Sept. 14, 1926. 1,599,570

S. M. LUCAS

TRANSFORMER

Filed August 12 1922

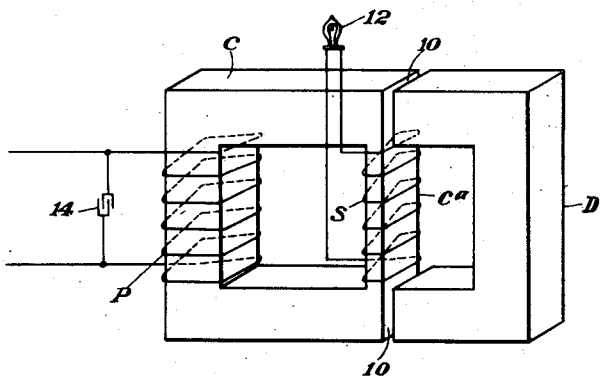


Fig. 1.

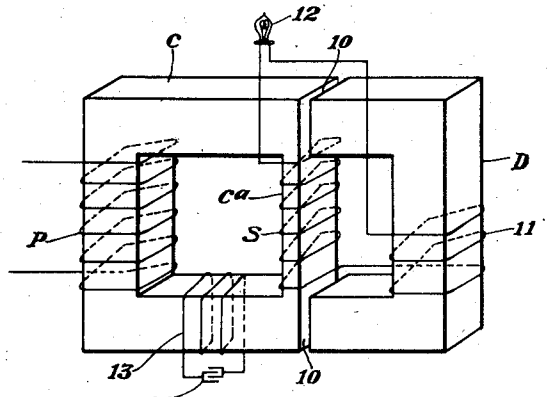


Fig. 2.

WITNESSES:

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TRANSFORMER.

Application filed August 12, 1922. Serial No. 581,398.

My invention relates to electrical transformers, and has for an object the provision of a transformer which will deliver a substantially constant voltage to the secondary circuit under wide variations in the voltage applied to the primary.

I will describe two forms of transformers embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawing, Fig. 1 is a view showing one form of transformer embodying my invention, and Fig. 2 is a view showing a modified form of transformer also embodying my invention.

Similar reference characters refer to similar parts in each of the views.

Referring first to Fig. 1, the transformer comprises a core C of magnetizable material, provided with a primary winding P and a secondary winding S. The portion of the core C^a which carries the secondary winding S is so designed that it is magnetically saturated at the normal voltage applied to the transformer, and in practice it is preferably saturated at some applied voltage less than the normal voltage. The transformer also comprises a member D of magnetizable material which forms a shunt around the portion C^a of the core C, this member being separated from the core by air gaps 10. This member D constitutes a magnetic leakage path in multiple with the saturated path C^a, and the air gaps 10 are such as to force sufficient flux through the saturated path to saturate it at all applied voltages under normal voltage and down to a predetermined minimum.

The primary winding P is, of course, connected with a source of alternating current and the secondary winding S is connected with a current-consuming device which, as here shown, is an electric lamp 12.

Assuming that the voltage applied to the primary winding P is the predetermined minimum referred to above, the portion C^a of core C will be saturated so that the normal amount of current will be delivered to the lamp 12. As the voltage applied to the primary winding P rises, the total magnetic flux due to this winding will increase, but all of the flux in excess of that required to saturate the core member C^a will pass through the leakage member D, so that the voltage supplied to the lamp 12 will remain substantially constant.

Referring now to Fig. 2, the transformer shown in this view is the same as that shown in Fig. 1, except that the leakage member D is provided with an auxiliary winding 11 of a few turns, which turns are included in series with the secondary S in the circuit for lamp 12. With this arrangement, the core member C^a is preferably so designed that at normal voltage it is not completely saturated, so that the voltage induced in secondary S will vary with the variations in the voltage applied to the primary P. The variations in the secondary voltage will be in the same direction as the variations in the primary voltage, but will be considerably smaller in degree. The voltage induced in the auxiliary winding 11, however, varies at a greater rate than the primary voltage, and inasmuch as the voltage of the auxiliary winding opposes that of the secondary winding the voltage applied to lamp 12 can be kept substantially constant even though the core member C^a is not operated at complete saturation.

Transformers embodying my invention are particularly well adapted for railway signaling systems comprising light signals, which signals are usually supplied from an alternating current transmission line through step-down transformers. On account of the fact that a small drop in voltage causes a large decrease in the candle power of the signal lamps, it is necessary to limit this drop to a small value, and this makes it necessary to apply a comparatively high voltage to the transmission line in order to avoid dropping below the permissive voltage at the lamps. By using transformers embodying my invention in a system of this nature, the voltage applied to the lamp can be kept substantially constant in spite of the variations in the line voltage of the transmission line. The watt efficiency of the transformers shown in Figs. 1 and 2 is fairly good, but due to a rather large magnetizing current the volt-ampere efficiency is low. This can be greatly improved by connecting a condenser 14 across the terminals of the primary winding P as shown in Fig. 1, or by connecting this condenser with a third winding 13 on the core C, as shown in Fig. 2.

Although I have herein shown and de-

scribed only two forms of transformers embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In combination, a transformer comprising a magnetizable core having a part of reduced cross-sectional area, a secondary winding on said reduced part of the core and a primary winding on another part of the core, a magnetic leakage member shunting the reduced part of said core, and an auxiliary winding on said leakage member; and an electro-responsive device connected with said secondary winding and said auxiliary winding in such manner that the voltages supplied to the device by the windings are in opposition; the parts being so adjusted that as the voltage applied to said primary winding rises above the normal value the voltage applied to said electro-responsive device remains substantially constant.

2. In combination, a transformer comprising a magnetizable core having a part of reduced cross-sectional area that is magnetically saturated at a voltage above normal, a secondary winding on said reduced part and a primary winding on another part of said core, a magnetic leakage member shunting the reduced part of said core, and an auxiliary winding on said leakage member; and an electro-responsive device connected with said secondary winding and said auxiliary winding in such manner than the voltages supplied to the device by the windings are in opposition; the parts being so adjusted that as the voltage applied to said primary winding rises above the normal value the voltage applied to said electro-responsive device remains substantially constant.

3. In combination, a transformer comprising a magnetizable core, a primary and a secondary winding on said core, a magnetic leakage member shunting the part of said core which carries said secondary winding and an auxiliary winding on said leakage member; and an electro-responsive device connected with said secondary winding and said auxiliary winding in such manner that the voltages supplied to the device by the windings are in opposition; the parts being so adjusted that as the voltage applied to said primary winding rises above the normal value the voltage applied to said electro-responsive device remains substantially constant.

4. In combination, a transformer comprising a magnetizable core having a part of reduced cross-sectional area, a secondary winding on said reduced part of the core and a primary winding on another part of the core, a third winding on said core, a condenser connected with said third winding, a magnetic leakage member shunting the reduced part of said core, and an auxiliary winding on said leakage member; and an electro-responsive device connected with said secondary winding and said auxiliary winding in such manner that the voltages supplied to the device by the windings are in opposition; the parts being so adjusted that as the voltage applied to said primary winding rises above the normal value the voltage applied to said electro-responsive device remains substantially constant.

In testimony whereof I affix my signature.

SAMUEL M. LUCAS.