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(54) **A circuit breaker**

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(73) Proprietor: **Circuit Breaker Industries Limited**
Elandsfontein, Gauteng (ZA)

(72) Inventor: **Bagalini, Dante**
Johannesburg, Gauteng (ZA)

(74) Representative: **Mouteney, Simon James et al**
MARKS & CLERK,
57-60 Lincoln's Inn Fields
London WC2A 3LS (GB)

(56) References cited:
WO-A-96/03760 **FR-A- 2 681 725**

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Description

[0001] THIS INVENTION relates to a circuit breaker. More particularly, the invention relates to a circuit breaker incorporating an earth leakage facility.

[0002] According to the invention, there is provided a circuit breaker which includes

a primary housing containing an operating mechanism, the operating mechanism including a plurality of output conductors;
an earth leakage sensing means comprising an oval-shaped core mounted in the primary housing; electrically conductive elements, mounted on the output conductors and projecting through an oval-shaped opening defined by the core; and current sensing circuitry and earth leakage sensing circuitry incorporated in a secondary housing, the secondary housing being received within the primary housing.

[0003] A circuit breaker according to the preamble of claim 1 is known from FR 2 681 725.

[0004] The primary housing may be dimensioned to be the same size as a housing and with the same size arc chutes of a circuit breaker of the same rating but excluding an earth leakage facility. In this specification, the term "same size", refers to a primary housing of a circuit breaker which has the same dimensions, interior capacity and layout as a housing of a conventional circuit breaker, i.e. a circuit breaker without an earth leakage facility, of the same rating. Corresponding words thus have corresponding means.

[0005] Thus, the primary housing may include a base having a floor bounded by a side wall portion, the core lying in a plane extending parallel to the floor.

[0006] The core may be a strip-wound core of a nanocrystalline alloy. The core may incorporate shielding material and insulating material and may be dimensioned to be accommodated in a recess in the primary housing.

[0007] The output conductors may protrude into the recess of the primary housing. Then, each electrically conductive element may be in the form of a spacer of an electrically conductive material, the spacers projecting from the conductors through the opening of the core to be surrounded by the core. An output lug, of an electrically conductive material, may be mounted on each spacer.

[0008] Each output conductor may be fastened to its associated spacer and output lug by a fastening means.

[0009] The current sensing circuitry may include a current sensing means. The current sensing means may comprise a current transformer having a winding surrounding the output lugs.

[0010] The current transformer and the earth leakage core may be connected to their appropriate circuitry which is contained in the secondary housing. The sec-

ondary housing may form a unit which is removably received in the primary housing of the circuit breaker. In a conventional fashion, the unit may incorporate a tripping device which acts on the operating handle of the circuit breaker.

[0011] The invention extends also to a circuit breaker which includes

a primary housing which is dimensioned to be the same size as a housing of a circuit breaker of the same rating but excluding an earth leakage facility; an earth leakage sensing means contained within the primary housing; and current sensing circuitry and earth leakage sensing circuitry incorporated in a secondary housing, the secondary housing being received within said primary housing.

[0012] The invention is now described by way of example with reference to the accompanying diagrammatic drawings.

[0013] In the drawings

Figure 1 shows a schematic, sectional side view of part of a circuit breaker, in accordance with the invention;

Figure 2 shows a schematic, sectional plan view of the part of the circuit breaker on an enlarged scale; Figure 3 shows a three dimensional view of an earth leakage core of the circuit breaker;

Figure 4 shows a three dimensional view of a base of a primary housing of the circuit breaker; and Figure 5 shows a schematic three dimensional view of the base of Figure 4 showing the arrangement of components of the circuit breaker in the base.

[0014] Referring to the drawings, a part of a circuit breaker, in accordance with the invention, is illustrated and is designated generally by the reference numeral 10. The circuit breaker 10 comprises a primary housing 12, the base of which is illustrated in the drawings. The housing 12 is the same size as a housing of a circuit breaker of the same rating but excluding an earth leakage facility. An operating mechanism 14 (Figure 5) and handle arrangement (not shown) of conventional size and rating are mounted via a frame in the housing 12, an edge of the frame being indicated schematically at 14.1 in Figure 1 of the drawings.

