Jan. 13, 1953 M. RIGERT 2,625,619

TRANSFORMER TAP CHANGER

Filed Aug. 7, 1948 2 SHEETS—SHEET 1

Fig. 1

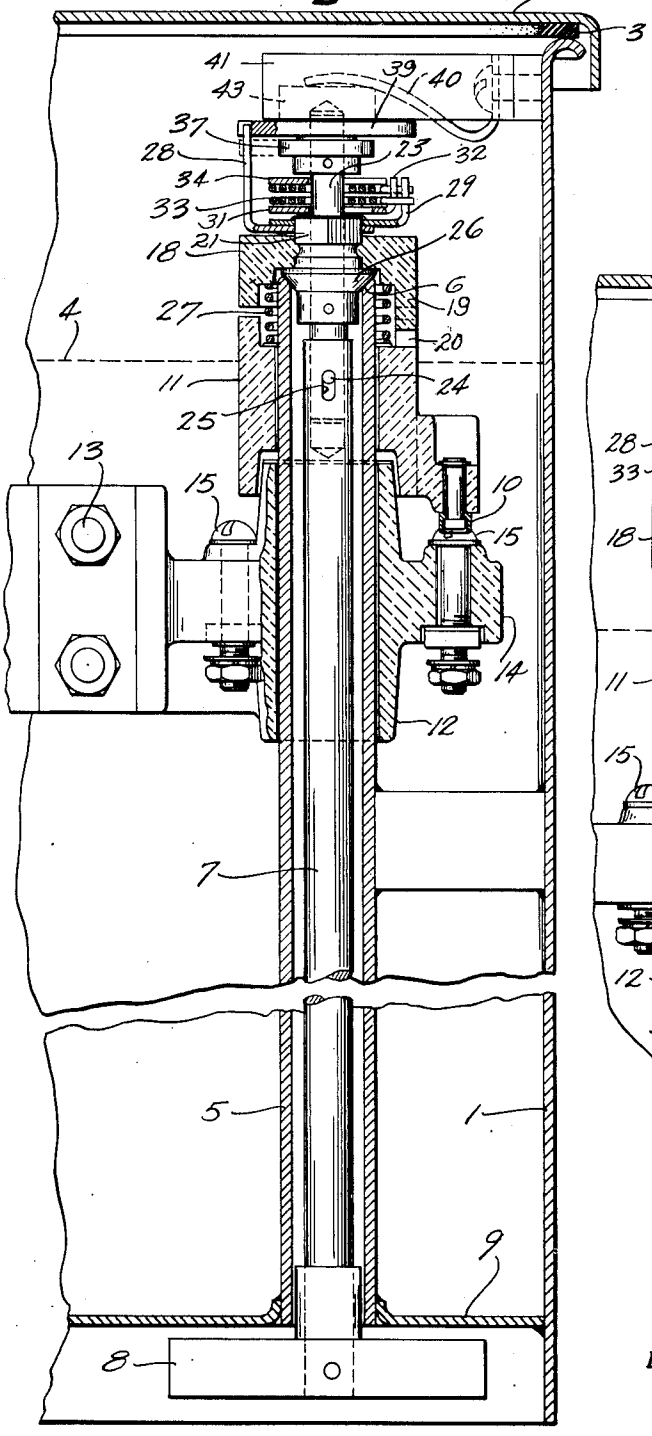
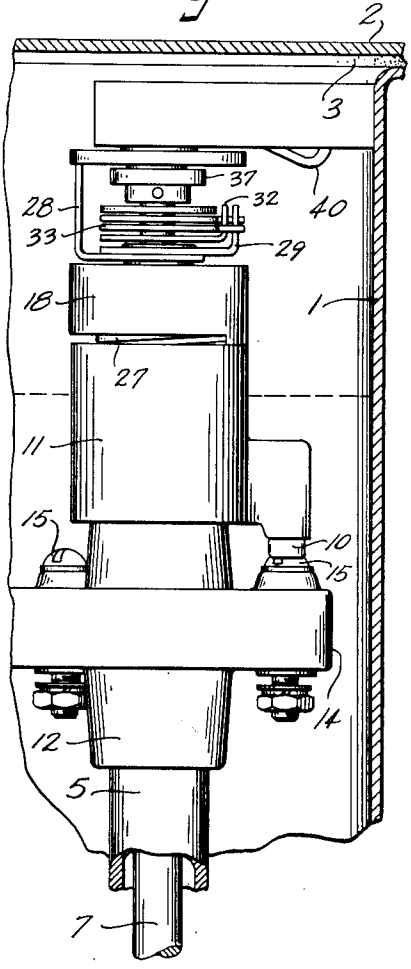


