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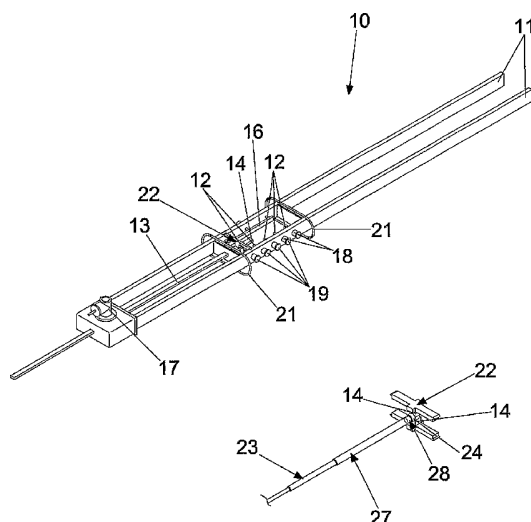
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(54) Title: OFF-CIRCUIT TAP CHANGER, WITH ACTUATING MECHANISM, FOR ELECTRICAL TRANSFORMERS



(57) Abstract: An off-circuit tap changer (10, 20), with actuating mechanism, for electrical transformers, of the type comprising a frame which includes at least two elongated bars (11), to which a series of stud-type fixed contacts (12) is integrally connected, arranged orthogonally in series, and a set of movable rubbing block contacts (14) which slide on the fixed contacts (12) thanks to the actuation of a worm screw (23); a nut thread is fitted or made in the end part of an insulating tube (27), coaxial with and outside the worm screw (23), so that the set of movable contacts (14) is fixed, by means of a shaped adaptor (28), in the end part of the insulating tube (27) opposite the nut thread. In this way, the nut thread is in a different position from that of the set of movable contacts (14) with respect to the overall length of the tap changer (10, 20), permitting the use of movable contacts (14) unconstrained by the dimensions of the tube (27) and/or worm screw (23).



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OFF-CIRCUIT TAP CHANGER, WITH ACTUATING MECHANISM, FOR
ELECTRICAL TRANSFORMERS

The present invention refers, in general, to an off-
5 circuit tap changer, with actuating mechanism, for
electrical transformers.

The technical solution adopted lends itself
particularly to use in high voltage tap changers, but
can equally be used in any off-circuit tap changer with
10 actuating mechanism.

Off-circuit tap changers for electrical transformers
are currently known whose structure substantially has
an elongated body where a set of fixed stud contacts is
integrally made orthogonally in series along the whole
15 length of the elongated body.

The elongated body in fact consists of a frame, which
laterally has the above-mentioned fixed stud contacts,
inside of which there runs at least one support for a
pair of movable rubbing-block type contacts, which the
20 user can operate by means of specific controls so that
they are brought into opposing positions, and are
adapted to alternatively and successively enter into
interference with two of the aforementioned fixed
contacts.

At present, two principal structures have been adopted of off-circuit high-voltage tap changers: rack-type high voltage tap changers (ATCs) and screw-type high voltage tap changers (ATVs), actuated by means of a
5 worm screw.

In rack-type high voltage tap changers (ATCs), the frame constitutes the sliding guide for a slide, adapted to constitute the support for the movable contacts, associated with a bar-shaped body which moves
10 it by means of a longitudinal rack forming part of the slide and coupled with a pinion, which in turn results integral with a composite handle fixed to the transformer body, which the operator can operate by hand.

15 On the other hand, in screw-type high voltage tap changers (ATVs), the support of the movable contacts is actuated by a worm screw, usually realised in insulating material, which is associated with a lead nut.

20 Both these traditional constructive solutions, however, foresee the use of movable contacts, which result constrained by the dimensions of the tube or the worm screw, and they foresee a number of pins, which it would be desirable to reduce so to limit the mechanical

problems.

Within the scope of the requirements described above, then, the object of the present invention is to avoid the drawbacks mentioned and, in particular, to create
5 an off-circuit tap changer for electrical transformers, with actuating mechanism, which shows a greater constructive simplicity and which foresees a reduced number of parts with respect to traditional solutions.

Another object of the present invention is to create an
10 off-circuit tap changer for electrical transformers, with actuating mechanism, which would be more functional, reliable and robust than traditional tap changers.

A further object of the present invention is to realise
15 an off-circuit tap changer for electrical transformers, with actuating mechanism, which would enable tap changers to be produced at a lower design and manufacturing cost than with the known techniques.

These and other objects are achieved by the off-circuit
20 tap changer for electrical transformers, with actuating mechanism, made according to claim 1 below.

