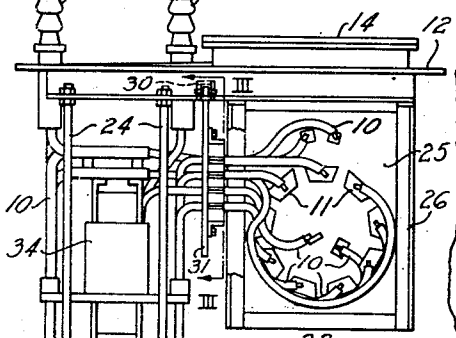
Sept. 1, 1942. F. W. BUSH 2,294,536

TRANSFORMER TAP CHANGER

Filed July 20, 1940
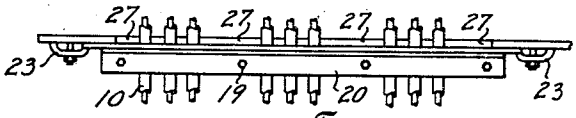



Fig. 4



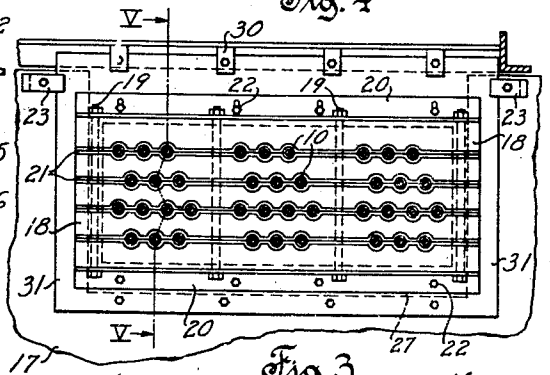




Fig. 3

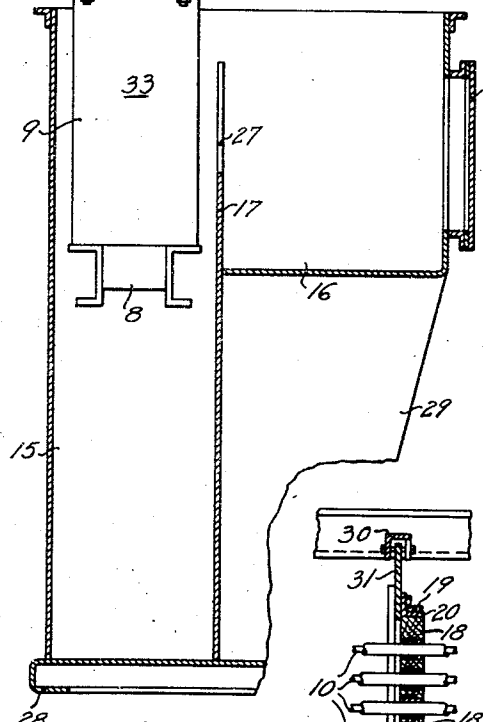



Fig. 2




Fig. 5

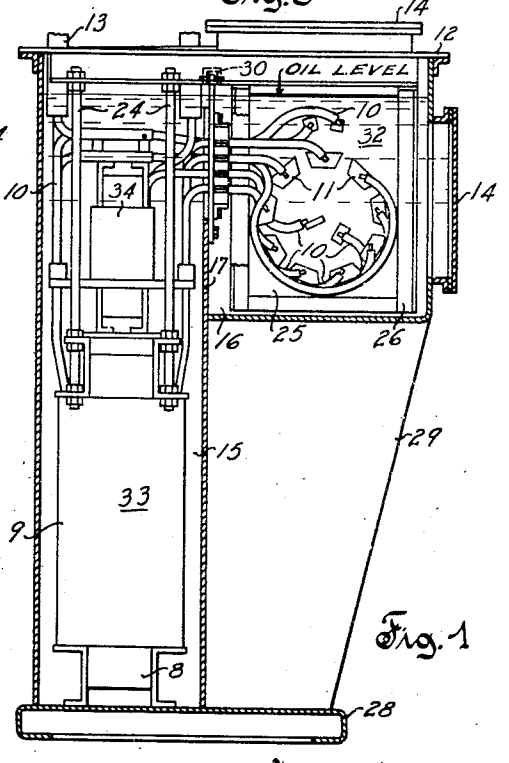



Fig. 1

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# UNITED STATES PATENT OFFICE

2,294,536

## TRANSFORMER TAP CHANGER

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Application July 20, 1940, Serial No. 346,475

8 Claims. (Cl. 171—119)

This invention relates in general to encased electrical apparatus and relates particularly to an encased transformer provided with a tap changing mechanism located adjacent the transformer casing and to a new and improved means for interconnecting the transformer and tap changing mechanism.