Fig. 2



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2 SHEETS—SHEET 2

Fig. 3

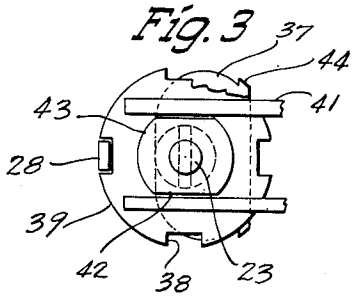


Fig. 4

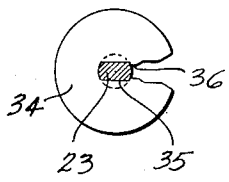


Fig. 5

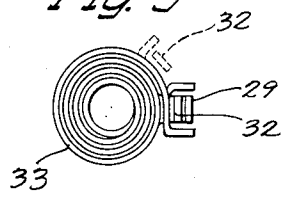


Fig. 6

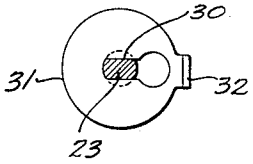


Fig. 7

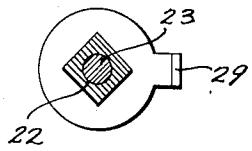


Fig. 8

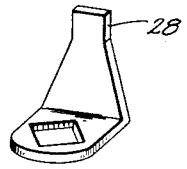


Fig. 9

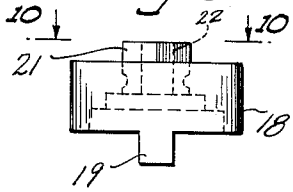


Fig. 10

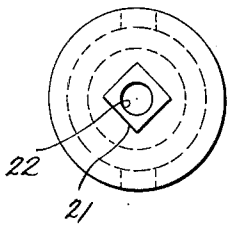


Fig. 11

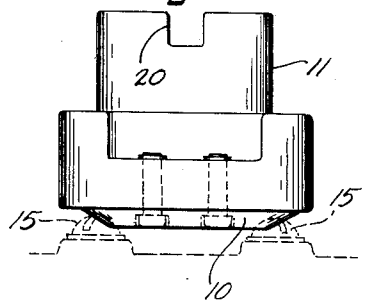


Fig. 12

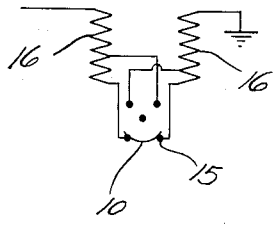
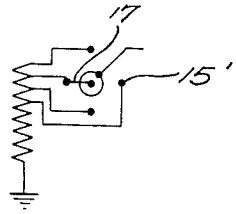


Fig. 13



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UNITED STATES PATENT OFFICE

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TRANSFORMER TAP CHANGER

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Application August 7, 1948, Serial No. 43,041

4 Claims. (Cl. 200—66)

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This invention relates to a transformer tap changer.

Objects of this invention are to provide a novel form of transformer tap changer which is so constructed that it can operate under load and which is arranged to have a quick make and a quick break.

Further objects are to provide a transformer tap changer in which the contact member is securely locked in its selected position, in which means are provided for storing energy in a spring when the manipulating handle is rotated by the operator and in which means are provided for suddenly releasing the contact and allowing it to move to its next successive position, the locking mechanism thereafter instantly coming into play to lock the contact in its new position.

Further objects are to provide a transformer tap changer in which, though the action is primarily through the agency of a stored spring, nevertheless means are provided for positively driving the contact from one position to its next adjacent position in the event that the contact should tend to stick in place.

Further objects are to provide a tap changer for transformers which is particularly suitable for suspended type transformers in which means are provided whereby the manipulating handle is arranged to be grasped by the operator from beneath the transformer, thus eliminating any danger to the operator, and in which means are provided to prevent loss of oil from the transformer casing under any condition of operation of the tap changer, and to so construct the device that it has a self-sealing action with reference to the transformer casing to thus allow it to be used with hermetically sealed units.

An embodiment of the invention is shown in the accompanying drawings, in which:

Figure 1 is a fragmentary sectional view through a portion of the transformer casing showing the tap changer in place, such view being partly in section.

Figure 2 is a fragmentary view of the upper portion of the tap changer.

Figure 3 is a view looking downwardly at the upper portion of the tap changer with parts removed and with parts broken away.

Figure 4 is a detail showing a section through the upper stem or rotary member and showing the spring retaining washer in place.

Figure 5 is a view showing the loading spring and a portion of the associated parts.

Figure 6 is a view partly in section showing the rotary member which loads the loading spring

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when the shaft, hereinafter described, is rotated.

Figure 7 is a view partly in section showing the member which is driven by the loading spring.

Figure 8 is a view of the locking spring.

