

C. E. EVELETH.

PROTECTIVE DEVICE FOR SERIES TRANSFORMERS.

APPLICATION FILED NOV. 12, 1904.

2 SHEETS—SHEET 1.

Fig. 1.

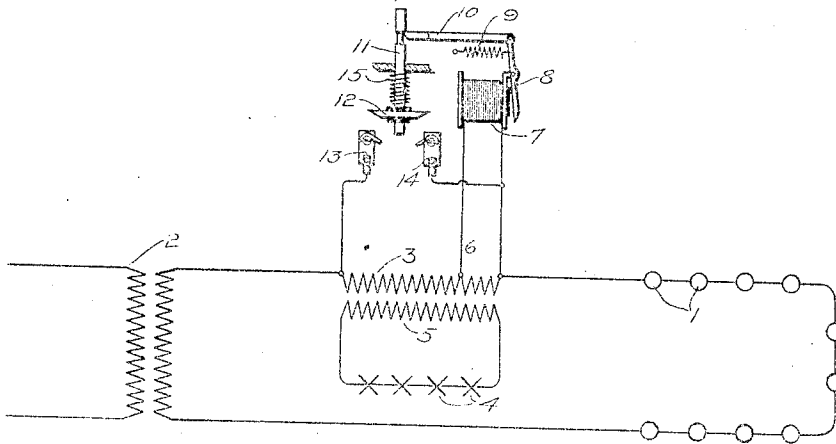
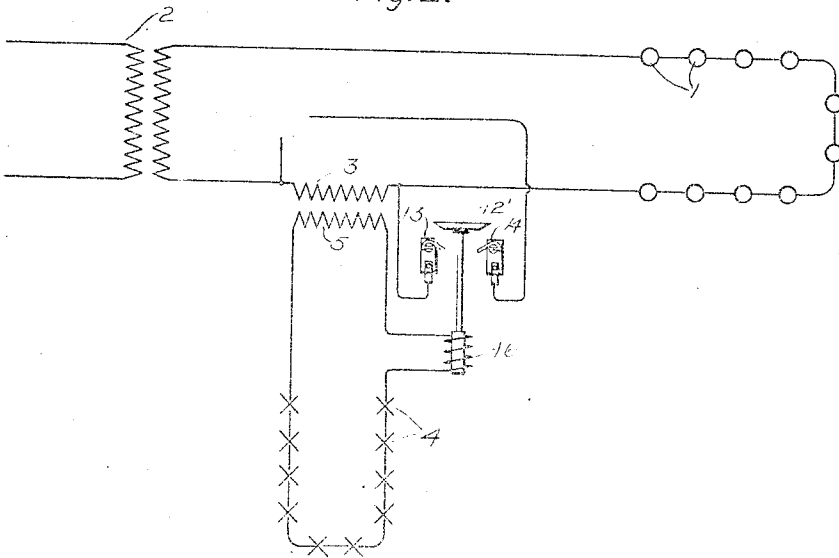


Fig. 2.



Witnesses:

William B. Hulse
Allen O. Ford

Inventor:

Charles E. Eveleth.
by *Albert H. Davis*
Att'y.

C. E. EVELETH.

PROTECTIVE DEVICE FOR SERIES TRANSFORMERS.

APPLICATION FILED NOV. 12, 1904.

2 SHEETS—SHEET 2.

Fig. 3.

