

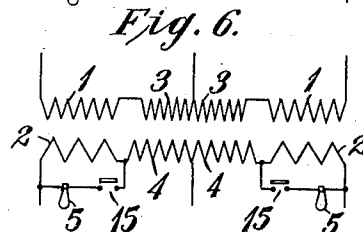
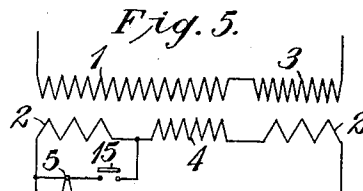
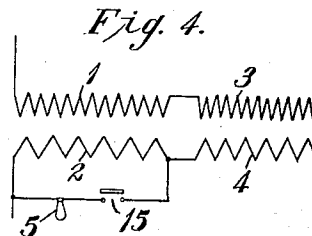
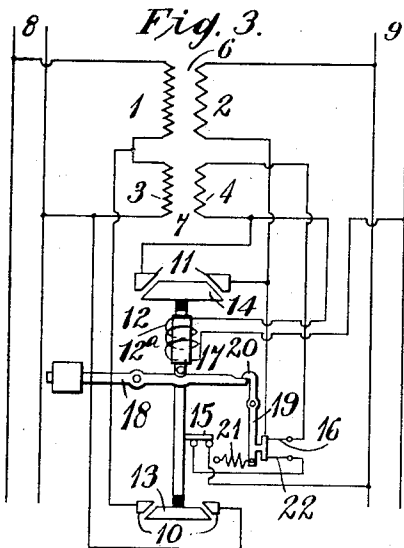
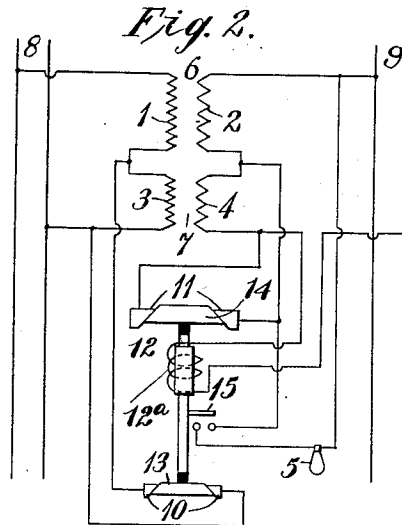
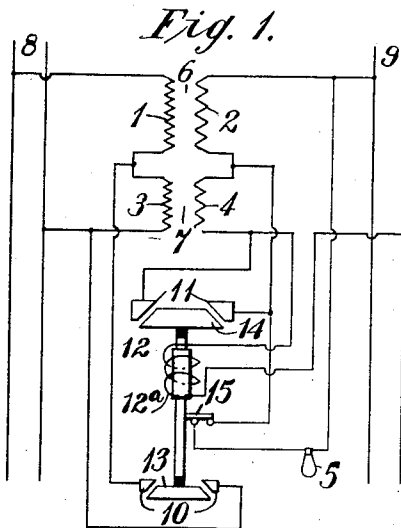
J. S. PECK.
ALTERNATING CURRENT TRANSFORMER SYSTEM.

1,007,482.

APPLICATION FILED OCT. 7, 1909.

Patented Oct. 31, 1911.

