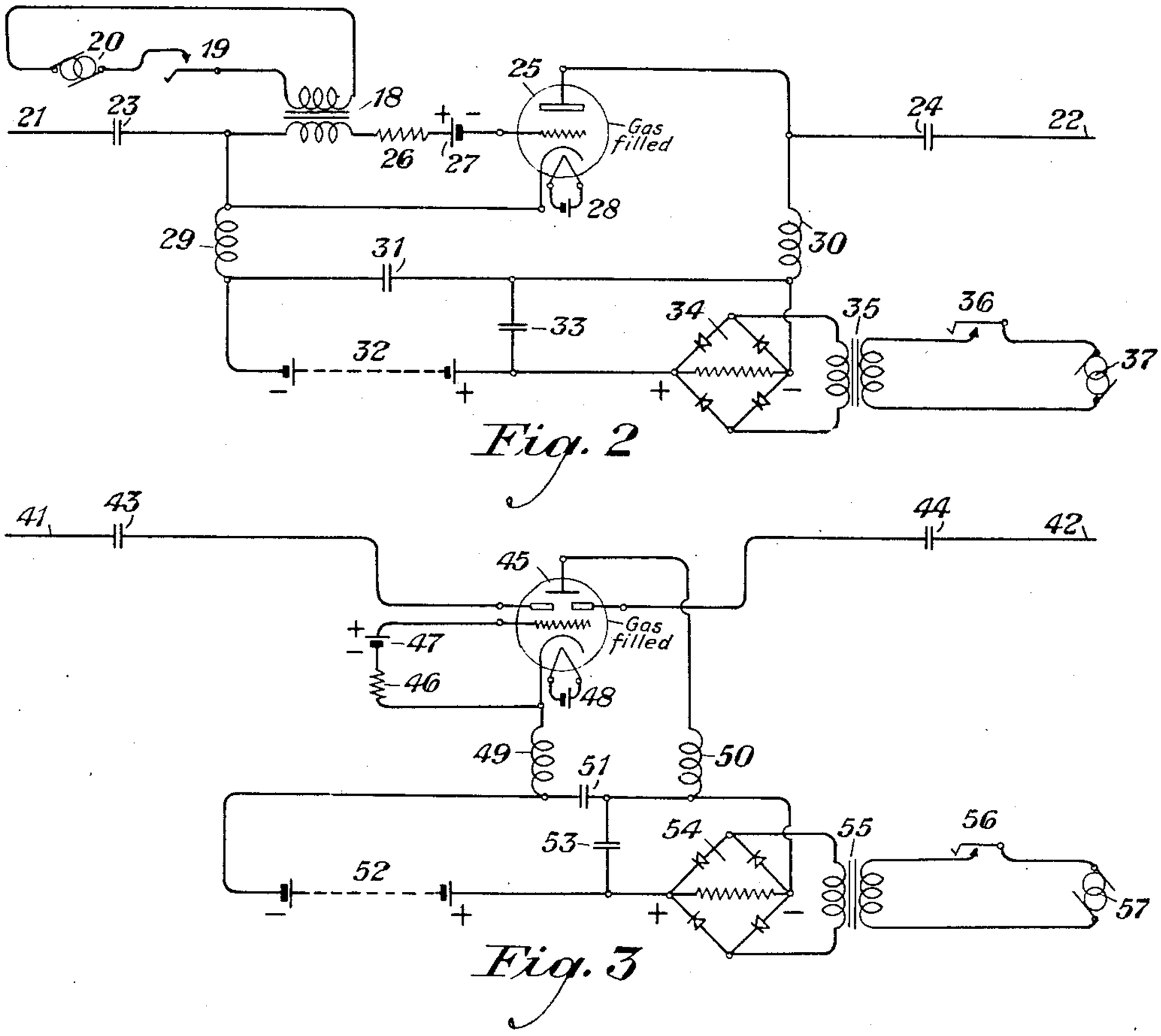

Fig. 2

Fig. 3

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GAS-FILLED DISCHARGE TUBE

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3 Claims. (Cl. 250—27)

This invention relates to electrical circuits and more particularly to that class of circuits utilized to control the operation of gas-filled discharge devices of the thermionic or cold cathode type, and particularly to render such devices non-conducting by quenching the arc or glow discharge therein.

Arrangements proposed in the past for this purpose have involved the use of either electromagnetic or mechanical switches to open the anode circuit, or impulse arrangements whereby a surge transmitted through a condenser momentarily reverses the anode-cathode voltage. The first method involves mechanically moving parts with the resultant necessity of mechanical adjustments and the possibility of contact troubles, while the second method requires careful adjustment of circuit constants and operating conditions to ensure sufficient time for de-ionization to occur before the charge upon the condenser utilized can leak off. This invention, however, avoids both these difficulties and provides means whereby the arc or glow discharge in a gas-filled discharge tube may be quenched or interrupted and the tube may be kept inoperative for as long a period as desired, without the use of switches or relays in the tube circuit. Other objects and features of this invention will be apparent from the following detailed description thereof.

The invention may be more fully understood from the following description together with the accompanying drawing in the Figures 1, 2 and 3 of which the invention is illustrated. Figure 1 is a circuit diagram showing an embodiment of the invention. Figs. 2 and 3 are circuit diagrams of modified forms of the invention.