[0015] The housing 12 is effectively divided into three parts, the operating mechanism 14 being contained within a central part 12.1 of the housing 12, an arc chute arrangement 15 being arranged in a part 12.2 on one side of the operating mechanism 14 with output conductors 16 of the operating mechanism 14 extending into a further part 12.3 on an opposed side of the operating mechanism 14.

[0016] Further, the base of the housing 12 has a floor 18 (Figure 4) surrounded by a side wall 19.

[0017] The circuit breaker 10 includes an earth leakage facility having an oval-shaped core 20 illustrated in Figure 3 of the drawings. The core 20 is a strip-wound core of a nanocrystalline alloy called VITROPERM 800F (Vitroperm 800F is a registered trade mark of Vacuum-schmelze GmbH of Hanau, Germany). The core 20 lies in a plane parallel to the floor 18 of the base of the housing 12 in the part 12.3 of the housing 12.

[0018] An electrical spacer 22 (Figure 1) is mounted on each output conductor 16 to protrude through an opening 24 in the core 20. Each spacer 22 has an output lug 26 mounted thereon, the output lugs 26 being of an electrically conductive material. Each output lug 26 is aligned with an output element 28 to form an output terminal 30 of the circuit breaker 10, each terminal 30 being accommodated in the part 12.3 of the housing 12.

[0019] Each conductor 16, spacer 22 and output lug 26 are fastened together by a bolt and nut combination 44 to hold the assemblies so formed together.

[0020] The circuit breaker 10 includes a current sensing means 32 for sensing current through the output terminals 30 of the circuit breaker 10. The current sensing means 32 includes a current transformer 33 having a winding 34 extending about the output lugs 26. An output from the current transformer 33 is connected to current sensing circuitry illustrated schematically in Figure 1 by a printed circuit board 36. Similarly, an output from the core 20 of the earth leakage facility is connected to earth leakage sensing circuitry indicated schematically in Figure 1 by a printed circuit board 38. The current sensing circuitry 36 and the earth leakage sensing circuitry 38 are both connected to a low energy shunt trip 40 which, in a conventional fashion, operates a tripping mechanism (not shown), the tripping mechanism, in turn, being connected to the operating handle of the operating mechanism 14 of the circuit breaker 10.

[0021] The current transformer 33, the current sensing circuitry 36, the earth leakage sensing circuitry 38 and the shunt trip 40 are contained within a secondary housing 42 which is received in the part 12.3 of the housing 12 of the circuit breaker 10. The housing 42 is mounted above the core 20 in the part 12.3 of the housing 12 such that the tripping mechanism engages the operating handle of the circuit breaker 10.

[0022] The arrangement of the oval-shaped core 20 parallel to the floor 18 of the base of the housing 12, and mounting of the secondary housing 42 above the core 12 facilitates the use of a housing 12 which has the same size as a conventional circuit breaker of the same rating but excluding an earth leakage facility. Those skilled in the art will appreciate that the output conductors 16 from the operating mechanism of the circuit breaker 10 are arranged with their usual spacing so that there is no need to provide additional insulation about the output conductors 16 nor is there a need to reduce their rating to overcome heating problems.

[0023] With the provision of the oval-shaped core 20, the core 20 lying parallel to the floor 18 of the base of

the primary housing 12 and the earth leakage sensing circuitry being accommodated in the secondary housing 42 which, in a conventional circuit breaker, only accommodates the current sensing circuitry of the circuit breaker 10, the same sized, configured and dimensioned primary housing 12 can be used for a circuit breaker of a particular rating without the need to reduce the rating of the circuit breaker 10. Thus, the need to reduce the arc chutes and, as a result, reducing the breaking capacity of the circuit breaker is obviated.

[0024] While the circuit breaker 10 has been described with reference to electronic current sensing, it will be appreciated that the same configuration of earth leakage sensing facility can be also used with thermal-magnetic current sensing devices or hydraulic-magnetic current sensing devices.

