March 21, 1933. K. B. McEACHRON ET AL 1,902,510

ELECTRICAL DISCHARGE DEVICE

Filed Jan. 20, 1932

Fig. 1.

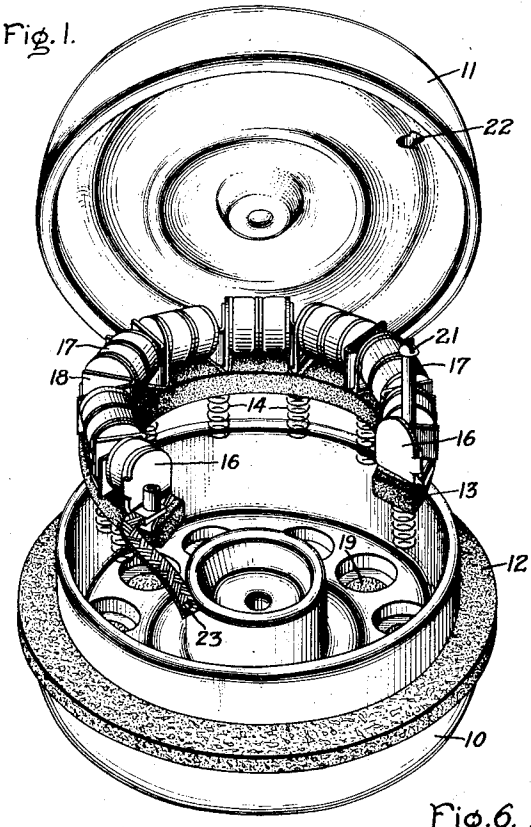



Fig. 2.

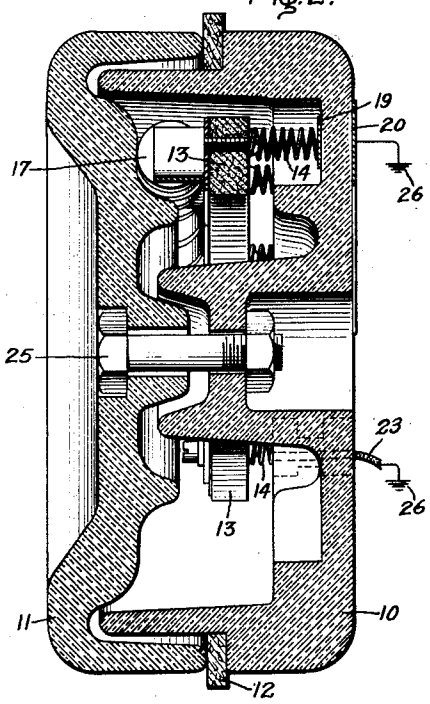



Fig. 3.

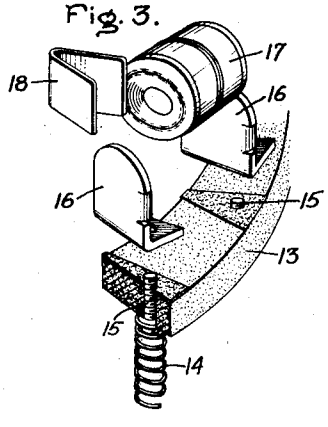



Fig. 6.




Fig. 4.

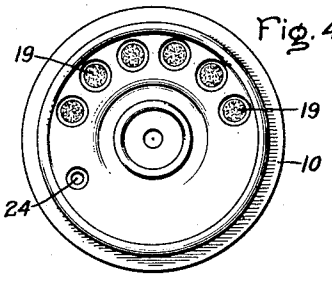



Fig. 8.

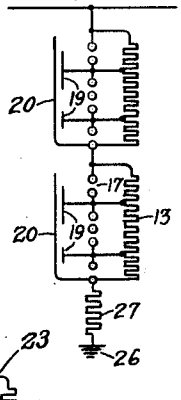



Fig. 5.

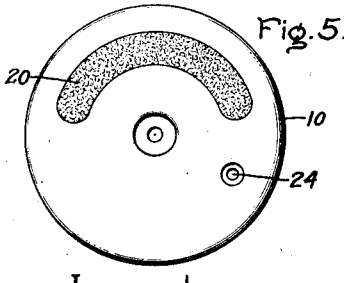
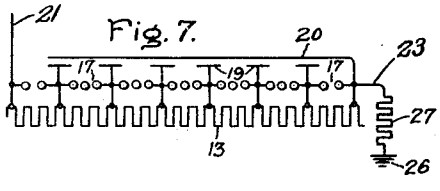



Fig. 7.




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# UNITED STATES PATENT OFFICE

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## ELECTRICAL DISCHARGE DEVICE

Application filed January 20, 1932. Serial No. 587,716.

Our invention relates to electrical discharge devices such as are used for protecting electrical transmission lines and apparatus from excess voltages. More particularly, the invention relates to an electrical discharge device provided with a series of spark gaps with means for distributing an applied normal voltage in a predetermined manner between the gaps under normal operating conditions and for disturbing this voltage distribution when an abnomal voltage is applied to cause the gaps to break down.