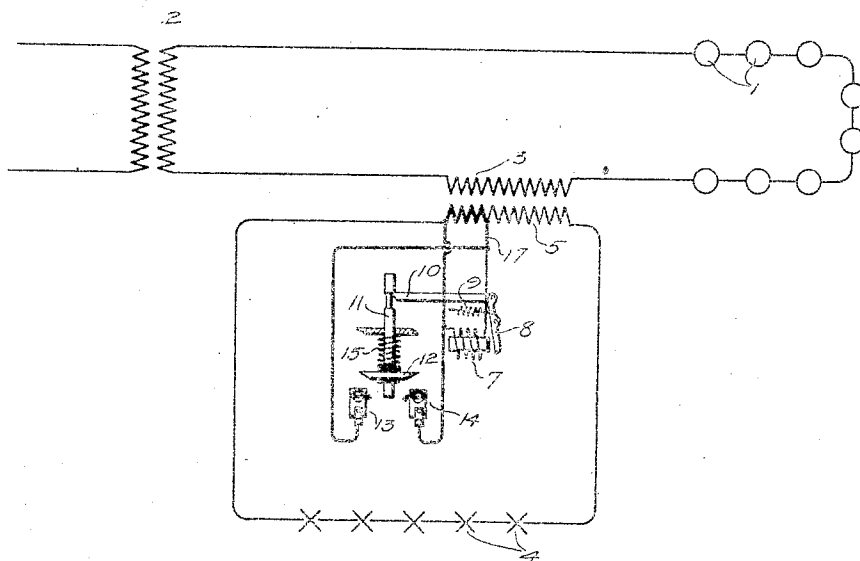
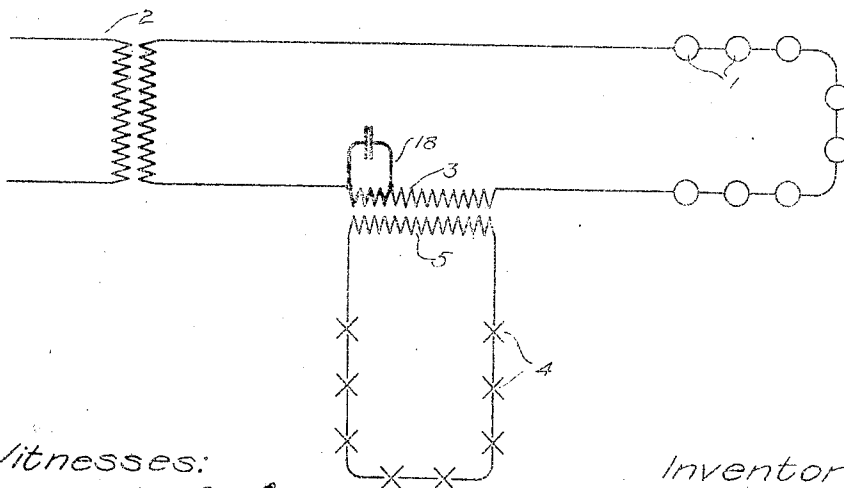


Fig. 4.



Witnesses:

Benjamin B. Huce
Allen Oxford

Inventor:

Charles E. Eveleth
by Albert H. Smith
Att'y.

UNITED STATES PATENT OFFICE.

CHARLES E. EVELETH, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

PROTECTIVE DEVICE FOR SERIES TRANSFORMERS.

No. 863,183.

Specification of Letters Patent.

Patented Aug. 13, 1907.

Application filed November 12, 1904. Serial No. 232,463.

To all whom it may concern:

Be it known that I, CHARLES E. EVELETH, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Protective Devices for Series Transformers, of which the following is a specification.

In electrical systems of the constant current type it is common to insert a series transformer in the main circuit and thus supply a local circuit with constant current of a higher or lower value than that in the main circuit. This arrangement is particularly useful when the load consists of a mixture of arc and incandescent lamps, and is rendered necessary by the difference in the current-carrying capacity of such lamps as commonly manufactured. Incandescent lamps adapted for use on series circuits are operated on approximately one and one half amperes, whereas arc lamps require say seven and one half. Some system of transformation is therefore necessary when a mixed load is carried. This transformation may be produced by a transformer having its primary connected in series with the main circuit and its secondary supplying constant current to the local circuit. As the secondary of the transformer normally operates on closed circuit the primary affords substantially no impedance to the main line current under normal conditions of working, but if for any reason the secondary circuit is open the demagnetizing action of the secondary current on the transformer core will no longer be present and the transformer primary will act as a powerful reactive coil to the main line current.

It is the object of this invention to provide a means whereby no detrimental reactive effect will be produced by the series transformer when the local circuit is opened, or when for any reason the secondary current decreases abnormally in value.

Figure 1 is a diagrammatic representation of one species of my invention in which a short-circuiting switch is provided for automatically short-circuiting the primary of the transformer when the voltage across the primary reaches an abnormal value because of the failure of current in the local circuit; Fig. 2 shows a short-circuiting switch for a series transformer controlled directly by the current in the local circuit; Fig. 3 shows a switch which automatically short circuits a portion of the secondary winding of the series transformer thus producing a local circuit through the short-circuited turns of such value as to prevent an abnormal reactance of the primary on the main circuit; Fig. 4 shows an arrangement in which the local short circuit is produced by the break down of a film cut-out of ordinary form shunted across a portion of the primary winding.

Throughout all the drawings the same reference numerals apply to similar parts.

The series lamps 1 or other constant current translating devices are operated by current from a constant current source 2, such as a movable coil transformer or constant current dynamo of ordinary form. In series with these lights is a primary 3 of a constant current transformer for supplying a local circuit through arc lamps 4, or other suitable translating devices having a current carrying capacity different from that of the lamps 1.