The other, dependent claims cover detailed characteristics of the invention.

Further objects and advantages of the present invention

will become clear from the description which follows,
related to a preferred but not limiting example
embodiment of the off-circuit tap changer with
actuating mechanism covered by the present invention,
5 and from the attached drawings, in which:

- Figure 1 is a perspective view of a rack-type high
voltage off-circuit tap changer realised according
to the known art;
- Figure 2 is a perspective view of a screw-type
10 high voltage off-circuit tap changer made
according to the present invention;
- Figure 3 is a perspective view of an adaptor
element used in the off-circuit tap changer for
electrical transformers, with actuating mechanism,
15 according to the present invention.

In particular, figures 1 and 2 show, respectively, a
rack-type high voltage off-circuit tap changer (ATC),
generically indicated with 10, and a screw-type high
voltage off-circuit tap changer (ATV), generically
20 indicated with 20.

It should be pointed out here that the technical
solution according to the invention lends itself
particularly to high voltage tap changers but can
likewise be used, without any kind of problem, in any

off-circuit tap changer with actuating mechanism.

With particular reference to Figure 1, the ATC rack-type high voltage off-circuit tap changer for electrical transformers 10 (ATC) comprises an outer
5 frame, formed by two parallel bars 11 of substantially rectangular section, which integrally bear stud-shaped fixed contacts 12, arranged orthogonally in series.

A central bar-shaped component 13, at whose end
respective rubbing-block type movable contacts 14 are
10 mounted, placed below a plastic protection 15, is utilised as a guide for the sliding of the movable contacts 14 over the fixed stud contacts 12.

In this way, the movable contacts 14 are adapted to
alternatively and successively enter into interference
15 with two fixed contacts 12 of one of the bars 11 or with one fixed contact 12 and a contact strip 16 made on the parallel bar 11 which is at the desired voltage.

The sliding guide consists of a longitudinal rack forming part of the central bar-shaped component 13 and
20 coupled with a pinion (not shown in the Figure), which in turn is connected to an operating device 17 for the operator to actuate.

On the outer side of the bars 11, each of the fixed stud contacts 12 presents a threaded ring 18 associated

with related distributor caps 19 for attaching the cable ends.

If required, moreover, two guard rings 21 can be used, tightly fixed to the external structure of the bars 11
5 and each connected with the stud of the nearest fixed contact 12 so as to be at the same potential as that contact.

The set of movable contacts 14 may take the form of medium-voltage fixed-point and/or pawl tap changers and
10 is protected inside protective elements 22, realised in plastic material and double shoulder shaped in order to provide considerable stability.

Figure 2, where components which have exactly the same form and function as those in Figure 1 are given the
15 same reference number, schematically shows a screw-type (ATV) high-voltage tap changer, indicated generically with 20, which differs with respect to the rack-type high-voltage tap changer 10 due to the typology of operation of the set of movable contacts 14.

20 In particular, the set of movable contacts 14 is made to slide over the fixed contacts 12 by means of a worm screw 23 (the so-called "large screw") which is associated with the set of movable contacts 14 by means of a coupling component 24, which is integral with the

nut thread 25 (which in the exemplifying and preferred embodiment consists of a lead nut).

The worm screw 23 can be operated from the outside by means of a movement device 26 available to the
5 operator.

The off-circuit tap changer for electrical transformers, with actuating mechanism, according to the present invention has the same mechanical and electrical components as the tap changer typologies
10 examined so far, and moreover it foresees an actuating mechanism (shown in detail in Figure 3) comprising a worm screw 23 (analogous to that used in the screw-type high-voltage tap changer), coaxial and inside an insulating tube 27 preferably realised in phenolic
15 resin, on which the nut thread is fitted or made at one end part.

The coupling 24 is connected to the end portion of the tube 27, and bears the set of movable contacts 14, housed inside a shaped protective structure 22.

20 The coupling 24 is further connected with the tube 27 by means of the interposition of a shaped adaptor 28, which allows for the coupling between the nut thread and the set of movable contacts 14.

With this type of connection and thanks to the use of

the adaptor 28, it is possible to use the same components in screw-type tap changers as those used in rack-type ones, reducing the number of pins to a minimum as well as reducing the overall bulk of the structure in general.

The use of the same components as for the rack-type high-voltage tap changer also permits lower expenditure on the production of the moulds and on research into the suitability of the electric contacts.