2 SHEETS-SHEET 1.



WITNESSES:
Fred H. Miller
R. J. Carlson

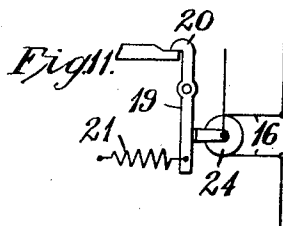
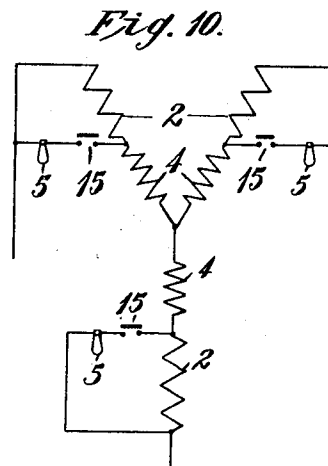
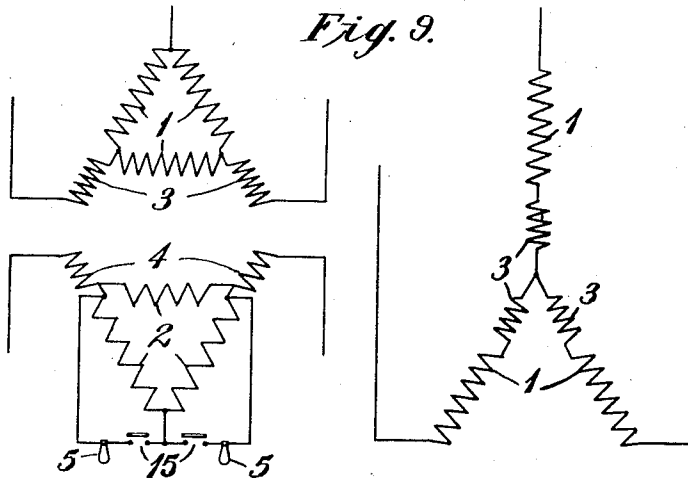
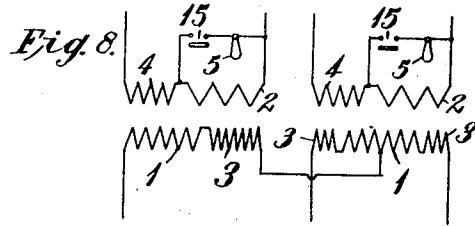
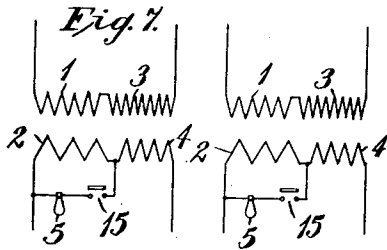
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2 SHEETS—SHEET 2.



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ALTERNATING-CURRENT-TRANSFORMER SYSTEM.

1,007,482.

Specification of Letters Patent.

Patented Oct. 31, 1911.

Application filed October 7, 1909. Serial No. 521,639.

To all whom it may concern:

Be it known that I, JOHN SEDGWICK PECK, a citizen of the United States, and a resident of Trafford Park, Manchester, England, have invented a new and useful Improvement in Alternating-Current-Transformer Systems, of which the following is a specification.

My invention relates to systems of electrical distribution by alternating current transformers and, in particular, to those systems where a main and an auxiliary transformer are connected in series, an automatic switch being provided for opening and closing a short-circuit around the auxiliary transformer in accordance with the load, so that a saving will be effected in the iron losses of the transformers at light loads.

With the above mentioned arrangement, it is possible for the auxiliary transformer to become short-circuited internally without affording any external evidence thereof, the automatic switch continuing to operate in exactly the same way as though the auxiliary transformer was in proper condition. Under these circumstances, the voltage across the main transformer would be always at its maximum value, and, consequently, no saving would be effected in the iron losses and the whole object of the arrangement would be defeated.

It is the object of the present invention to provide means whereby the existence of a short-circuit in the auxiliary transformer may be indicated.

According to my invention, therefore, I provide means, such, for instance, as a lamp or fuse, for indicating whether full voltage exists across the main transformer terminals, when the automatic short-circuiting switch for the auxiliary transformer is open. Alternatively, I may employ a fuse to hold up a lever or weight which would otherwise effect a closure of the short-circuiting switch, this fuse being blown if the auxiliary transformer becomes short-circuited when the short-circuiting switch is open.

In the accompanying drawings, Figure 1 is a diagrammatic view of a distribution system embodying my invention, the automatic switch for short-circuiting the auxiliary transformer windings being shown in its open position. Fig. 2 is a similar view of the system of Fig. 1, but showing the automatic switch in its closed position. Fig. 3

is a diagrammatic view similar to Figs. 1 and 2 but illustrating a modification of the invention. Figs. 4, 5, 6, 7, 8, 9, and 10 are diagrammatic views showing various transformer connections with distributing systems of the kind to which the invention relates and illustrating its application. Fig. 11 is a detail view illustrating a modification of a part of the system of Fig. 3.

