

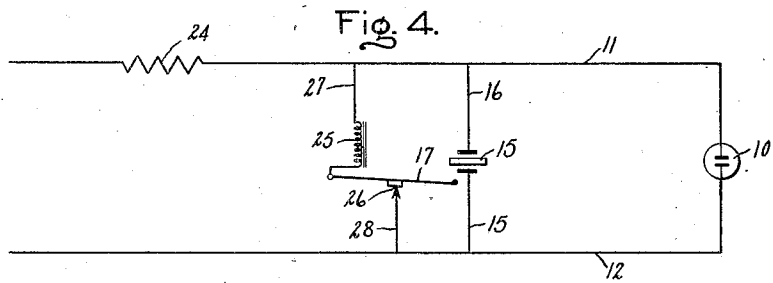
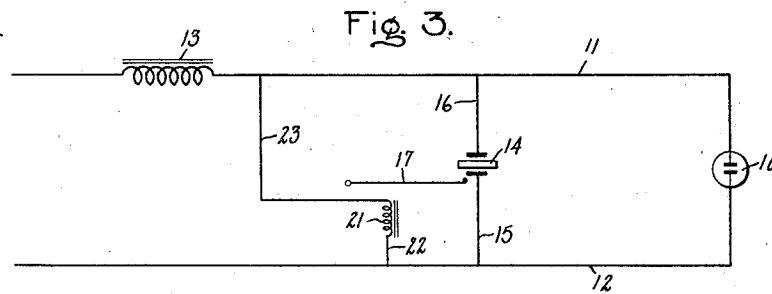
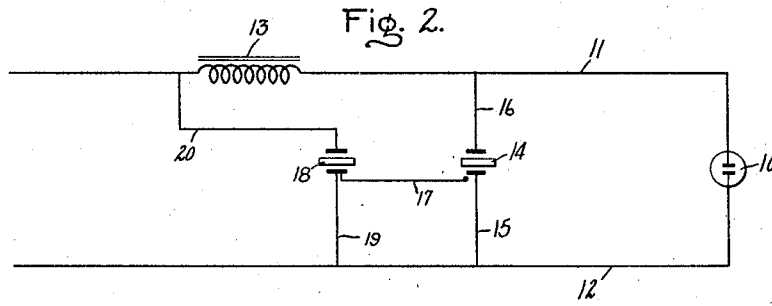
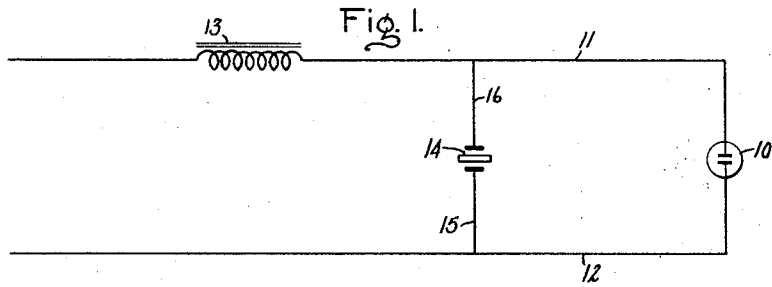
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2,123,056

STARTING CIRCUIT FOR ELECTRIC DISCHARGE DEVICES

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# UNITED STATES PATENT OFFICE

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## STARTING CIRCUIT FOR ELECTRIC DIS- CHARGE DEVICES

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5 Claims. (Cl. 176—124)

My invention relates to electric discharge de-  
vices generally, and more particularly to a  
method and apparatus for starting and operating  
such devices.

5 One of the objects of my invention is to pro-  
vide a novel and exceedingly simple circuit for  
starting and operating electric discharge devices  
such as gaseous electric discharge lamps con-  
taining a rare gas, such as argon or neon and/or  
10 metallic vapor, such as mercury. According to  
my invention, I provide a starting circuit com-  
prising a piezo-electric crystal which, when  
physically deformed, generates piezo-electricity  
of sufficient voltage to start the discharge device.  
15 The deformation of the crystal may be accom-  
plished manually or by means of a reed or other  
member which is caused to vibrate and strike the  
crystal when the circuit is closed. Other features  
and advantages of my invention will appear from  
20 the following detailed description of species  
thereof.

In the drawing, Fig. 1 is a diagram of a start-  
ing circuit comprising my invention, and Figs.  
2, 3 and 4 are diagrams of modifications of the  
25 starting circuit.

Referring to Fig. 1, the electric discharge lamp  
10 is connected by conductors 11 and 12 across  
the terminals of a source of current of, for ex-  
ample, 110 volts. A choke coil 13 may be inserted  
30 in the conductor 11 in series with the lamp 10  
to serve as a ballast therefor. For starting the  
lamp 10, I provide a piezo-electric crystal 14,  
preferably a Rochelle salt crystal, which is con-  
nected across the lamp by conductors 15 and 16,  
35 the conductor 15 being shown connected to con-  
ductor 12 and the conductor 16 being shown con-  
nected to conductor 11 at a point between the  
lamp and the choke coil 13. The crystal 14  
may consist of a single crystal with a metallic  
40 foil connected to opposite surfaces in which case  
one lead 15 is connected to foil and the other lead  
16 is connected to the other foil, or the said  
crystal 14 may consist of two crystals with a foil  
cemented between the adjacent surfaces and  
45 another foil on each of the opposite surfaces in  
which case one lead 15 is connected to the middle  
foil and the other lead 16 is connected to the  
two outer foils. The said crystal 14 may be sup-  
ported at the ends and deformed by striking it  
50 at the middle or it may be supported at three  
corners and deformed by striking it at the fourth  
corner.