Next, the use of a nut thread fitted or made in the end portion of the tube 27 and coaxial with the worm screw 23, with the set of movable contacts 14 fixed to the end part of the tube 27 itself opposite the internal thread, makes it possible for the aforementioned nut thread in a diverse position, with respect to that of the set of movable contacts 14, depending on the overall length of the tap changer.

Because of the aforementioned arrangement, and by virtue of the use of a shaped adaptor 28 fitted into the tube 27 at the opposite end from the nut thread, it is thus possible to employ movable contacts 14 which are entirely unconstrained by the size of the tube 27 and/or that of the worm screw 23, with obvious benefits from the point of view of practicality in use,

reduction in overall size and total costs, as stated above.

The overall structure of the tap changer, indeed, is decidedly simpler than that of traditional ones, yet
5 functional and robust; moreover, such structure can, as we have seen, be readily adapted to various transformer typologies, including many that have already gone into production.

The characteristics of the off-circuit tap changer for
10 electrical transformers with actuating mechanism covered by the present invention, and its advantages, are clear from the above description.

Lastly, it is obvious that numerous other variants of the off-circuit tap changer in question could be
15 designed while preserving the innovative principles inherent in the inventive idea, as it is clear that the materials, forms, and dimensions of the illustrated details may be of any type depending on the requirements, and that those details could be
20 substituted with other technically equivalent details.

CLAIMS

1. Off-circuit tap changer (10, 20), with actuating mechanism, for electrical transformers, of the type comprising at least one frame, which includes elongated
5 bars (11), to which a series of stud-type fixed contacts (12) is integrally connected, arranged orthogonally in series, said tap changer (10, 20) moreover comprising a set of movable rubbing-block type contacts (14) which slide on the fixed contacts (12)
10 thanks to at least one actuating element (23), characterised in that said at least one actuating element (23) is at least partially fitted inside an insulating tubular element (27) which is coaxial with said actuating element (23), so that the set of movable
15 contacts (14) is connected with at least one end portion of said tubular element (27).
2. Off-circuit tap changer (10, 20), with actuating mechanism, as in claim 1, characterised in that said at least one actuating element (23) consist of a worm
20 screw (23) and at least one nut thread is fitted or made in the end part of said tubular element (27), coaxial with and outside of said the worm screw (23).
3. Off-circuit tap changer (10, 20), with actuating mechanism, as in claim 2, characterised in that the set
25 of movable contacts (14) is connected, through at least

one shaped adaptor element (28) which permits the coupling between the nut thread and the set of movable contacts (14), to an end portion of said tubular element (27), opposite said nut thread, so that the nut thread is situated in a different position from that occupied by the set of movable contacts (14), with respect to the overall length of the tap changer (10, 20), in order to permit the use of movable contacts (14) unconstrained by the dimensions of said tubular element (27) and/or worm screw (23).

4. Off-circuit tap changer (10, 20), with actuating mechanism, as in claim 1, characterised in that said stud-type fixed contacts (12) have respective threaded rings (18), associated with related distributor caps (19), for attaching the cable ends.

5. Off-circuit tap changer (10, 20), with actuating mechanism, as in claim 1, characterised in that said elongated bars (11) are connected to respective guard rings (21), each connected with a stud of the nearest fixed contact (12), so as to be at the same potential.

6. Off-circuit tap changer (10, 20), with actuating mechanism, as in claim 1, characterised in that said set of movable contacts (14) is placed inside shaped protective elements (22) realised in plastic material.

7. Off-circuit tap changer (10, 20), with actuating

mechanism, as in claim 1, characterised in that said tubular element (27) is connected, at one of its end portions, to said set of movable contacts (14), by means of at least one coupling element (24).

- 5 8. Off-circuit tap changer (10, 20), with actuating mechanism, for electrical transformers, as substantially described and illustrated and for the specified objects.