Referring to Fig. 1, conductors 1 and 2 represent parts of a signaling circuit, carrying low voltage alternating signaling currents, whose amplitudes are always small in comparison with the arc drop in the thermionic gas-filled discharge tube 5 which is used as a switching element to open and close a connection between conductors 1 and 2. The tube 5 may be filled with a monatomic gas, such as neon. As shown in Fig. 1, this connection is normally closed as grid biasing battery 7 is so poled as to apply a positive bias to the grid of tube 5. Resistance 6 is provided to limit the current in the grid circuit. Battery 8 provides heating energy for the indirectly heated cathode. Choke coils 9 and 10 and condenser 11 are provided to separate the signaling current path from the anode battery path, forming a low pass filter whose cutoff is less than the lowest frequency to be passed through the arc path of tube 5 from conductor 1 to 2. Blocking condensers 3 and 4 pass the alternating signaling currents but keep the direct current of the anode circuit out of the signal circuit.

In order to interrupt the arc current means are provided for lowering the anode potential below the minimum required to sustain an arc. This is done by rectifier and resistance element 14, which is connected so that when an alternating current of sufficient magnitude is applied, a voltage is developed across the resistance element of 14 having the polarity indicated, namely an opposite polarity to that of the plate battery. If this voltage is greater than or even less than that of anode battery 12, by less than the minimum arc drop of tube 5, the application of alternating current to rectifier and resistance unit 14 will quench the arc in tube 5. A condenser 13 smooths out any ripples in the rectifier output which might otherwise get into the tube circuits. The alternating current for quenching is obtained from generator 17, being applied to transformer 15 when key 16 is closed. This control circuit has been shown as a manually operated key for illustrative purposes only.

Fig. 2 illustrates a second embodiment of this invention, in which conductors 21 and 22 are the signaling current conductors to be connected together by the arc path of thermionic discharge tube 25. Blocking condensers 23 and 24 keep the direct current of the anode battery 32 out of the signaling circuits, while the filter formed by chokes 29 and 30 and condenser 31 keeps signaling current from flowing in the battery supply circuit. Battery 28 furnishes heating energy to the cathode. Rectifier and resistance element 34 serves to quench the arc in the same manner as the similar element 14 of Fig. 1, and the alternating current supply for this purpose is obtained from generator 37 when key 36 is closed. The difference between this Fig. 2 and Fig. 1 lies in the arrangements of the grid circuit, which in Fig. 1 was provided with a positive bias and no input circuit, so that an arc would exist in tube 5 whenever key 16 was not closed. In Fig. 2 grid battery 27 is arranged to provide a negative bias, while an input transformer 18 is provided. Resistance 26 limits the grid current to safe values. If key 19 is closed alternating current from generator 20 is applied to the grid circuit through transformer 18, whereby the first positive half-cycle will override the nega-

tive grid bias due to battery 27 and cause an arc to strike in tube 25, after which the input circuit will lose control until the arc is quenched by the operation of key 36. Thus key 19 controls the starting and key 36 the stopping of the discharge in tube 25.

Fig. 3 illustrates an arrangement identical in all respects with that of Fig. 1 except that the tube 45 has separate electrodes serving as terminals of the signaling circuit between conductors 41 and 42. Blocking condensers 43 and 44 prevent any direct current from flowing to the aforesaid auxiliary or probe electrodes. As is well known in the art, such electrodes pass currents of small amplitude from one to the other quite readily when immersed in the positive column of an arc discharge. Other reference characters have the same significance as those having a number 40 less in Fig. 1.

While this invention has been described with regard to certain specific embodiments thereof, it is to be understood that it is not so limited, but includes any and all organizations falling within the scope and spirit of the appended claims.

What is claimed is:

1. A gas-filled discharge tube comprising cathode, grid and plate electrodes, a line circuit connected to said cathode and plate electrodes and adapted to be closed by the discharge between said electrodes, means for applying voltages to the grid and plate electrodes of such values that said tube may discharge, a rectifier in the plate circuit of said tube, and means for applying an alternating voltage to said rectifier, said rectifier being so poled that the application of said alternating voltage to said plate circuit through said rectifier will change the voltage normally applied to said plate electrode so that the discharge in said tube will be extinguished.

2. A gas-filled discharge tube comprising cathode, grid, and plate electrodes, a line circuit connected to said cathode and plate electrodes and adapted to be closed by the discharge between said electrodes, means for applying a positive biasing voltage to said grid, means for applying a positive voltage to said plate, said voltage being of such values that said tube will normally be in a discharge condition, a rectifier in the plate circuit of said tube, and means for applying an alternating voltage to said rectifier, said rectifier being so poled that said alternating voltage will oppose the previously mentioned voltage applied to said plate and will reduce it sufficiently so that the discharge of said tube will cease.

3. A gas-filled discharge tube comprising cathode, grid and plate electrodes, a line circuit connected to said cathode and plate electrodes and adapted to be closed by the discharge between said electrodes, mans for applying a positive voltage to said plate, means for applying a negative biasing voltage to said grid to prevent said tube from discharging, means for so reducing said negative voltage applied to said grid that said tube will discharge, a rectifier in the plate circuit of said tube, and means for applying an alternating potential to said rectifier, said rectifier being so poled that the application through said rectifier to said plate circuit of said alternating voltage will so reduce the positive voltage applied to said plate that said tube will be extinguished.

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