To start the lamp 10, the conductors 11 and  
12 are connected to the line and the crystal 14  
55 is deformed, as by striking it a sharp blow. When

the crystal 14 is deformed, it generates piezo-  
electricity of sufficient voltage (500 volts, for  
example) with a peaked wave front to start the  
lamp 10 which then continues to operate with  
the choke 13 as a ballast. The choke coil 13 5  
provides sufficient inductance in the circuit to  
prevent the high voltage generated by the crystal  
14 from being fed back and shorted through the  
line. If desired, a switch may be provided in the  
conductor 15 or 16 to open the circuit to the 10  
crystal 14 after the lamp has started. When oper-  
ating on direct current a resistance is, of course,  
substituted for the choke coil 13.

Fig. 2 illustrates a modification in which means  
are provided for automatically causing the crystal  
14 to be deformed when the circuit is closed to a  
source of alternating current. The said means  
consists of a reed 17 mounted on a second piezo-  
electric crystal 18 which is connected across the  
line by conductors 19 and 20. The said crystal 18  
20 is one whose characteristics cause great defor-  
mation at line voltage. When the circuit is  
closed, the crystal 18 is deformed or deflected at  
a rate equal to the frequency of the line voltage  
(60 cycles, for example), thereby causing the reed  
25 17 to vibrate and strike the crystal 14 which pro-  
duces a high voltage with a peaked wave front to  
start the lamp 10. The vibration of the reed 17  
and the voltage generated by crystal 14 will not  
affect the operation of the lamp after it has  
30 started due to the amount of current produced by  
said crystal which is very small. However, if  
desired, a switch may be provided in conductor  
19 or 20 to open the circuit to crystal 18 after  
35 the lamp 10 has started.

Another method of causing the crystal 14 to  
be deformed when employing a source of alter-  
nating current is shown in Fig. 3 wherein a  
metallic reed 17 is caused to vibrate by the alter-  
nating flux of an electromagnet 21 which is con-  
40 nected by conductors 22 and 23 to the conductors  
12 and 11 respectively. The reed 17 strikes the  
crystal 14 to generate a high voltage to start  
the lamp 10, the same as in Fig. 2.

The circuit shown in Fig. 4 is similar to that  
shown in Fig. 3 but is designed for operation from  
a direct current source. A resistance 24 is, in  
this case, substituted for the choke 13. The  
metallic reed 17 is caused to vibrate as it is 45  
alternately attracted by a magnetic coil 25 and  
pulled back against a contact 26. The coil 25  
is connected across the line by a conductor 27,  
armature or reed 17, contact 26 and conductor  
28. The vibrating reed 17 strikes the crystal 14 55

to generate a high voltage to start the lamp 10, the same as in Fig. 3.

My invention is applicable to the starting of metallic vapor lamps, such as high pressure mercury lamps, for example, of the type shown in Patent No. 2,009,211, J. A. St. Louis, or of the type shown in my application Serial No. 102,554, filed September 25, 1936, when the starting electrode is omitted therefrom.

While I have described my invention by reference to specific embodiments thereof, it is to be understood that the invention is not limited thereto, but that various changes, substitutions or omissions may be made in the method and apparatus shown and described without departing from the spirit of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. The method of starting an electric discharge lamp device having electrodes sealed therein which comprises connecting said device to the terminals of a source of current, connecting a piezo-electric crystal across the terminals of said device and causing said crystal to be deformed to generate piezo-electricity of sufficient voltage to start a discharge between the electrodes in said device.

2. A circuit for starting an electric discharge lamp device having electrodes sealed therein comprising means for connecting said device to a source of current, and a piezo-electric crystal connected across the terminals of said device whereby when said crystal is deformed it generates piezo-electricity of sufficient voltage to start a discharge between the electrodes in said device.

3. A circuit for starting an electric discharge lamp device having electrodes sealed therein com-

prising means for connecting said device to a source of current, a piezo-electric crystal connected across the terminals of said device, a reed located adjacent to said crystal and means for causing said reed to be vibrated upon closing of the circuit, said reed thereby striking said crystal which generates piezo-electricity of sufficient voltage to start a discharge between the electrodes in said device.

4. A circuit for starting an electric discharge lamp device having electrodes sealed therein comprising means for connecting said device to a source of alternating current, a piezo-electric crystal connected across the terminals of said device, a second piezo-electric crystal connected across said current source and having a reed attached thereto and extending adjacent to said first-mentioned crystal whereby when the circuit to said current source is closed the said second-mentioned crystal is caused to vibrate and the said reed strikes said first-mentioned crystal which generates piezo-electricity of sufficient voltage to start a discharge between the electrodes in said device.

5. A circuit for starting an electric discharge lamp device having electrodes sealed therein comprising means for connecting said device to a source of current, a piezo-electric crystal connected across the terminals of said device, a reed located adjacent to said crystal and an electromagnetic coil adjacent to said reed, said coil causing said reed to be vibrated upon closing of the circuit and said reed thereby striking said crystal which generates piezo-electricity of sufficient voltage to start a discharge between the electrodes in said device.

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