Aug. 27, 1963 H. W. LAWSON, JR 3,102,245

ELECTRICAL TRANSFORMER

Filed Aug. 3, 1959

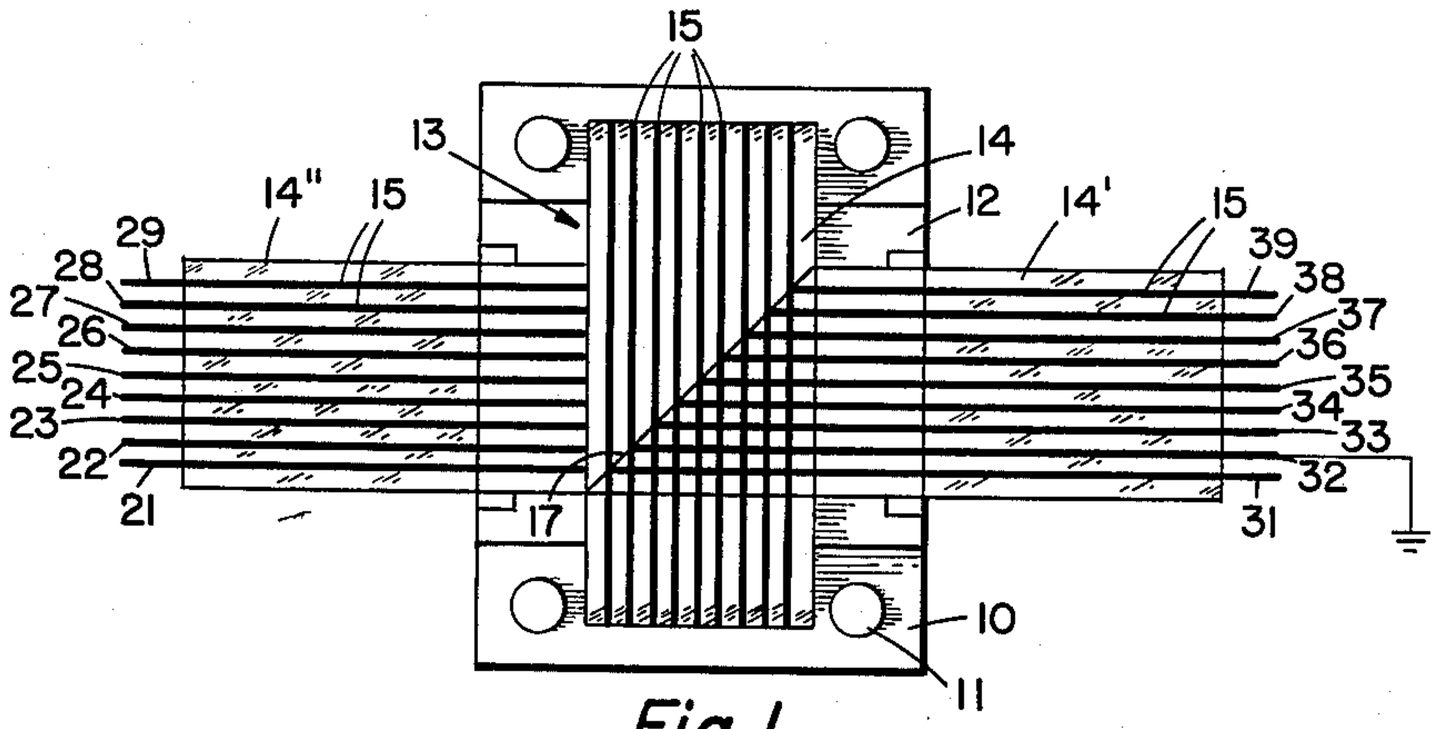

Fig. 1

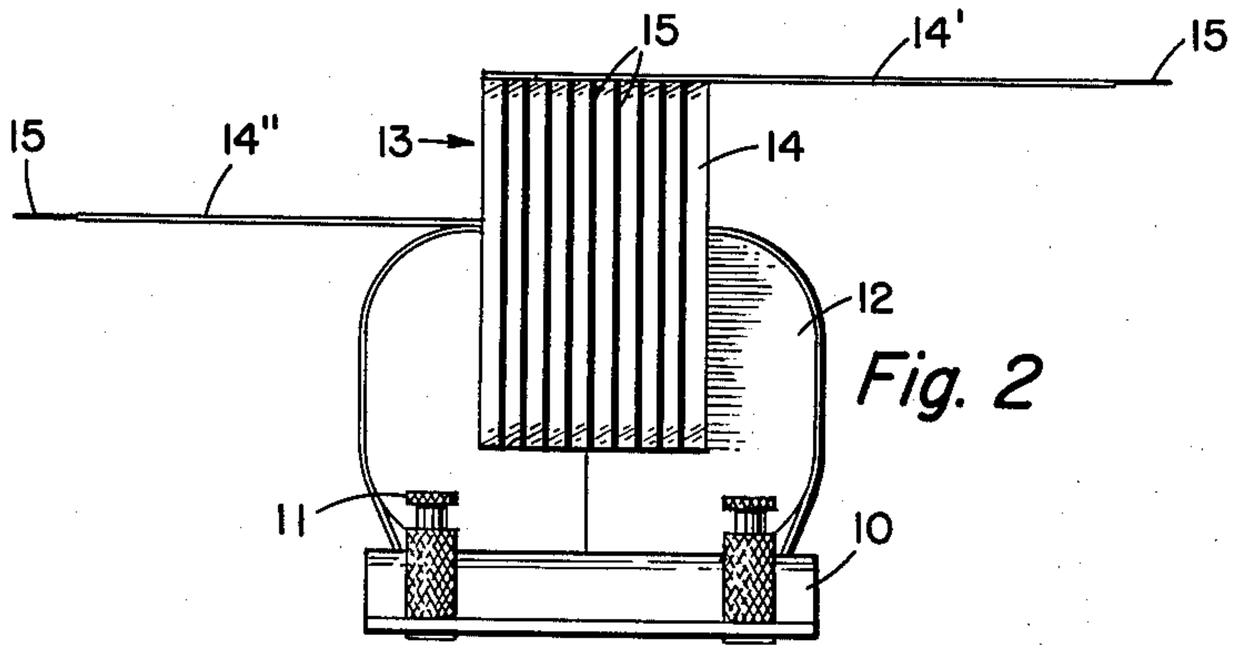

Fig. 2

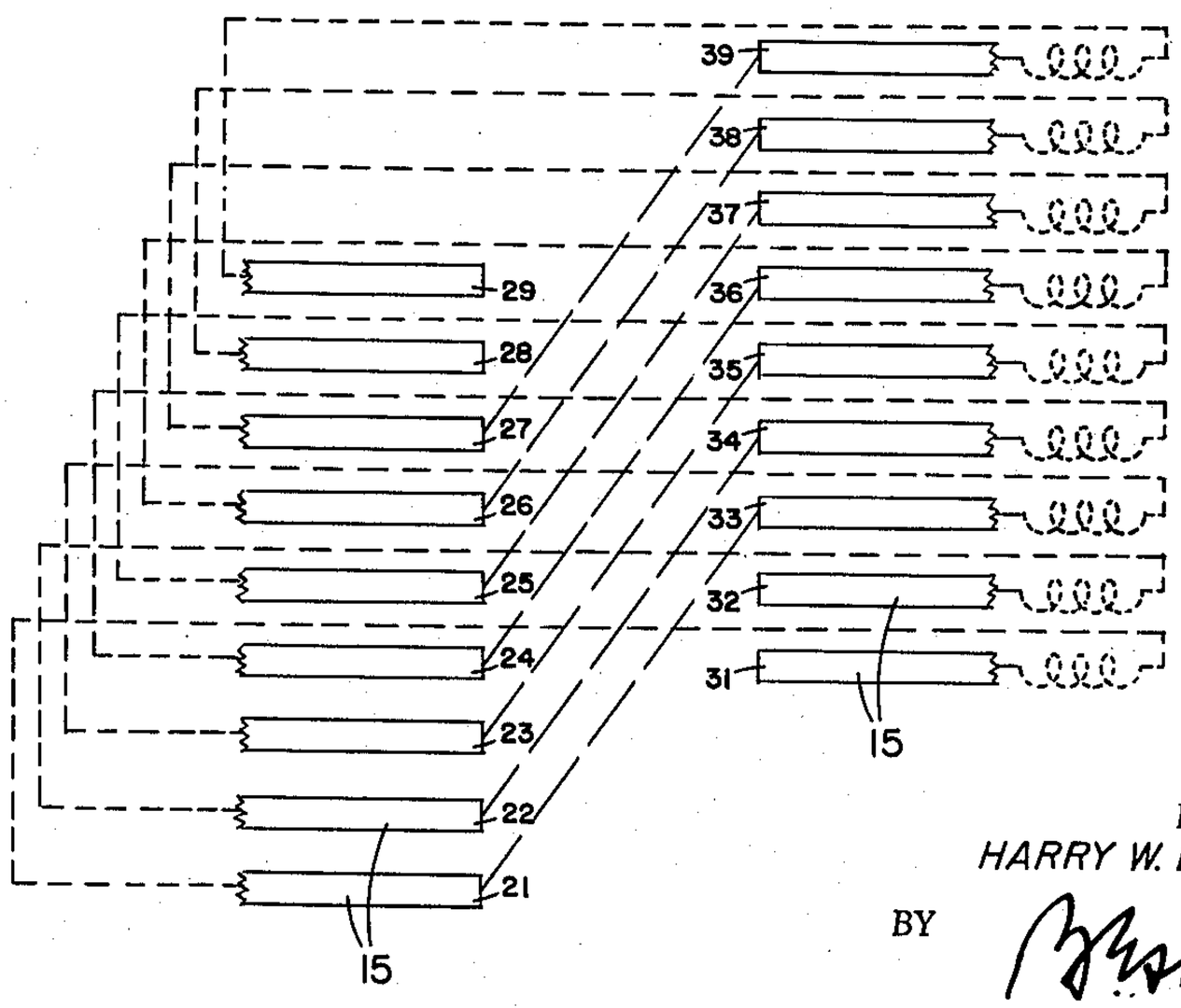

Fig. 3

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ELECTRICAL TRANSFORMER

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The present invention relates to electrical devices employing coils with multiple windings, and more particularly, to an electrical transformer.

One object of this invention is to provide a transformer having multiple windings in which the windings can be used individually, that is, separately from one another or in any number of multiple combinations.

A further object of the invention is to provide a transformer that has improved efficiency and marked decrease in leakage reactance.

Another object of the invention is to provide an electrical coil having multiple windings and in which the start and finish leads of each winding are easily locatable and identifiable.

Another object of the invention is to provide an electrical coil having multiple windings, that can be wound easily by machine.