Claims

1. A circuit breaker which includes

a primary housing (12) containing an operating mechanism (14), the operating mechanism including a plurality of output conductors (16); an earth leakage sensing means, **characterised in that** it also comprises an oval-shaped core (20) mounted in the primary housing; electrically conductive elements, mounted on the output conductors and projecting through an oval-shaped opening (24) defined by the core; and current sensing circuitry (36) and earth leakage sensing circuitry (38) incorporated in a secondary housing (42), the secondary housing being received within the primary housing.

2. The circuit breaker as claimed in Claim 1 in which the primary housing is dimensioned to be the same size as a housing and with the same size arc chutes of a circuit breaker of the same rating but excluding an earth leakage facility.

3. The circuit breaker as claimed in Claim 1 or Claim 2 in which the primary housing includes a base having a floor bounded by a side wall portion, the core lying in a plane extending parallel to the floor.

4. The circuit breaker as claimed in any one of the preceding claims in which the core is a strip-wound core of a nanocrystalline alloy.

5. The circuit breaker as claimed in Claim 4 in which the core incorporates shielding material and insulating material.

6. The circuit breaker as claimed in any one of the preceding claims in which each electrically conductive

element is in the form of a spacer of an electrically conductive material, the spacers projecting through the opening of the core to be surrounded by the core.

7. The circuit breaker as claimed in Claim 6 in which an output lug is mounted on each spacer.

8. The circuit breaker as claimed in Claim 7 in which each output conductor is fastened to its associated spacer and output lug by a fastening means.

9. The circuit breaker as claimed in Claim 7 or Claim 8 in which the current sensing circuitry includes a current sensing means.

10. The circuit breaker as claimed in Claim 9 in which the current sensing means comprises a current transformer having a winding surrounding the output lugs.

11. The circuit breaker as claimed in any one of the preceding claims in which the secondary housing is removably received in the primary housing.

Patentansprüche

1. Schaltungsunterbrecher, der aufweist:

ein primäres Gehäuse (12), das einen Betätigungsmechanismus (14) enthält, wobei der Betätigungsmechanismus mehrere Ausgangsleiter (16) aufweist;
ein Erdschluss-Sensormittel.

dadurch gekennzeichnet, dass er ferner aufweist:

einen ovalförmigen Kern (20), der in dem primären Gehäuse gelagert ist;
elektrisch leitende Elemente, die an den Ausgangsleitern angebracht sind und durch eine von dem Kern gebildete ovalförmige Öffnung (24) vorstehen; und
eine Strom-Sensorschaltung (36) und eine Erdschluss-Sensorschaltung (38), die in einem sekundären Gehäuse (42) untergebracht sind, wobei das sekundäre Gehäuse sich innerhalb des primären Gehäuses befindet.

2. Schaltungsunterbrecher nach Anspruch 1, bei dem das primäre Gehäuse so dimensioniert ist, dass es die gleiche Größe wie ein Gehäuse und gleich große Lichtbogenrinnen eines Schaltungsunterbrechers mit der gleichen Unterbrecherrate, jedoch ohne Erdschlussmöglichkeit hat.

3. Schaltungsunterbrecher nach Anspruch 1 oder 2, bei dem das primäre Gehäuse eine Basis mit einem Boden hat, der von einem Seitenwandabschnitt begrenzt wird, wobei der Kern in einer parallel zu dem Boden verlaufenden Ebene liegt.

4. Schaltungsunterbrecher nach einem der vorhergehenden Ansprüche, bei dem der Kern ein bandgewickelter Kern aus einer nanokristallinen Legierung ist.

5. Schaltungsunterbrecher nach Anspruch 4, bei dem der Kern Abschirmmaterial und Isoliermaterial enthält.

6. Schaltungsunterbrecher nach einem der vorhergehenden Ansprüche, bei dem jedes elektrisch leitende Element die Form eines Abstandsstückes aus einem elektrisch leitenden Material hat, wobei die Abstandsstücke durch die Öffnung des Kerns vorstehen, um von dem Kern umgeben zu werden.