Figure 9 is a side elevation of the upper driving member.

Figure 10 is a plan view of the structure shown in Figure 9, such view corresponding to a view on the line 10—10 of Figure 9.

Figure 11 is an elevation of the lower or driven member of the tap changer.

Figure 12 is a diagrammatic view showing the wiring diagram for the form of tap changer illustrated in Figures 1 through 11.

Figure 13 is a wiring diagram showing a further form of tap changer.

Referring to the drawings, it will be seen that a transformer casing 1 has been shown as provided with a cover 2 and a sealing gasket 3 so that the transformer casing may constitute a hermetically sealed unit. Within the casing the transformer, not shown, is positioned and the casing is filled with oil or other dielectric to the level indicated by the reference character 4. A metal pipe or tube 5 extends from the bottom of the casing to a point above the oil level and is provided with an upper beveled annular surface 6. An operating or rotary shaft 7 extends through the tube or pipe 5 and terminates in a lower manipulating handle 8 located below the bottom 9 of the transformer tank. It is obvious that a lineman or other operator can manipulate the operating handle 8 to operate the tap changer as desired without any danger to the lineman. The suspended transformer usually has all of the leads extending out of the upper portion thereof in accordance with the usual practice and it is obvious that a lineman manipulating the handle 8 from below the transformer is not in any danger whatsoever.

The tap changer consists of a contact member 10 of metal which is carried by a sleeve-like member or rotary hub 11 formed of porcelain or Bakelite. This composite member formed of the portions 10 and 11 is the driven member and is driven ultimately from the shaft 7 but means are operatively interposed between the shaft 7 and the composite member 10, 11 so as to give this member a quick motion for a quick make or a quick break irrespective of the direction of rotation of the handle 8. The construction is such that the tap changer may be rotated in either direction and due to the quick make and quick break hereinafter described and due to the

fact that the active contact portions are located below the oil level 4, it may be operated under load without danger of injuring the contact members.

A stationary porcelain or Bakelite member 12 loosely surrounds the tube 5 and is supported as indicated at 13 from a portion of the transformer. The member 12 is provided with an annular outwardly projecting part 14 which is equipped with a plurality of stationary contacts 15 which are connected as indicated in Figure 12 to different portions of the primary winding 16, 16.

At this point it is to be noted that it is obvious that if desired a movable contact member 17, see Figure 13, could be employed and could be arranged to engage any one of a plurality of stationary contacts 15' corresponding to the stationary contacts 15 hereinbefore described.

Obviously though the description is directed to a tap changer for the primary of a transformer, the tap changer could naturally be used for the secondary thereof if desired. However, it is preferable to use it for the primary of the transformer in accordance with the usual practice.

In the schematic diagrams of Figures 12 and 13 the secondary has not been shown.

The means for operatively coupling the shaft 12 with the movable contact 10 of the tap changer includes a hub or driving member 18 of Bakelite or other insulating material provided with a pair of downwardly projecting lugs 19 which loosely fit within notches 20 formed in the member 11, see Figure 11. This member 18 is provided with a metal bushing 21 of rectangular external contour and having an aperture 22 therethrough through which an upper shaft 23 loosely passes. The shaft 23 is provided with a transverse pin 24, see Figure 1, which slidably fits within a slot 25 formed in the shaft 7 so that even if the shaft 7 is pushed upwardly by the operator when he manipulates the handle 8 it will not dislodge a tapered sealing member 26 rigidly pinned to the upper shaft 23. This sealing tapered valve-like member 26 revolubly seats against the tapered surface 6 of the tube 5.

It is to be noted that a spring 27 is interposed between the driving member 18 and the driven member 11 and holds the movable contact 10 of the tap changer downwardly into firm engagement with the selected stationary contact.

A locking spring 28 is mounted on the rectangular portion 21 of the driving member 18 and this member also carries an arm 29. Preferably, the upper end of the rectangular member or bushing 21 is peened over. The bushing or rectangular member 21 is rigid with the driving member 18 and consequently the spring 28 and the arm 29, see Figures 1, 7, and 8, are also rigid with the driving member 18.