The invention will be better understood from the following description taken in connection with the accompanying drawing in which Fig. 1 is a view of a discharge device constructed in accordance with the invention, the parts of the device being separated to show the construction more clearly; Fig. 2 is a sectional view of the discharge device with the parts assembled; Fig. 3 is an explanatory, perspective view of a detail of the construction; Fig. 4 is an inside view of the base of the casing; Fig. 5 is a view of the bottom of the casing; Fig. 6 is a sectional view of a spark gap assembly; Fig. 7 is a diagrammatic view of the electrical circuits, and Fig. 8 is a diagrammatic view of two units connected in series between a line and ground. Like reference characters indicate similar parts in the above figures of the drawing.

The discharge device as shown in the drawing includes a casing having a base portion 10 and a cover 11 formed of insulating material such as porcelain. The base and cover are fitted together with an interposed gasket 12 to keep out moisture. A curved strip of resistance material 13 is supported in the casing by a plurality of conductive springs 14, the lower ends of the springs resting in depressions in the base 10 and the upper ends of the springs being connected to screws 15 extending through the resistance strip 13. A terminal 16 is secured to the upper surface of the resistance strip 13 by each of the screws 15. A spark gap assembly 17 is inserted between each adjacent pair of terminals 16 and held in place by a spring 18.

The lower end of each spring 14 rests on a conductive coating 19 in the bottom of the corresponding depression in the base 10. A conductive coating 20 is applied to the outer surface of the base 10 opposite all of the inner coatings 19. One of the end terminals 16 is provided with a projection 21 which extends through an opening 22 in the cover 11 and the other end terminal 16 is provided with a projection 23 extending through an opening 24 in the base 10, these projections 21 and 23 serving as terminal connections for the discharge device. The base 10 and cover 11 are held tightly together by a bolt 25, the inner surface of the cover pressing on the gap assemblies 17 to hold these gap assemblies and the resistance strip 13 and springs 14 in place.

With the construction which has been described, a section of the resistance strip 13 is connected in parallel with each of the gap assemblies 17 and each of the terminals 16 is electrically connected to the conductive coating 20 through its spring 14 and the capacity between the corresponding inner coating 19 and the outer coating 20. This outer conductive coating 20 is connected to a ground 26 and in some cases it may be desirable to connect the coating 20 to the ground 26 through a resistance 27.

The resistance strip 13 has a very high resistance so that the leakage-current under normal operating conditions will be very small. The current through this resistance 13, however, at normal operating frequency will determine the distribution of voltage across the several gap assemblies 17. The capacities between the coatings 19 and 20 are so small that at normal operating frequency the current to ground through these capacities from the terminals 16 is negligible and has no appreciable effect on the distribution of voltages across the gap assemblies. The current through these capacities, however, will increase very rapidly with an increase in frequency although this change in frequency changes the current through the resistance only to the extent that the voltage across the resistance changes. Thus, whereas at normal operating frequency the resistance current predominates and maintains a uniform voltage distribution throughout the

series of gaps, the capacity current will predominate under steep wave front or high frequency conditions and result in a non-uniform distribution of voltage to cause progressive breakdown of the gaps. Therefore, when a voltage having a steep wave front or high frequency is applied across the terminals 21 and 23, the distribution of voltage between the gap assemblies is determined by the capacities between the coatings 19 and 20. The voltages necessary to break down the gaps between the gap assemblies are proportional to the respective gap settings and will therefore all be equal if the gap settings are equal. The values of the capacities between the coatings 19 and 20 are large as compared with the capacities across adjacent gaps so that the currents through these capacities under high frequency conditions will be comparatively large so as to determine the high frequency voltage distribution between the gap assemblies.

Where the operating voltage is higher than that for which a single unit, such as has been described, is designed, a plurality of units may be connected in series as indicated diagrammatically in Fig. 8.

The invention has been explained by describing and illustrating a particular form of the invention, but it will be apparent that changes may be made without departing from the spirit of the invention and the scope of the appended claims.

What we claim as new and desire to secure by Letters Patent of the United States, is,—

1. An electrical discharge device including an insulating casing, a plurality of gap assemblies in said casing, a support for said gap assemblies, springs between said support and the inner surface of said casing and connected to said gap assemblies, a conductive member between each spring and the inner surface of said casing, and a conductive member on the outer surface of said casing and extending opposite all of said inner conductive members.

2. An electrical discharge device including an insulating casing having a base and a cover, a plurality of gap assemblies in said casing, a support for said gap assemblies, springs between said support and the inner surface of said base and connected to said gap assemblies, a conductive member between each spring and the inner surface of said base, a conductive member on the outer surface of said base and extending opposite all of said inner conductive members, and means for holding said cover against said gap assemblies to hold them in place in said casing.

3. An electrical discharge device including an insulating casing having a base and a cover, a plurality of gap assemblies in said casing, a support for said gap assemblies, springs between said support and the inner surface of said base and connected to said gap assemblies, a conductive member between each spring and the inner surface of said base, a conductive member on the outer surface of said base and extending opposite all of said inner conductive members, and means including said cover for holding said gap assemblies in place in said casing.

In witness whereof, we have hereunto set our hands.

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