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TRANSFORMER RELAY

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Fig. 1.

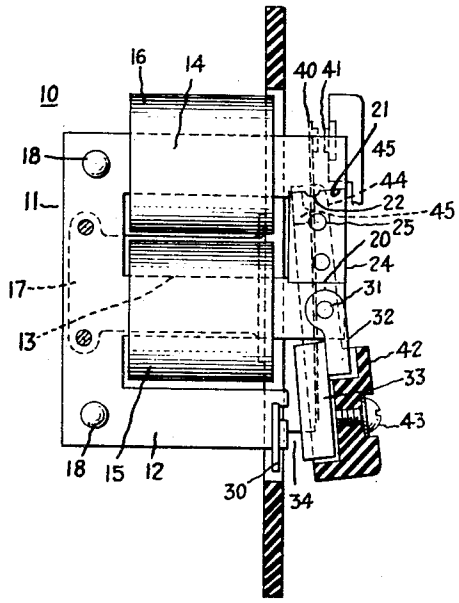
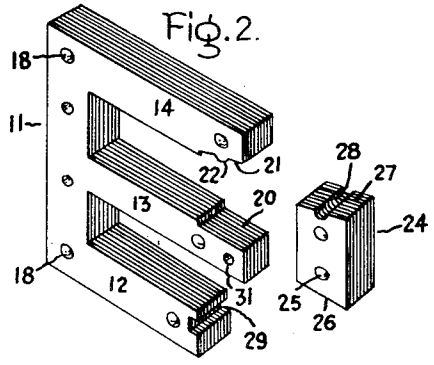


Fig. 2.



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TRANSFORMER RELAY

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5 Claims. (Cl. 175—338)

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The invention relates to electromagnetic devices and provides improvements in magnetic core structure that are of particular advantage in a three-legged transformer relay of the improved type disclosed and claimed in the Estes patent application Serial No. 794,298 filed concurrently herewith and assigned to the same assignee as the instant application, although some of the magnetic core structural improvements may be used with advantage generally in electromagnetic devices.

In a transformer relay, the flux generated by the transformer primary winding is shifted into and out of an operating armature by closing and opening the transformer secondary winding. Thus, one of the problems involved is a magnetic structure for more effectively shifting the flux out of the armature.

One object of the present invention is to provide an improved form of integral laminated E-shaped transformer relay core with a removable laminated yoke wedged between the free ends of a pair of adjacent winding legs thereof that serves not only to facilitate the mounting of the transformer primary and secondary windings thereon, but particularly to enable the middle leg carrying the secondary windings to form an unbroken magnetic barrier that will more effectively shift the magnetic flux from the open third leg of the transformer core to dropout the operating armature when the secondary transformer winding is open-circuited.

Another object is to provide an improved snap interlocking combination for holding a removable laminated yoke tightly wedged between the free ends of a pair of transformer winding core legs that are integrally yoked together at their other ends.

Other objects and advantages of the invention will appear in the following description of the accompanying drawing in which Fig. 1 is a side view of a transformer relay having the improved E-shaped core provided with a removable yoke wedged between a pair of legs thereof in accordance with the present invention and Fig. 2 is a perspective view of the E-shaped core of Fig. 1 more clearly showing the structural features whereby the removable yoke is held wedged between a pair of adjacent legs of the core so that the middle leg can form the unbroken magnetic barrier between the outer legs of the core.

As shown in Fig. 1 the transformer relay indicated generally by the reference character 10 is provided with an improved integral E-shaped laminated core 11 with one of the outer legs 12

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shorter than the other pair of legs 13 and 14 on which the transformer secondary and primary windings 15 and 16 respectively are mounted. All three legs 12, 13 and 14 are joined at one end by the integral yoke 17 and the laminations of the E-core are held together by means of the rivets 18.

As more clearly shown in Fig. 2, the middle leg 13 forms an unbroken magnetic barrier between the outer legs 12 and 14. The middle leg 13 is provided with a step 20 adjacent the free end thereof and the adjacent leg 14 is provided with an opposing inverted step 21 that is sloped or inclined outwardly so as to provide in conjunction with the opposite step 20 a pair of opposing, converging faces adjacent the free ends of the transformer winding legs 13 and 14. The inverted step 21 is provided with a protuberance in the form of a transverse ridge 22 extending across the face of the step.

A removable laminated yoke 24 that is held together by rivets 25 preferably is formed of the lamination parts punched out of the E-shaped core laminations to provide the opposing steps 20 and 21 with the ridge 22 on the face of the outwardly sloping step 21. Thus the removable yoke 24 is provided with end faces 26 and 27 that will register in precise abutment with the opposing, converging steps 20, 21 when the yoke 24 is wedged between the ends of the core-winding legs 13 and 14 after the primary and secondary windings 15 and 16 are mounted upon the core legs 13 and 14. Due to the slope of the inverted step 21, the yoke 24 may readily be inserted between the steps 21 and 20 with the laminations of the yoke and the core parallel and then securely wedged into position by exerting pressure on the outer side of the yoke so as to force the ridge 22 to snap into the complementary valley 28 in the upper face end of the yoke 24 just as the inner corners of the yoke 24 engage with the back of the steps 20 and 21. In this way interlocking engagement between the transverse ridge 20 and the transverse valley 28 serves to hold the removable plug 24 firmly wedged between the free ends of the core winding legs 13 and 14 so as to provide a relatively low reluctance flux path therebetween.