In step regulators where the tap changing switch mechanism and casing are located on the side of the transformer casing, disadvantages have arisen in connecting the switch contacts and the transformer taps. It is desirable to have separate casings or a casing partitioned to provide separated portions. If an insulating partition is provided between the two casings and provided with conducting studs therethrough, to which connections are made on one side to the tap switch and on the other side of the transformer taps, the additional work of making and maintaining these connections is a disadvantage. In a three phase regulator with thirteen leads per phase, there would be seventy-eight such connections. Loose connections provide a source of operating trouble, and bolted connections provide a source of loose connections as well as an added manufacturing cost.

If such connections at the insulating partition are brazed or otherwise solidly made, inability to easily untank the transformer or switch mechanism is a disadvantage. If these connections are bolted, they may become loose and cause trouble. If the leads are brought from one casing to the other in one piece over the partition separating the oil in the casings, half of the connections are avoided, but only at the expense of exposing the leads to the air and moisture breathed into the transformer and thereby lowering their insulation value.

It is desirable to have a construction in which the transformer and tap switch mechanism can be tanked and untanked without making and breaking any connections, to avoid bolted connections at the separating partition between the two tanks, and to have the connecting leads entirely in oil or other insultaing fluid throughout their length.

It is therefore an object of the present invention to provide a step regulator avoiding one or more of the above disadvantages and utilizing one or more of the above advantages.

It is also an object of the present invention to provide a step regulator of the above type, in which the transformer and tap switch are in separate casings, with solid leads connecting the transformer taps and the tap switch, and so arranged as to be in oil throughout their length and yet permit the untanking of transformer and tap switch mechanism without disconnecting the leads.

It is a further object of this invention to provide a cover for both casings and to suspend the transformer and switch mechanism from the cover.

It is a further object of this invention to provide means for tightly clamping the connecting leads to withstand short circuit stresses.

It is also an object of this invention to reduce manufacturing cost and to simplify maintenance of a transformer tap changer by including the transformer, the tap changing switch, the interconnecting leads, and the clamping means therefor, in a unitary structure attached to the casing cover.

Objects and advantages other than those above set forth will be apparent from the following description when read in conjunction with the accompanying drawing, in which:

Fig. 1 is an elevational view, with part of the casing removed, of a transformer tap changer embodying the present invention;

Fig. 2 is a view of the tap changer shown in Fig. 1 showing the transformer and tap changing switch partly removed from the casing;

Fig. 3 is an enlarged end view of the clamping means for the leads interconnecting the transformer tap changer shown in Figs. 1 and 2;

Fig. 4 is a top view of the clamping means shown in Fig. 3; and

Fig. 5 is a cross-sectional view of the clamping means shown in Figs. 3 and 4 taken on the line V—V of Fig. 3.

The single embodiment of the invention shown in the drawing comprises generally a transformer 33, a tap changing switch 32, and leads 10 interconnecting the same, through a partition 17 dividing the casing into portions 15 and 16. The portions 15 and 16 of the casing are maintained separate in order that impurities, dirt and products of arcing of the tap switch contacts 11 do not mix with the oil surrounding the transformer 33 in the casing 15. The partition 17 has a portion thereof cut out as indicated by the numeral 27.

The leads 10 interconnecting the various windings 9 and 34 of the transformer and the tap switch contacts 11 are solid leads throughout their length. This avoids bolted connections at the partition 17, which may loosen under operation and cause trouble. These leads 10 are immersed in insulating liquid in both casings 15 and 16 and their insulation strength is there-

fore high and their insulation is not exposed to moisture or air above the level of the oil in the transformer casing, and therefore subject to added corrosion.

In order to avoid disconnecting the leads at the partition 17 upon untanking of the transformer, the leads 10 go through the partition 17 through a removable portion 31 thereof. Mounted on the plate 31 is a clamping structure which rigidly braces the leads 10 against forces due to short circuit current. In order to simplify manufacture and maintenance, the entire transformer structure, the tap changing switch, and the clamping structure for the leads 10 are supported from the cover 12 of the casing. In Fig. 2 the transformer and tap changer structure is shown partly removed from the casing, and the transformer windings and cores are supported on the cover member by means of staybolts 24.

The tap changing switch 22 is illustrated as an insulating panel 25 on which are mounted contacts 11 in a dial conformation. The leads 10 from the transformer taps are connected to the contacts 11 in any suitable manner. The movable member of the tap switch 32 and its connection into the circuit are not shown. However, this tap changing switch 32 may be of the type shown in Patent No. 2,177,109, granted to L. H. Hill October 24, 1939, for Voltage regulator.