7. Schaltungsunterbrecher nach Anspruch 6, bei dem ein Ausgangsansatz an jedem Abstandsstück vorgesehen ist.

8. Schaltungsunterbrecher nach Anspruch 7, bei dem jeder Ausgangsleiter an seinem zugehörigen Abstandsstück und Ausgangsansatz durch ein Befestigungsmittel befestigt ist.

9. Schaltungsunterbrecher nach Anspruch 7 oder 8, bei dem die Strom-Sensorschaltung ein Strom-Sensormittel aufweist.

10. Schaltungsunterbrecher nach Anspruch 9, bei dem das Strom-Sensormittel einen Stromumformer mit einer die Ausgangsansätze umgebenden Wicklung aufweist.

11. Schaltungsunterbrecher nach einem der vorhergehenden Ansprüche, bei dem das sekundäre Gehäuse in dem primären Gehäuse auswechselbar angeordnet ist.

Revendications

1. Disjoncteur qui comprend :

un boîtier principal (12) contenant un mécanisme de commande (14), le mécanisme de commande comportant une pluralité de conducteurs de sortie (16) ;
des moyens de détection de fuite à la terre, **caractérisé en ce qu'il** comprend également un noyau de forme ovale (20) monté dans le boîtier principal ;

des éléments conducteurs électriques, montés sur les conducteurs de sortie et faisant saillie à travers l'ouverture de forme ovale (24) délimitée par le noyau ; et
un circuit de détection de courant (36) et un circuit de détection de fuite à la terre (38) incorporés dans un boîtier secondaire (42), le boîtier secondaire étant logé à l'intérieur du boîtier principal.

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2. Disjoncteur selon la revendication 1, dans lequel le boîtier principal est dimensionné pour avoir les mêmes dimensions comme boîtier et avec les boîtes de soufflage de même taille qu'un disjoncteur de même caractéristique mais en excluant un équipement de fuite à la terre. 15
3. Disjoncteur selon la revendication 1 ou 2, dans lequel le boîtier principal comprend une base avec un fond délimité par une partie de paroi latérale, le noyau étant situé dans un plan s'étendant parallèlement au fond. 20
4. Disjoncteur selon l'une quelconque des revendications précédentes, dans lequel le noyau est un noyau à enroulement plat d'un alliage nanocristallin. 25
5. Disjoncteur selon la revendication 4, dans lequel le noyau comporte du matériau de blindage et du matériau isolant. 30
6. Disjoncteur selon l'une quelconque des revendications précédentes, dans lequel chaque élément conducteur électrique est réalisé sous la forme d'une entretoise en un matériau conducteur de l'électricité, les entretoises faisant saillie à travers l'ouverture du noyau de manière à être entouré par le noyau. 35
7. Disjoncteur selon la revendication 6, dans lequel une cosse de sortie est montée sur chaque entretoise. 40
8. Disjoncteur selon la revendication 7, dans lequel chaque conducteur de sortie est fixé à son entretoise et à sa cosse de sortie associées par des moyens de fixation. 45
9. Disjoncteur selon la revendication 7 ou 8, dans lequel le circuit de détection de courant comprend des moyens de détection de courant. 50
10. Disjoncteur selon la revendication 9, dans lequel les moyens de détection de courant comprennent un transformateur de courant comportant un enroulement entourant les cosses de sortie. 55

11. Disjoncteur selon l'une quelconque des revendications précédentes, dans lequel le boîtier secondaire est logé de manière amovible dans le boîtier primaire.