Other objects of the invention will be apparent hereinafter from the specification and from the recital of the appended claim.

In the drawing:

FIG. 1 is a plan view of a transformer with multiple windings constructed according to one embodiment of this invention;

FIG. 2 is a side elevation thereof; and

FIG. 3 is a schematic diagram indicating one way in which the start and finish leads of the windings of this coil can be connected for a specific transformer application.

Referring now to the drawing by numerals of reference, **10** denotes the base of the transformer, and **11** the screws by which the base may be secured to any suitable support. Mounted on the base is an iron core **12**. Wound around one arm of this core in a coil, denoted generally at **12**, is a flat, ribbon **14** that has a plurality of longitudinally parallel, laterally-spaced, flat, copper electrical conductors **15** embedded therein which constitute the windings of the transformer coil. The ribbon **14** is made of a film of transparent, flexible synthetic resin that has electrical insulating characteristics; and the conductors, which are embedded in the ribbon, are separated from one another in each layer by the film, and surrounded on all sides by the film. The ribbon is wound around the core in a plurality of layers; and the conductors **15** of successive layers are insulated from one another by the film. The conductors **15**, therefore, provide a plurality of windings insulated from one another and equal in number to the number of conductors embedded in the ribbon, nine in the instance shown. The coil is wound so that the conductor of each winding lies in its own plane at right angles to the axis of the coil. Hence, each winding is in a single plane and wound spirally from the core outward.

The outer terminal end **14′** of the ribbon is folded along a diagonal line **17** with respect to the main body of the coil of ribbon, as shown in FIG. 1, so that it extends axially away from the coil. The inner or starting end **14″** of the ribbon is similarly folded upon the main body of the coil of ribbon to extend axially from the coil, but in the opposite direction to the outer end **14′**. The end portions **14′** and **14″** are preferably folded so that the conductors **15** at both ends of the ribbon are in alignment axially of the coil, as shown. However, this is a matter of choice.