The clamping structure, as shown more clearly in Figs. 3 and 5, comprises a series of wooden blocks 18 each having half-round holes in one or both edges thereof. When clamped together, the half-round holes in adjacent blocks form a clamping means for a lead 10. In order to prevent the free flow of oil from one part of the casing to another, a felt gasket 21 is placed between the boards 18 and around the leads 10. While this joint is not oil tight, it sufficiently separates the casing 16 from the casing 15 in that particles of dirt, carbon, or other arc products cannot move from one casing to the other.

In assembling the device, the transformer 33 and the tap changing switch 32 are mounted on the cover 12, and then all connections at both ends of the leads 10 are made. The clamping boards 18 are then positioned around the leads in the manner shown more clearly in Figs. 3 and 5. In a transformer of the three-phase type shown, there are thirty-nine of these leads from the transformer to the tap changing switch, thirteen for each phase. The clamping boards 18 are then clamped togethher by long bolts 19 running through the board as shown more clearly in Fig. 3.

Clamped along the top and bottom edges of the clamping board by means of the bolts 19 are metal angles 20 which add rigidity to the clamping means for positioning the clamping board on the plate 31. The angles 20 are then clamped to the plate 31 as by means of bolts 22. The plate 31 has an opening therein practically coinciding with the clamping boards 18 when clamped together. The plate 31 is securely clamped to the cover 12 by means of clamps 30.

After the transformer, tap switch, clamping structure and cover are lowered as a unitary construction into the casings 15 and 16, as shown in Fig. 1, the plate 31 is securely clamped to the partition 17 by means of the clamps 23 which are easily positioned and tightened through the inspection plates 14.

The term solid connection used in reference to the leads 10 defines a conductor that is continuous, unbroken and non-detachable in the sense that it has no bolted or equivalent parts where it passes through the partition 17.

Although but one embodiment of the present invention has been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

It is claimed and desired to secure by Letters Patent:

1. In a regulating device, a tapped transformer winding immersed in a casing containing insulating liquid, a second casing adjacent said transformer casing, switch contacts immersed in insulating liquid in said second casing, means for connecting said switch contacts and said winding comprising solid leads maintained below the level of said insulating liquid, and means whereby said winding and said switch are removable from said casings while maintaining said leads connected to said winding and said contacts.

2. In combination, a casing divided with a partition provided with a removable portion, a cover for said casing, a transformer in one portion of said casing, switch contacts in another portion of said casing, insulating liquid in said casings, solid leads connecting said transformer and said switch contacts, and means for rigidly clamping said leads to said removable portion of said partition below the level of said liquid, said clamping means being supported from said cover.

3. In combination, a transformer winding provided with taps thereon, a casing for said transformer, tap changing switch contacts, a casing positioned adjacent to and without said transformer casing for enclosing said tap changing switch contacts, a cover for said casings, non-detachable conductors connecting said taps and said contacts, and means for rigidly clamping said conductors to said cover.

4. In combination, a casing divided with a partition, a transformer in one portion of said casing, switch contacts in another portion of said casing, insulating liquid in said casings, non-detachable leads connecting said transformer and said switch contacts, means for rigidly clamping said leads to said partition, said clamping means forming a part of said partition below the level of said liquid, and means whereby said part of said partition is removable therefrom simultaneously with removal of said transformer and said switch contacts from said portions of said casing.

5. In a transformer tap changing device, a transformer winding provided with taps thereon, tap changing switch contacts, separate casings for said transformer and said tap changing switch, means for non-detachably connecting said taps and said contacts, means for wholly immersing said connecting means in insulating liquid, and means whereby said transformer winding, said switch contacts and said connecting means are removable from said separate casings as a unitary structure.

6. In a transformer tap changing device, a transformer winding provided with taps thereon, tap changing switch contacts, separate casings for said transformer and said tap changing switch provided with a common wall portion, means for non-detachably connecting said taps and said contacts, means for wholly immersing said connecting means in insulating liquid, and

means for rigidly clamping said connecting means intermediate the ends thereof, said clamping means forming a part of said common wall portion.

7. In a transformer tap changing device, a transformer winding provided with taps thereon, tap changing switch contacts, separate casings for said transformer and said tap changing switch, means for non-detachably connecting said taps and said contacts, means for wholly immersing said connecting means in insulating liquid, means for rigidly clamping said connecting means intermediate the ends thereof, and means whereby said transformer, said clamping means and said tap changing switch contacts are removable from said casings as a unitary structure.

8. In combination, a casing divided by a partition provided with a removable portion, a transformer winding having a plurality of taps thereon in one fixed portion of said casing, a plurality of switch contacts in another fixed portion of said casing, insulating liquid in both said fixed portions of said casing, and means comprising a plurality of electrical conductors extending through said removable portion of said partition below the level of said liquid, whereby said transformer winding, said switch contacts, said removable portion of said partition and said conductors are removable from both said fixed portions of said casing as a unitary structure.

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