The open end of the shorter leg 12 of core 11 is provided with a transverse slot 29 for mounting a pole shader 30 therein as shown in Fig. 1. Also a pivot pin 31 is driven into a suitable hole through the free end of the middle leg 13 for pivotally mounting on the projecting ends thereof the forked bracket 32 that carries the

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armature 33, preferably welded to the bracket 32.

Operation

Assuming the transformer primary winding 16 is normally energized from a suitable alternating current source and the secondary winding 15 is open-circuited, the alternating flux generated will pass through a relatively low reluctance magnetic loop formed by the core leg 14, the integral upper part of yoke 17, the integral middle core leg 13 and the removable yoke 20. The only breaks in this magnetic circuit are at the ends of the removable yoke 20 which however are wedged tightly into abutment with the opposing steps 20 and 21. In this way the magnetizing current of the transformer primary winding 16 can be maintained relatively low with a resulting minimum heating effect.

When the transformer secondary winding 15 is closed, then a substantial portion of the generated flux is shifted from the unbroken middle leg 13 into the shorter outer leg 12 to attract the pivoted armature 33 towards the pole formed at the end of the open core leg 12. When the armature 33 abuts the end of leg 12, the air gap 34 previously existing between the end of leg 12 and the middle leg 13 is substantially closed except for the small gap between the pivoted end of armature 33 and the middle leg 13 required for free pivotal movement of the armature. As a result, the magnetic pull exerted on armature 33 in its attractive position becomes materially increased while the energy input into the primary transformer winding 16 is still limited to a value that will not produce overheating of either the primary winding 16 or the short-circuited secondary winding 15.

By means of the improved magnetic core structure the armature 33 is enabled to operate a substantial load without overheating and with minimum noise or chatter. For example, as disclosed in the above-mentioned Estes application, the armature 33 may operate a spring switch arm 40 that is fixedly mounted at its lower end into wiping engagement with the cooperating stationary switch contact 41 by means of the insulating moulded switch operating member 42 secured to the armature 33 by a screw 43 and provided with the arm 44 having finger 45 for engaging with the switch arm 40. As soon as switch arm 40 engages with the stationary contact 41, the spring gradient of the spring switch arm 40 is sharply increased to press the switch arm 40 into firm circuit closing engagement with contact 41 and thus enable reliable switching service to be obtained. As a result, the operating load on armature 33 in its attractive position is materially increased so that an ample magnetic attractive pull must be exerted upon the armature 33 in order to hold it in firm and quiet engagement with the end of leg 12.

When the transformer secondary winding 15 is open circuited to dropout or release the armature 33, the unbroken magnetic barrier formed by the middle leg 13 serves more effectively to shift the flux generated by the normally energized primary winding 16 out of the core leg 12 and armature 33 since the flux path through the middle leg 13 is unbroken by any lamination joints and hence is of minimum reluctance. Thus even though a substantial portion of the generated flux may pass through leg 12 when armature 33 is in the attractive position to provide the required relatively large magnetic pull on the armature, the unbroken middle leg 13 provides a bypass or shunt path of maximum effectiveness for this flux when the secondary winding 15 is open circuited and thus insures dropout of the armature 33.

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

1. A transformer relay having in combination an integral laminated E-shaped transformer core, separate primary and secondary windings on a pair of adjacent legs of said core, a separate laminated yoke wedged between the free ends of said pair of legs, and a movable armature mounted on said core in bridging relation between the free ends of the center and third legs of said core.

2. A transformer relay having in combination an integral laminated E-shaped transformer core, separate primary and secondary windings mounted upon a pair of adjacent legs of said core, said secondary winding being upon the center leg of said core a separate laminated yoke wedged between the free ends of said pair of legs for holding said windings thereon, and an armature pivotally mounted upon one leg of said core in aligned relation with said separate yoke and in attractive relation with the adjacent leg of said core when said primary winding is energized and said secondary winding is closed.

3. A transformer relay having in combination an integral laminated E-shaped transformer core, separate primary and secondary windings on a pair of adjacent legs of said core, said legs having opposing inwardly converging faces formed adjacent the free ends thereof, a separate laminated yoke having end faces formed for registering abutment with said converging faces when said yoke is wedged between said free ends of said pair of legs, one of a pair of said registering faces having a protuberance and the other a complementary interlocking indentation formed therein for holding said yoke wedged in abutment between said free ends of said pair of legs, and an armature pivoted on the middle leg of said core in attractive relation with the third leg of said core when said primary winding is energized and said secondary winding is closed.

4. A transformer relay having in combination an integral laminated E-shaped transformer core having one outer leg shorter than the other two legs thereof, separate preformed primary and secondary windings, each slidable onto a corresponding one of said other legs, said other legs having opposing steps formed adjacent the free ends thereof with one step sloping outwardly and provided with a central transverse ridge, a separate laminated yoke having end faces for seating on said steps when said yoke is wedged between said free ends of said pair of legs, with one of said end faces provided with a central transverse valley for interlocking with said ridge for holding said yoke wedged in position between said free ends of said pair of legs, and an armature pivoted on the middle leg of said core in attractive relation with the shorter leg of said core when said primary winding is energized and said secondary winding is closed.

5. A transformer relay having an integral core member including a pair of open ended legs in parallel spaced relation and a third leg, primary and secondary windings mounted upon said parallel legs, a separate yoke member wedged between the open ends of said parallel legs, and a movable armature member mounted upon said core in bridging relation between said third leg

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and that side of the open end of said pair of legs remote from said yoke member.

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