This invention relates generally to transformers, and more particularly to transformers of the type used in conjunction with oil burner devices as ignition devices, being generally known as ignition transformers.

Ignition transformers per se are not new but have been used for many years with oil burner devices to ignite the atomized oil by causing a high voltage spark to jump the gap between a pair of igniter electrodes. The life expectancy of the oil burner device is generally longer than that of the ignition transformer, and consequently the oil burner service industry has found that there is a need to replace ignition transformers which have broken down in use. The ignition transformers are mounted external to the blower device of the oil burner immediately beneath the blower motor, and a pair of leads are run through a cut-out in the oil burner housing to connect the igniters to the transformer high voltage secondary terminals. While all manufacturers of oil burners mount their ignition transformers at substantially the same position relative to the blower motor, the orientation of the opening through the oil burner housing has not been standardized. Consequently, a relatively large number of replacement ignition transformers have been made to satisfy the replacement requirement of all of the various different oil burners.

The present invention is directed toward the elimination of the previous necessity for replacing a given ignition transformer with one of the exact same type insofar as the physical positioning of the high voltage terminals is concerned. This is accomplished by the transformer according to this invention by providing a plurality of high voltage electrical terminals so interconnected that there is always a pair of properly positioned terminals available for utilization with presently known oil burner structures, so that the transformer has substantially universal application.

It is a primary object of this invention to provide a novel ignition transformer having a plurality of terminals so physically arranged and electrically interconnected that any adjacent pair of terminals may be utilized for connection to the igniters of an oil burner.

Another object of this invention is to provide a novel ignition transformer of the aforesaid type having terminals so physically arranged that at least one adjacent pair of terminals may be made to register with the housing aperture of all types of oil burners through which the igniters are passed, and that conductors are disposed for connection to an energizing ignition transformer.

Still another object of this invention is to provide an ignition transformer having a novel pre-assembled unitary terminal block provided with a plurality of terminals of such configuration that the transformer, terminals and terminal block are electrically interconnectable and installable within the enclosing transformer casework with a minimum of time and labor.

The foregoing and other objects of the invention will become clear from the reading of the following specification in conjunction with the examination of the appended drawings, wherein

FIGURE 1 illustrates a plan view of the ignition transformer according to the invention together with the mounting plate by means of which it is secured in operative position to the oil burner with which it is to be used, the mounting plate being partly broken away;

FIGURE 2 is a horizontal sectional view through the transformer as would be seen when viewed along the line 2—2 of FIGURE 3, the direction of viewing being downward into the casing as in FIGURE 1;

FIGURE 3 is a vertical sectional view through the ignition transformer according to the invention as would be seen when viewed along the line 3—3 of FIGURE 2;

FIGURE 4 is a vertical sectional view through the transformer as would be seen when viewed along the line 4—4 of FIGURE 2;

FIGURE 5 is a top perspective view of the novel terminal block structure according to the invention;

FIGURE 6 is a bottom perspective view of the terminal block structure shown in FIGURE 5;

FIGURE 7 is a bottom perspective view similar to that of FIGURE 6 but showing the various parts of the structure in exploded relationship;

FIGURE 8 is a vertical sectional view on a reduced scale taken along a diagonal through the structure of FIGURE 5 as would be seen when viewed along the line 8—8 thereof;

FIGURE 9 is a vertical sectional view on a reduced scale taken through a pair of adjacent terminals of the terminal block structure of FIGURE 5 as would be seen when viewed along the line 9—9 thereof;

FIGURE 10 is a plan view of one type of contact terminal assembly to and laterally extending from the novel terminal block of FIGURES 5 through 9; and

FIGURE 11 is a side view of the contact terminal seen in plan view in the showing of FIGURE 10.

In the several figures, like elements are denoted by like reference characters.

Turning now to an examination of the figures, and considering first FIGURES 1 to 4, there will be seen a transformer according to the invention contained within a drawn case 20 having a cover section 21 provided with downturned side flanges 22 by means of which with screws 23 the cover section 21 is secured to case 20. The cover 21 is provided with a generally square cutout 24 through which the upper surface of the novel terminal block 25 is visible, a knockout 26 and a plurality of holes 27 by means of which the transformer mounting plate 28 may be secured thereto with screws 29. The mounting plate 28 is centrally cut out as at 30 to expose the terminal block 25 and knockout 26 therethrough for direct access.