At the two ends of the ribbon **14**, a portion of the resin film is removed to expose the ends of the conductors **15**, to provide leads for making electrical connections with the coil windings.

To distinguish these leads from one another, the leads at one end of the coil are designated **21** to **29** inclusive, and the leads at the other end of the coil are designated **31** to **39** inclusive.

The nine windings can, of course, be used separately. By a displaced cable splice all nine windings can instead, if desired, be placed in series. Thus, lead **21** could be connected, to lead **32**, lead **22** to lead **33**, etc. This would, of course, provide maximum inductance. Instead of so connecting the leads, the lead **21** can be connected, as shown in FIG. 3, to lead **33**, lead **23** can be connected to lead **35**, lead **25** to lead **37**, and lead **27** to lead **39**. Lead **31** would then become one terminal of the primary, and lead **29** the other terminal thereof. With this set-up, lead **22** might then be connected to lead **34**, lead **24** to lead **36**, and lead **26** to lead **38**. Lead **32** might then be one terminal of the secondary and lead **28** the other terminal thereof.

Obviously instead of displacing the lead connections by two as in the last described set-up, they might be displaced so that lead **21** was connected to lead **34**, lead **24** to lead **37**, and lead **27** to lead **39** so that leads **31** and **29** were the terminals of the primary, and lead **22** could be connected to lead **35**, and lead **25** to lead **38** making leads **32** and **28** the terminals of the secondary.

In another arrangement, any one or several alternate windings may be used as intervening shields. Thus the conductor **15** whose two lead ends are designated **21**, **31**, respectively, might be used as the primary winding of the transformer, while the conductor **15** whose two lead ends are denoted **23**, **33**, respectively, might be used as the secondary winding of the transformer, and the intervening conductor whose two lead ends are denoted at **22**, **32**, respectively, might be grounded to act as a shield between the primary and the secondary windings. Similarly lead **21** might be connected to lead **34**, and lead **24** to lead **37** so that leads **31** and **27** would be the terminal ends of the primary; and lead **23** could be connected to lead **36**, and lead **26** to lead **39** so that leads **33** and **29** would be the terminal leads of the secondary; and lead **22** could be connected to lead **35**, and lead **25** to lead **38**, and leads **32** and **28** could be grounded so that a spiral shield of conductors would again intervene between the primary and secondary windings.

An almost infinite number of permutations and combinations is available, therefore, within the limits provided by the number of conductors in the ribbon **14**. All of the windings can be used individually, or in any desired multiple combination; and any single, or several alternate windings, may be used as interwinding shields.

Because each individual metallic conductor **15** is flat and forms a winding that is in substantially a single plane that is at right angles to the axis of the coil, transformer efficiency is improved due to a marked decrease in leakage reactance.

The transformer construction described can, of course, apply to all iron structures, including toroids, and can employ ribbon that has any desired number of conductors, at any desired spacing.

While the invention has been described in connection with a specific embodiment thereof, then, it will be understood that it is capable of further modifications, and this application is intended to cover any variations, uses, or adaptations of the invention following, in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains and as may be applied to the essential features hereinbefore set forth, and as fall within the scope of the invention or the limits of the appended claim.

Having thus described my invention, what I claim is:

An electrical transformer comprising an iron core, a single ribbon of flexible electrically insulating plastic wound upon itself in a spiral of a plurality of convolutions about said core to form the coil of the transformer, said ribbon having embedded therein in electrically-insulated relation a plurality of flat electrical conductors that are disposed lengthwise of said ribbon and that are laterally spaced from each other, at least one of said conductors constituting the primary of the transformer, at least another of said conductors constituting the secondary of the transformer, and at least one conductor intervening between the primary and secondary conductors being grounded to form a shield between the primary and the secondary.

References Cited in the file of this patent

UNITED STATES PATENTS

217,466	Le Conte	July 15, 1879
447,569	Kennedy	Mar. 3, 1891
901,299	Kitsee	Oct. 13, 1908
2,777,110	Kodama	Jan. 8, 1957

FOREIGN PATENTS

221,594	Great Britain	Sept. 18, 1924