Referring now to Figs. 1 and 2, a main transformer 6 and an auxiliary transformer 7 are indicated as connected in series with each other between the supply circuit conductors 8 and the distribution circuit conductors 9, the transformers 6 and 7 being provided with primary windings 1 and 3 and secondary windings 2 and 4, respectively. The terminals of the primary winding 3 and the terminals of the secondary winding 4 of the auxiliary transformer 7 are connected to the stationary contact terminals 10 and 11, respectively, of the short-circuiting switch 12, the movable member of which is provided with bridge pieces 13 and 14 to engage the contact terminals 10 and 11, respectively, when the automatic switch 12 is in its closed position. The switch 12 is provided with an actuating solenoid 12^a that is connected in series with the secondary windings of the transformers and is adapted to close the switch when the load upon the distribution circuit exceeds a predetermined amount.

When the switch 12 is in its open position, as illustrated in Fig. 1, the circuit of the indicating lamp 5, which is connected across the secondary winding 2 of the main transformer 6 is closed by means of a switch 15, the movable member of the switch 15 being carried by the movable member of the automatic switch 12 and the switch 15 being open when the automatic switch 12 is in its closed position, as indicated in Fig. 2.

The operation of the apparatus is as follows: When the switch 12 is in its open position, as shown in Fig. 1, if the auxiliary transformer is in proper order, there will be practically no voltage across the main transformer winding 2, and the lamp 5 will consequently not light. This will be true because the secondary winding 2 has a larger current capacity than the winding 4, with which it is connected in series, and consequently a lower resistance, the result being that by far the greater drop of potential oc-

curs over the winding 4 when the secondary windings are connected in series and there is nothing wrong with the winding 4. If, however, the auxiliary transformer winding is short-circuited, the full voltage of the distribution circuits 9 will be across the main transformer winding 2 and the lamp will consequently burn at full brilliancy.

Referring now to Fig. 3, a modification of the arrangement of Figs. 1 and 2 is illustrated in which the indicating lamp 5 is replaced by a fuse 22, a second fuse 16 being connected, in the usual manner, between the junction of the secondary windings 2 and 4 of the main and auxiliary transformers 6 and 7, respectively, so as to protect the auxiliary transformer. The movable member of the automatic switch 12 is provided with a stop 17 which is adapted to be engaged by one arm of a weighted lever 18 to move the switch 12 into its closed position when said lever is released. The weighted lever 18 is held out of engagement with the stop 17 by means of a pivoted latch 19, one arm of which is provided with a hook 20 to engage one arm of the lever 18 and prevent the said lever from closing the automatic switch 12. Withdrawal of the hook 20 from the end of the lever 18 is effected by means of a spring 21, the fuses 22 and 16 serving to oppose the action of the spring 21 and prevent withdrawal of the hook 20, so long as they remain intact.

The operation of the device is as follows: So long as both the fuses 22 and 16 are intact, the weighted lever 18 is held away from the stop 17 on the movable member of the automatic switch 12, and the said switch can therefore be opened or closed, as desired, in accordance with the load on the distribution circuit. In the event of a short-circuit in the auxiliary transformer, the full voltage of the distribution circuit will be impressed upon both of the fuses 16 and 22 which will be ruptured by the resulting current and thus permit the spring 21 to withdraw the hook 20 from the weighted lever 18. The weighted lever 18 will thereupon engage the stop 17 and move the switch 12 into its closed position to short-circuit the auxiliary transformer winding. The circuit through the fuses when a short circuit occurs in the auxiliary transformer winding 4 is from the right-hand distribution circuit conductor, through the short circuit in the winding 4, fuses 16 and 22, and switch 15 to the left-hand distribution circuit conductor. The large amount of current that will be permitted to flow in this circuit upon the occurrence of a short circuit in the winding 4 is sufficient to melt the fuses 16 and 22. A similar operation will be effected in case the fuses 16 and 22 are destroyed by reason of an overload on the system when the automatic switch 12 is open, so that the said

switch will be automatically closed either when the auxiliary transformer is short-circuited or when it is overloaded. The circuit including the fuses 16 and 22 in which such an excessive amount of current flows as to destroy the said fuses when the distribution circuit is overloaded, is the same as that above described which includes the fuses upon the occurrence of a short circuit in the winding 4.