The shaft 23 is provided with a flattened portion which is received within the slot 30 of a disk 31 which is provided with a finger 32. The finger 32, see Figures 1 and 5, is arranged to load a driving or loading spring 33, whose opposite ends are adapted to be engaged by the fingers 29 and 32 as the device is operated, as will be explained in detail hereinafter. The driving spring 33 is retained in place by means of a washer 34 which has a slotted portion 35, see Figure 4, adapted to engage a flattened portion of the shaft 23. Preferably the washer has slightly overhanging portions or inwardly projecting minute lugs 36, see Figure 4, which prevents it from inadvertently slipping transversely from the shaft 23. The

shaft 23 is provided with a double cam 37 which is shown most clearly in Figure 3 and which is rigidly pinned to the shaft. This cam 37 is adapted to move the locking spring 28 from engagement with the notch 38 in a stationary disk 39 within which it may be temporarily seated. The stationary disk 39 loosely rides on the top of the shaft 23 and is spring pressed downwardly by means of the relatively heavy leaf spring 40, see Figure 1. The leaf spring 40 is more powerful than the spring 27. The stationary disk 39 is held from turning by means of a pair of rigid fingers 41 which are secured to the transformer casing 1 and which engage flat portions 42 formed in the hub 43 of the stationary disk 39.

In operating the device the operator rotates the handle 8 in either direction depending upon the particular position that he wishes the tap changer to move to. In turning the shaft, he causes the finger 32 to load the driving spring 33 and tend to move the finger 29 and thus tend to move the driving member 18 which in turn tends to move the driven member 11. However, no motion can be imparted to either the driving member or the driven member until the locking spring 28 is detached from the notch 38 in which it is then seated.

This occurs through the action of the cam 37. It sometimes happens that the force of the driving spring 33 is not sufficient to move the tap changer to its new position due to a temporary freezing or sticking of the contacts. Provision is made to overcome this difficulty. The cam 37 is provided with a pair of projecting lugs 44 which are adapted to engage the locking spring 28 in the event that the contacts stick and to thus positively move the contacts to the new position by means of the engagement with the locking spring 28. It is to be noted that after the initial motion of the contacts, that the freezing or sticking is broken and the contacts are then quickly moved by means of the driving spring 33.

The motion of the movable contacts of the tap changer is very rapid both in the "make" and in the "break" of the switch and in view of the fact that the contacts are located below the oil level it is clear that the tap changer can be operated under load. As stated, the tap changer can be operated in either direction.

It is to be noted that the connecting leads have been omitted in Figures 1 and 2 for the sake of clearness.

It will be seen that a novel form of tap changer has been provided by this invention which is extremely safe in its operation and which does not require the exposure of the lineman to any of the high tension leads of the transformer. Further it is to be noted that the tap changer can be operated in either direction and under load.

Although this invention has been described in considerable detail, it is to be understood that such description is intended as illustrative rather than limiting, as the invention may be variously embodied and is to be interpreted as claimed.

I claim:

1. A transformer tap changer arranged to operate under load comprising in combination with a container arranged to contain oil, a plurality of stationary contacts arranged in a circle and submerged in said oil, a rotary contact member arranged to contact said stationary contacts and to rotate to successive positions, a tube extending upwardly from the bottom of said container to a point above the oil level and constituting a housing for said shaft, a rotary shaft extending

upwardly through said tube for operating said rotary contact member, external means located below the bottom of said container for operating said shaft, and sealing means for sealing the upper end of said tube.

2. A transformer tap changer comprising a rotary member provided with a movable contact, a rotary driving member interlocking with said rotary member, a rotary shaft having a projecting arm, said driving member having a projecting arm, a driving spring operatively interposed between said arms for driving said driving member when said shaft is rotated, a stationary disk having a plurality of notches, a locking spring arranged to selectively engage said notches and normally preventing rotation of said driving member, cam means operated by said shaft for temporarily releasing said locking spring, and a plurality of stationary contacts arranged to be selectively engaged by said movable contact, said shaft having free axial motion with reference to said first mentioned projecting arm and said rotary member having free axial motion with reference to said rotary driving member.

3. A transformer tap changer comprising a plurality of stationary contacts arranged in a circle, a rotary contact member arranged to contact said stationary contacts and to rotate to successive positions, a rotary shaft, a coiled driving spring operatively interposed between said shaft and said rotary contact member and arranged to be stressed and tending to rotate said rotary contact member when said shaft is rotated, locking means for locking said rotary contact member in any one of a plurality of selected positions, cam means operated from said shaft for releasing said locking means after said spring has been stressed, and means connected to said shaft for positively driving said movable contact member in the event the force of said spring is insufficient to move said movable contact member after release by said cam means.

4. A transformer tap changer arranged to operate under load comprising in combination with a container arranged to contain oil, a plurality of stationary contacts arranged in a circle and submerged in said oil, a rotary contact member arranged to contact said stationary contacts and to rotate to successive positions, a tube extending upwardly from the bottom of said container to a point above the oil level and constituting a housing for said shaft, a rotary shaft extending upwardly through said tube for operating said rotary contact member, external means located below the bottom of said container for operating said shaft, and a rotary assembly including a rotary member positively driven from said shaft and having limited movement axially of said shaft and axially slidably interlocking with said rotary contact member and having sealing means revolubly seated on the upper end of said tube.

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