As best seen in FIGURES 3 and 4 apart from the case 20, cover 21 and mounting plate 28, the operative portion of the ignition transformer consists of the terminal block 25, busying 25a and transformer assembly 31. The transformer assembly 31 comprises a magnetic core having two parallel legs 32 connected at opposite ends by yoke portions 33. Disposed upon the core legs 32 at one end thereof are primary windings 34, and similarly disposed about the core legs 32 at the opposite end thereof are the high voltage secondary windings 35. One end of each of the primary winding coils 34 are interconnected and the opposite ends are led out through the transformer partial end bell plate 36 as conductors 37 adapted for connection to a source of energizing power, normally 115 or 230 volts alternating current. The partial end bell plate 36 is physically secured to the core stack by the nut and bolt 38. One end of each of the high voltage secondary winding coils 35 are connected to the solder lug 39 which is riveted or otherwise secured to the core stack, as best seen in FIGURE 4, while the opposite end of the secondary winding coils are connected to conductors 40 and 41 which terminate respectively in terminal lugs 42 and 43. Disposed around and between the coil legs 32 and clamped to the core stack is a copper plate or foil 44 which serves as an electrostatic shield between the primary and secondary windings 34 and 35.
3. Referring now also to FIGURES 5 through 11 for details of the terminal block assembly 25, it is observed that the assembly comprises a unitary molded bushing block 45 of insulating material, a pair of U-shaped terminal parts 46 and 47, a pair of laterally projecting terminals 48 and nuts 49 and washers 50 by means of which the various parts of the terminal block assembly 25 are secured together as a unit. The molded bushing block 45 comprises a rectangular block 51 of square shape when viewed in plan from below and of vertical thickness substantially less than its horizontal dimensions, four hollow cylindrical bushings 52 open at their upper end with each such bushing disposed at one of the corners of the rectangular block 51 so that the bushings 52 are arranged in a square array, and a pair of mounting flanges 53 extending laterally from one pair of opposite side edges of the rectangular block 51. Each of the mounting flanges 53 includes a rectangularly slotted opening 54 extending vertically therethrough adapted to receive a lock prong to be subsequently described, and the rectangular block 51 is received upwardly from its lower face at each corner as at 55 and provided with a cylindrical hole 56 extending vertically upward from the center of each recess 55 through the block 51 coaxially with the hollow cylindrical bushings 52.

The U-shaped terminal part 46 includes a pair of externally threaded parallel extending terminals 57 spaced apart a distance equal to the spacing between either pair of catcorner positioned cylindrical holes 56 through the block 51. The terminal part 46 is transversely staked below each of the threaded terminals 57 as for example at 58 and 59, the staking 59 being positioned somewhat further from the end of its associated terminal 57 than is the staking 58 for reasons which will become subsequently clear. The transversely extending base portion of the U-shaped terminal part 46 which bridges between the terminal 57 is covered by a sheath 60 of insulating having a high dielectric strength. The terminal part 47 is similar to the part 46 having externally threaded terminals 61, stakings 62 and 63 and insulation sheath 64. As is best seen in FIGURES 8 and 9 the insulated portion of terminal part 46 lies substantially further below the stakings 58 and 59 than does the insulated portion of terminal part 47 below its stakings 62 and 63.

The lateral terminals 48 each include a flattened lug portion 65 apertured as at 66 and an offset externally threaded terminal portion 67, the staking 63 providing a stop element which limits the projection of the threaded terminal portion 67 into the cylindrical bushing portion 69 of bushing block 25, as best seen in FIGURES 2 and 3.

The terminal block assembly 25 is assembled by first slipping the terminal lug 42 downward over its associated terminal 61 until it abuts staking 62, then projecting that terminal 61 upward through the aperture 66 and the flattened lug portion 65 of one of the lateral terminals 48, and then inserting the threaded terminals 61 upward through a catcorner pair of cylindrical holes 56 of molded bushing block 45 and securing the same in position by means of nuts 49 and washers 50. The difference in position of stakings 62 and 63 is most clearly seen in the showing of FIGURE 8 which discloses that the reason therefore is that staking 63 provides a stop by abutment with the upper surface of recess 55 while staking 62 is lower to compensate for the positioning hold-off resulting from terminal lug 42 and lateral terminal 48. U-shaped terminal part 46 together with terminal lug 43 and the remaining lateral terminal 48 are then assembled to the molded bushings block 45 in the same manner, the stakings 58 and 59 providing the appropriate down spacing beneath the terminal part 47.

The ignition transformer is best assembled by first placing the transformer assembly 31 into the drawn case 20 position as shown in FIGURES 3 and 4. The electrostatic shield 44, transformer core and high voltage winding midpoint connections are connected to the case 20 by means of conductors 70 and 71 which are solder connected to brackets 72, which latter are spot welded or otherwise bonded to the inside of opposite side walls of case 20 as best seen in FIGURES 2 and 4. The bushing block 25a is next inserted through a suitable aperture in a side wall of the case 20 as most clearly appears from FIGURES 2 and 3 with a gasket 73 of suitable material such as cork disposed between the bushing block 25a and the side of the case 20 as best seen in FIGURES 2 and 4.