An alternative arrangement of the device for releasing the closing mechanism of the automatic switch is illustrated in Fig. 11 in which the fuses 22 and 16 are replaced by a single fuse 16 of U-shape which is engaged by a pulley 24 on the latch 19. The pulley 24 is electrically connected to one of the stationary contact terminals 11 of the switch 12 so that the portions of the fuse on the respective sides of the pulley constitute the fuse connected between the junction of the main and the auxiliary secondary windings 2 and 4, and the fuse connected in the circuit of the switch 15, respectively. In case either of these portions of the fuse 16 is destroyed, the hook 20 will be withdrawn by the spring 21 and allow the closing mechanism of the automatic switch to operate, as already described.

Referring now to Figs. 4 to 10 inclusive, various circuit arrangements of transformers are shown in connection with indicating lamps or fuses, the lamps or fuses being indicated at 5 and the switches, which are in circuit therewith, being indicated at 15, in all the figures. It will be understood that, in each of the arrangements shown, the destruction of the fuse (when a fuse is provided instead of an indicating lamp) will cause the automatic switch to close, in the manner above described.

The diagram of Fig. 4 illustrates in a simplified manner the arrangement of the circuits when the invention is used in connection with single phase circuits and transformers, and Fig. 5 illustrates a modification of the circuits in which the secondary winding 4 of the auxiliary transformer is connected between two sections of the secondary winding 2 of the main transformer.

Fig. 6 illustrates the arrangement of the circuits when two main transformers are connected in a V to three-phase circuits.

The diagram of Fig. 7 illustrates the circuit arrangements of the parts when the invention is used in connection with a two-phase system, and in the diagram of Fig. 8, the arrangement of the windings of the main and auxiliary transformer windings is shown when the main transformers are arranged for two-phase to three-phase transformation.

Fig. 9 diagrammatically illustrates the circuits when three main transformers are connected in delta arrangement to three-

phase circuits, and Fig. 10 shows the circuits when three transformers are connected in Y- or star-arrangement.

It is clear that other variations in the manner of carrying out my invention are included within the scope thereof.

I claim as my invention:

1. In an alternating current distribution system, the combination with a main transformer, an auxiliary transformer, and a switch for automatically short-circuiting the auxiliary transformer, of an indicating device connected across the terminals of the main transformer winding, and a switch in the circuit of said indicating device that is closed when the automatic switch for the auxiliary transformer is in its open position, and vice versa.

2. In an alternating current distribution system, the combination with a main transformer, and an auxiliary transformer, of a switch for short-circuiting the auxiliary transformer, and means for automatically closing the short-circuiting switch in the event of a short-circuit within the said transformer.

3. In a system of electrical distribution, the combination with a main transformer, an auxiliary transformer, and a switch for automatically short-circuiting the auxiliary transformer under predetermined load conditions, of an indicating device connected across the terminals of the main transformer, and means for opening and closing the circuit of said indicating device as the short-circuiting switch is closed or opened.

4. In a system of electrical distribution, the combination with a main transformer and an auxiliary transformer normally con-

nected in series, of a switch for automatically short-circuiting the auxiliary transformer under certain load conditions, an indicator electrically connected across the terminals of the main transformer, and a switch in said indicator circuit that is opened and closed by the movable contact member of the short-circuiting switch.

5. In a system of electrical distribution, the combination with a main transformer and an auxiliary transformer normally connected in series therewith, of a normally open short-circuiting switch for the auxiliary transformer, a closing means for said switch, and a releasing means for said closing means comprising a fuse connected across the terminals of the main transformer.

6. In a system of electrical distribution, the combination with a main transformer and an auxiliary transformer normally in series therewith, of a switch for automatically short-circuiting the auxiliary transformer under certain load conditions, a fuse in the secondary circuit of said transformer, a fuse connected across the terminals of the secondary circuit of the main transformer, a closing means for the short-circuiting switch, and a latch for said switch-closing means which is released by the rupture of said shunt connected fuse.

In testimony whereof, I have hereunto subscribed my name this sixteenth day of September, 1909.

JOHN SEDGWICK PECK.

Witnesses:

G. W. FINNICA,
J. C. WHITMEYER.