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Fig. 1

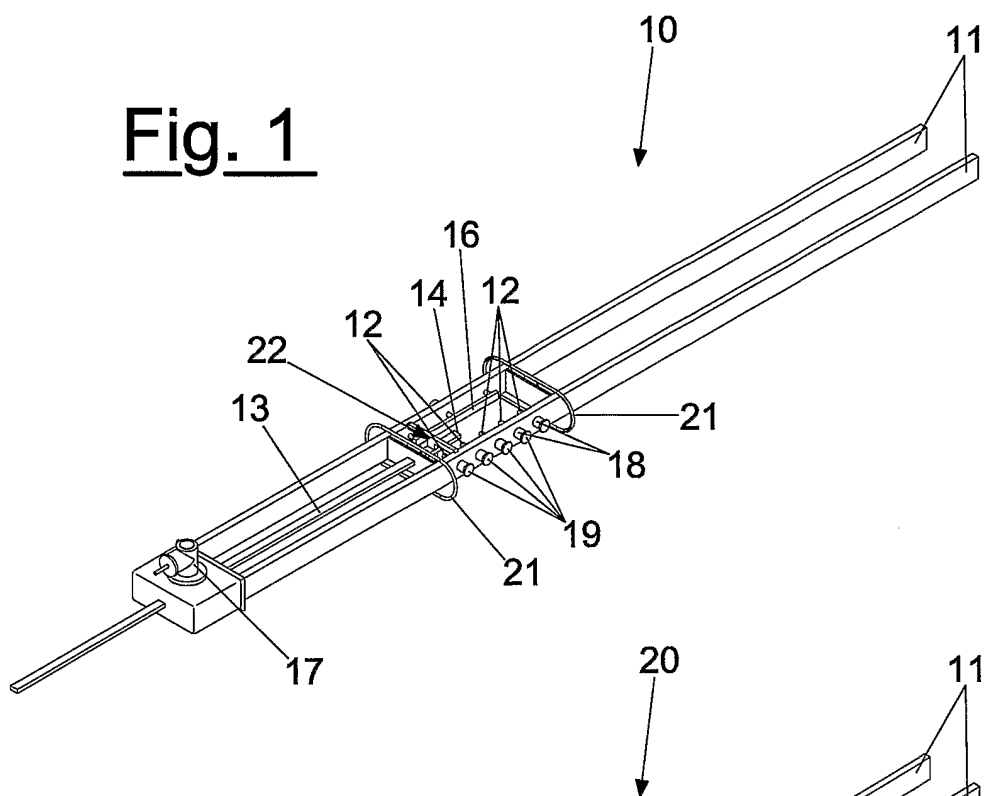


Fig. 2

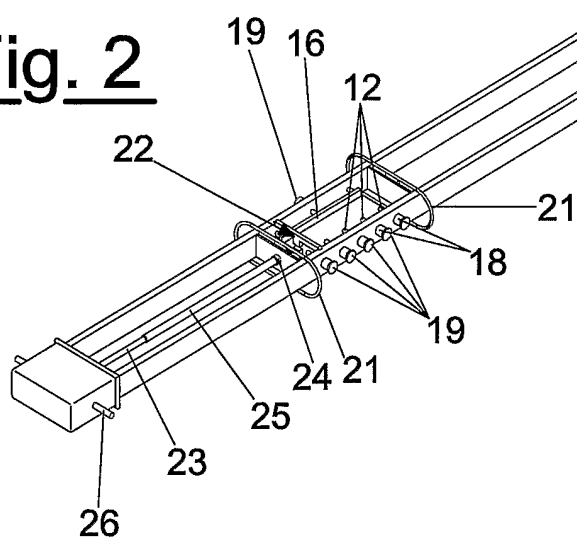
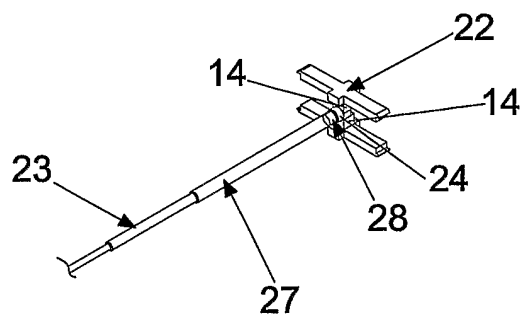


Fig. 3



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2005/014179

A. CLASSIFICATION OF SUBJECT MATTER

INV. H01H9/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	EP 0 354 423 A (REINHAUSEN MASCHF SCHEUBECK; MASCHINENFABRIK REINHAUSEN GMBH) 14 February 1990 (1990-02-14) column 1, line 39 - column 2, line 20	1-8
A	US 3 652 812 A (DONALD J. RISTUCCIA) 28 March 1972 (1972-03-28) column 2, line 71 - column 7, line 51; figure 2	1-8
A	US 4 935 586 A (BLEIBTREU ET AL) 19 June 1990 (1990-06-19) column 3, line 28 - column 4, line 65; figure 6	1-8
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Further documents are listed in the continuation of Box C.



See patent family annex.

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2005/014179

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 008, no. 074 (E-236), 6 April 1984 (1984-04-06) & JP 58 222506 A (HITACHI SEISAKUSHO KK), 24 December 1983 (1983-12-24) abstract -----	1-8

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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