The terminal block assembly 25, pre-assembled as shown in FIGURES 5 and 6 excepting for the solder connections of terminal lugs 42 and 43 to high voltage conductors 49 and 50, is next mechanically and electrically installed by soldering the high voltage conductors and terminals 57 and 53 to terminal lugs 42 and 43 respectively, then projecting lateral terminals 48 through cylindrical bushings 69 of bushing block 25a from the rear of the bushing block and seating the mounting flanges 53 of molded bushing block 45 down upon brackets 74 so that upstanding prongs 74 of these brackets project upward through the rectangular slot openings 54 of the mounting flanges. The bracket prongs 74 are then turned laterally over the upper surface of the mounting flanges 53 to lock the terminal block assembly 25 physically in position, in the manner best seen in the showings of FIGURES 2 and 4. As best seen in FIGURE 3, washers 49 and nuts 50 are respectively slipped over and threaded onto the lateral terminals 48 and pulled up tightly to thereby anchor the bushing block 25a. The case 29 is then filled with potting compound 77 in and around the core and coils of the transformer assembly 31, under the partial end bell plate 36 and upward about the high voltage wiring connection to encapsulate the same and embed the bushing blocks 25a and 45, all as best seen in the showings of FIGURES 3 and 4.

The threaded terminals 57, 61 and 67 have electrical connections normally made thereto by igniter conductors terminating in apertured terminal lugs of the type most clearly seen in FIGURE 7 as 42 and 43, these terminal lugs being slipped downward over the terminal block and clamped in place by insulator cap nuts 78 such as shown in FIGURES 1, 2 and 3. The cap nuts 78 are externally insulated and thereby suppress any tendency for arc-over to take place between the ends of the high voltage terminals and metal portions of the housing to which the ignition transformer is secured. Connection can of course also be made to the high voltage terminals by utilizing other types of connectors, as for example the push-on type of connector designated as 79 in FIGURES 1 and 2. Such a connection may be made by use of an adapter 80 illustrated in FIGURE 2, the adapter 80 being internally drilled and threaded for threaded engagement with the high voltage terminals 57, 61 or 67, the exterior configuration of the adapter being that required for proper connection with the push-on connector 79.

As best seen from FIGURES 2 and 6 the high voltage terminals 57 and one of the lateral terminals 48 are commonly energizable through conductor 41 from one side of the high voltage winding of the transformer, while the terminals 61 and the other lateral terminal 48 are commonly energizable via conductor 40 from the other end of the high voltage winding of the transformer. Thus, the high voltage desired can be picked off from the lateral terminals 48 or from any adjacent pair of terminals 57 and 61. The two terminals 57 and two terminals 61 of terminal block assembly 25 thus result in four pairs of terminals across which the desired high voltage is available, each such pair of terminals lying along one side of a square defined by lines extended between each terminal 57 and its adjacent terminals 61. The unique ability of the ignition transformer according to the invention to provide four differently positioned pairs of high voltage terminals from a total of only four terminals
results from the novel crossed configuration of the U-shaped terminal parts 46 and 47.

Having now described my invention in connection with a particularly illustrated embodiment thereof, it will be appreciated that variations and modifications of the same may now occur from time to time to those persons normally skilled in the art without departing from the essential scope or spirit of my invention, and accordingly it is intended to claim the same broadly as well as specifically as indicated by the appended claims.

What is claimed as new and useful is:
1. In combination with an ignition transformer having a case and a transformer assembly disposed therewithin which includes primary and high voltage secondary windings together with means for energizing the primary winding from a source of electric power and conductor means for connecting the secondary winding to an output terminal assembly,
   (a) a pair of integral pre-formed generally U-shaped electrically conductive parts,
      (1) one of said U-shaped parts having arms which are longer than those of the other of said U-shaped parts,
      (2) said U-shaped parts being disposed in upright-U fashion with the free ends of their arms non-engagingly lying substantially in a common plane and with their bases disposed cross-wise to one another in vertically spaced relation,
   (b) a unitary insulator bushing block having four apertures therethrough arranged in a rectangular array, the arms of one of the U-shaped parts being projected through two of the apertures located on one diagonal of the rectangular array to form two electrical terminals and the arms of the other U-shaped part being projected through the remaining two apertures located on the other diagonal of the rectangular array to form two additional electrical terminals,
   (c) means locking the freely extending upper portions of the arms of said U-shaped parts to said insulator bushing block with the crossed bases of said parts disposed in spaced electrically insulated relation below said block,
   (d) means electrically connected to each of said U-shaped parts for connecting the same to the conductors of the transformer high voltage winding,
   (e) bracket means carried by said transformer case with said insulator bushing block seated thereon and locked thereto, said brackets being so positioned that said terminals are disposed entirely and said bushing block is disposed substantially entirely within the transformer case with all of said terminals simultaneously accessible from the exterior of the case through an apertured wall thereof,
   (f) a pair of parallel extending rigid electrically conductive terminals respectively secured to and projecting laterally from points of connection with different ones of said U-shaped parts into a second insulator bushing block which projects through an opening in a wall of the case, said bushing block being oriented at a right angle to the case wall through which the terminal arms of said U-shaped parts are accessible.

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