

June 10 , 1924.

1,496,818

D. T. MAY

ELECTRICAL SWITCHING CIRCUIT

Filed Dec. 21, 1920

Fig. 1.

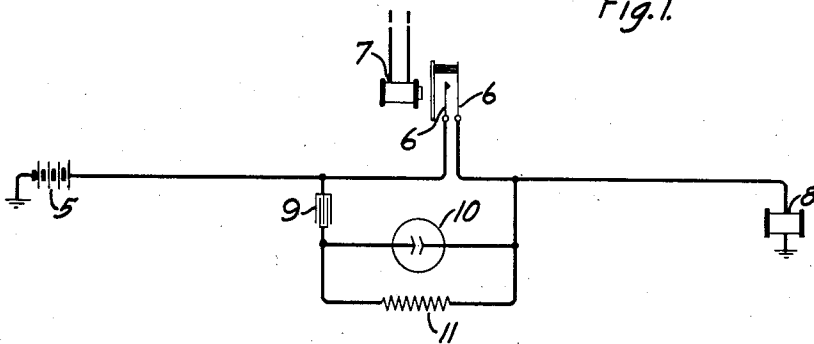


Fig. 2.

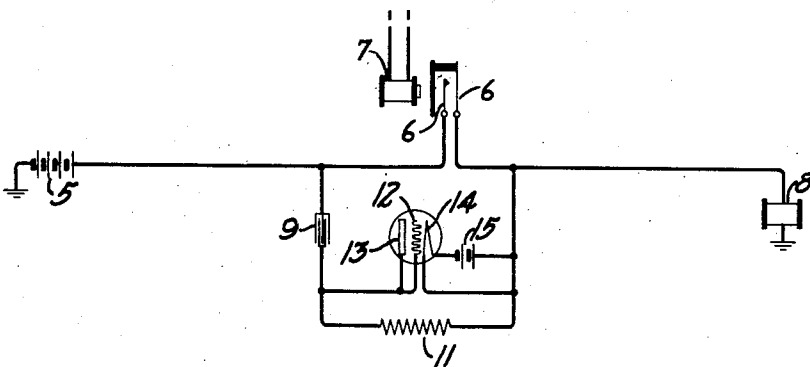
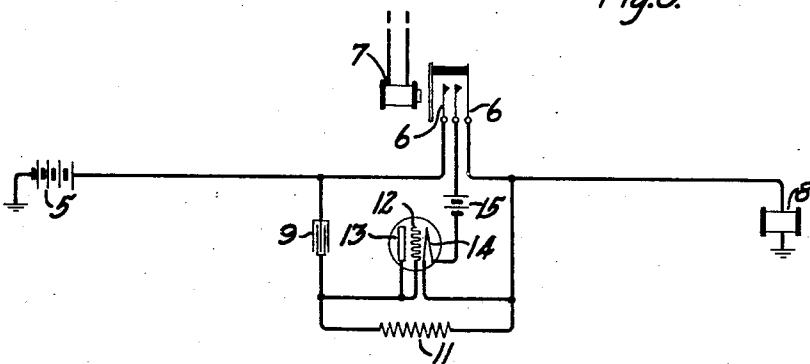


Fig. 3.



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UNITED STATES PATENT OFFICE.

DAVID T. MAY, OF NEW YORK, N. Y., ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

ELECTRICAL SWITCHING CIRCUIT.

Application filed December 21, 1920. Serial No. 432,198.

To all whom it may concern:

Be it known that I, DAVID T. MAY, a citizen of the United States, residing at New York, in the county of New York, State of New York, have invented certain new and useful Improvements in Electrical Switching Circuits, of which the following is a full, clear, concise, and exact description.

This invention relates to electrical switching circuits and more particularly to such a circuit in which means is provided to eliminate excessive sparking at the switch contacts.

In connection with the protection against transient voltages resulting from the opening or closing of a highly inductive electrical circuit, it is the ordinary practice to connect a capacity or a capacity and resistance in series across the contacts or across the inductive load. For the reduction of the transient voltages, a capacity alone, if of the proper value, is the most efficient arrangement. However, when thus used the capacity remains charged until the subsequent closing of the circuit when it discharges across the closing contacts, causing intense heating and frequently resulting in pitting and welding of the contacts.

To limit the current flow upon discharge of the capacity, it is the well known practice to employ a resistance in series with a condenser. This resistance, however, lowers the efficiency of the condenser as related to its ability to absorb the transient voltages, and the condenser-resistance combination is, therefore, at best, a compromise in that it cannot be made the most efficient for protecting the contacts both upon opening and closing of the circuit. Other methods of protection, employing condensers, have been proposed, such for instance as the preliminary break key; but such a scheme is dependent more or less upon the speed of operation of the key and it is at times difficult to associate with the circuit which it is desired to protect.