When normal current is flowing through the arc lamps 4 and through the secondary 5 of the series transformer the reactance offered by the primary 3 to the current in the main circuit is comparatively small, but on the other hand if for any reason the local circuit through the arc lamps is opened, as by failure of one of the lamps, the primary 3 will operate as a powerful reactance in the main circuit and thus cut down the current in the main circuit to such a value as to make the operation of the series lamps unsatisfactory. To overcome this difficulty I provide an automatic means for either short-circuiting the primary winding of the transformer, or for establishing a local current in one of the transformer windings of sufficient value to practically remove the reactive power of the transformer. In Fig. 1 the primary winding is provided with a tap 6 and electromagnet 7 is connected between this tap and one end of the primary. This electromagnet is provided with a movable armature 8, the lower end of which is normally held at some distance from the core of the electromagnet 7 by coil spring 9. A horizontal tripping bar 10 is pivoted to the upper end of armature 8 and serves as a trigger for a vertically moving plunger 11. This plunger carries at its lower end a metallic cross piece 12 which serves as a switch to electrically connect two terminals 13 and 14 connected to the respective ends of the primary winding. A coil spring 15 encircling the plunger 11 serves to firmly seat the switch 12 on these terminals 13 and 14 when the tripping bar 10 is withdrawn by the action of armature 8. The winding of the electromagnet 7 is so proportioned with respect to the strength of coil spring 9 and the voltage supplied from the transformer tap that under normal conditions of operation the attractive power of the electromagnet is not sufficient to overcome the moment exerted by the coil spring 9 and the tripping bar and plunger remain in the position shown. If however one of the lamps in the local circuit becomes accidentally open-circuited, or if for any reason the local current decreases abnormally in value, the voltage across the primary 3 will immediately increase and the increased current in electromagnet 7 will be sufficient to attract the armature 8 and withdraw the tripping bar 10, and thus permanently short-circuit the primary winding and so prevent an abnormal decrease in the main line current.

In Fig. 2 a solenoid 16 is connected in series with the

local circuit and operates to hold the short-circuiting plate 12' out of contact with the terminals 13 and 14, but permits a short-circuit to be established across the transformer primary upon an abnormal decrease in current in the local circuit.

In Fig. 3 a tap 17 is provided on the secondary of the series transformer and the winding between this tap and one end of the secondary is made extra heavy and capable of carrying continuously a heavy local current. The tripping electromagnet and the short-circuiting plunger are in all respects similar to those shown in Fig. 1 and the operation is the same, except that instead of short-circuiting the transformer primary, the short circuit is across a few turns of the secondary winding, thus producing a heavy local current through these turns and permitting the passage of enough current through this local circuit to prevent an abnormal increase in reactance in the transformer primary.

In Fig. 4 a tap 18 is provided for the primary winding and a film cut-out of ordinary form is connected between this tap and one end of the winding so that upon abnormal increase in voltage, as by failure of the current in the local circuit, the film cut-out will be broken down and a local short circuit produced through the heavy transformer turns shunted by the film cut-out, thus preventing an abnormal increase in the reactive effect of the primary. It is obvious that this film cut-out might be inserted across a portion of the secondary winding, if such an arrangement appeared desirable, but by using it across a portion of the primary the increase in cross section of the winding to secure ample current carrying capacity for the local current is considerably less than would otherwise be necessary. If desired the film cut-out may be used in Fig. 1 in series with the tap 6 to increase the operating voltage of the electromagnet 7, but such a modification I believe to be included within the scope of my invention, as defined by the appended claims. Although I believe my invention to be particularly valuable when used in connection with a mixed load of arc and incandescent

lamps it is obvious that it is applicable to circuits containing a mixed load of constant current apparatus of any description.

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

1. In an electrical system, a plurality of translating devices, means for supplying a substantially constant current thereto, a transformer having its primary winding in series with said devices and its secondary winding connected to a normally closed local circuit, a tap for one of said windings, and automatic means connected to said tap for preventing an abnormal decrease in the current through said translating devices when the current in said local circuit is interrupted.

2. In an electrical system, a circuit containing a plurality of translating devices connected in series, means for supplying a substantially constant current thereto, a transformer having its primary winding connected in series with said translating devices and its secondary winding connected to a local circuit, a tap for one of said transformer windings, an electromagnetic device energized by current from said tap, and means operated by said electromagnetic device for automatically short-circuiting turns of one of said windings when the current in said local circuit is decreased abnormally.

3. In an electrical system, a constant current circuit, a transformer connected thereto, a local circuit supplied by current from said transformer, an electromagnet in shunt with a portion of one of said transformer windings, and means actuated by said electromagnet for short-circuiting said winding when the pressure across said electromagnet reaches a predetermined value.

4. In an electrical system, a circuit containing a plurality of translating devices connected in series, means for supplying a substantially constant current thereto, a transformer having its primary winding connected in series with said translating devices and its secondary winding connected to a local circuit, a tap for said primary winding, an electromagnet energized by current from said tap, and means operated by said electromagnet for short-circuiting said primary when the voltage across said primary reaches a predetermined value.

In witness whereof I have hereunto set my hand this 7th day of November, 1904.

CHARLES E. EVELETH.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.