It is the object of the present invention to provide a switching system in which the contact members are efficiently protected against arcing, both when the circuit is closed and when it is opened. It is a further object of the invention to provide such an arrangement which is compact and can with little difficulty be adapted for use with standard circuit arrangements.

To accomplish these objects and in accordance with a feature of the invention, there is provided a circuit arrangement in which a capacity element is bridged across the contact members or across the load to absorb the transient voltages, and additional means are provided to allow this condenser to operate efficiently upon absorbing the transient voltages, but to discharge at a current rate so low as not to cause excessive arcing at the contacts.

These and other features of the invention may be more fully understood by reference to the accompanying drawing in which Fig. 1 discloses an inductive circuit in which the switching members are protected in accordance with a feature of the invention; Fig. 2 discloses a somewhat similar arrangement in which a vacuum tube is employed as a rectifying element; and Fig. 3 discloses an arrangement similar to that disclosed in Fig. 2, but differing in that the filament circuit of the vacuum tube is controlled by the switching member.

Referring more particularly to Fig. 1, there is disclosed a circuit arrangement in which current flows from battery 5 through the contacts 6, 6 of a circuit-controlling relay 7, and through an inductive coil 8, to ground. A condenser 9 and an asymmetric cell 10 are connected in series and bridged across the contact members 6, 6. In parallel with the cell 10 there is connected a resistance element 11, which preferably is of the order of one or two megohms. The cell 10 is so connected that its resistance is very low to current flowing from the condenser 9, thus permitting the condenser to efficiently absorb any transient voltages due to the opening of contact 6, 6. Upon the closing of these contacts, the condenser 9 discharges through the contacts 6, 6 and the resistance element 11, the connection of the cell 10 being such as not to permit current to flow in that direction. Since the resistance element 11 may be made of high value, the condenser discharges at such a low current rate as to cause no damage to the contact members 6, 6.

In the arrangement disclosed in Fig. 2, a vacuum tube is employed as the asymmetric cell and is connected in series with the condenser 9 across the contact points 6, 6. The grid member 12 and the plate member 13 are connected together and the filament 14 is

supplied with current from a battery 15. A resistance element 11 is bridged across the vacuum tube as shown. The operation of this circuit is the same as that described above. Upon the opening of the contacts, the transient voltages are absorbed by the condenser 9, which is in series with the vacuum tube, the resistance between the grid and filament of which is low for current flowing in this direction. Upon closing of the contacts, the condenser discharges across the contacts and through the high resistance element 11, the apparent resistance of the vacuum tube being extremely high for current flowing from the filament to the grid.

With the arrangement described above, it is necessary to have the current flowing continuously through the filament circuit. To eliminate this waste of current it is preferable to employ the arrangement disclosed in Fig. 3 in which there is provided an extra pair of contacts which are connected with the filament circuit and are under control of the switching relay 7, so that the filament circuit is closed prior to the closing of this circuit through the contacts 6, 6, and remains closed until after the opening of the circuit through the contacts 6, 6.

The arrangements disclosed have been found to be equally efficient in suppressing arcing due to transient voltages at the switching contacts both upon opening and closing of inductive circuits, and these arrangements can be easily applied to a great majority of inductive circuits to eliminate excessive sparking.

What is claimed is:

1. In an electrical circuit having a pair of contacts to be protected, a condenser, an asymmetric cell connected in series with said condenser across said contacts, means for rendering said asymmetric cell operable immediately prior to the closing of said con-

tacts, and a resistance element in parallel with said cell.

2. An electrical circuit having a pair of contacts to be protected, a condenser adapted to absorb transient voltages, means connected in series with said condenser and contacts to provide a low resistance path to current flowing only in one direction to charge said condenser, means for rendering said first means operable immediately prior to the closing of said contacts, and additional means to provide a high resistance path to current flowing in the opposite direction to discharge the condenser.

3. In an electrical circuit, a switching member including a pair of contacts to be protected, a condenser connected in series with a vacuum tube across said contacts to absorb transient voltages, an additional contact on the switching member adapted to close the filament circuit of the vacuum tube immediately prior to the closure of said pair of contacts and to open said circuit immediately after the opening of the circuit through said pair of contacts, and a resistance element in parallel with the vacuum tube.

4. In an electrical circuit, a switching member including a pair of contacts to be protected, a condenser connected in series with a vacuum tube across said contacts to absorb transient voltages, a third contact on said switching member and cooperating with one of said pair of contacts whereby the filament circuit of the vacuum tube is closed before said pair of contacts are closed, and a resistance element in parallel with said vacuum tube.

In witness whereof, I hereunto subscribe my name this 18th day of December, A. D. 1920.

DAVID T. MAY.