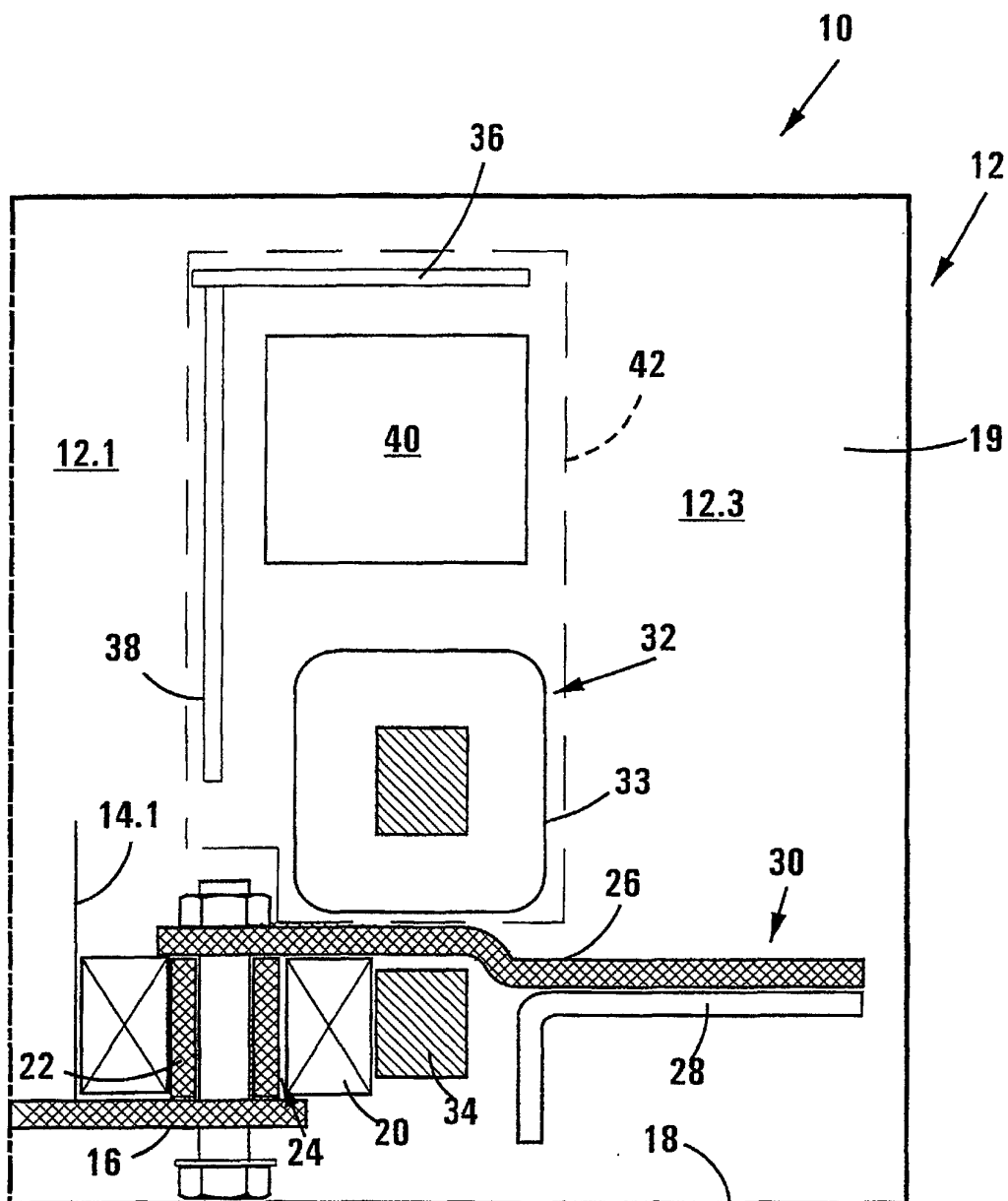


FIG 1

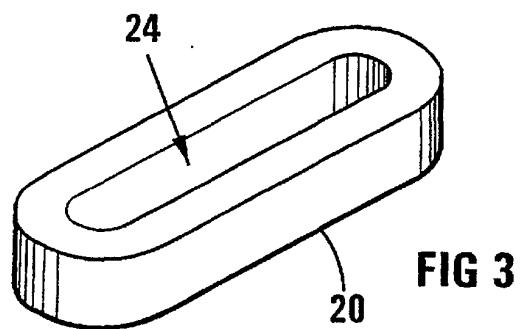


FIG 3

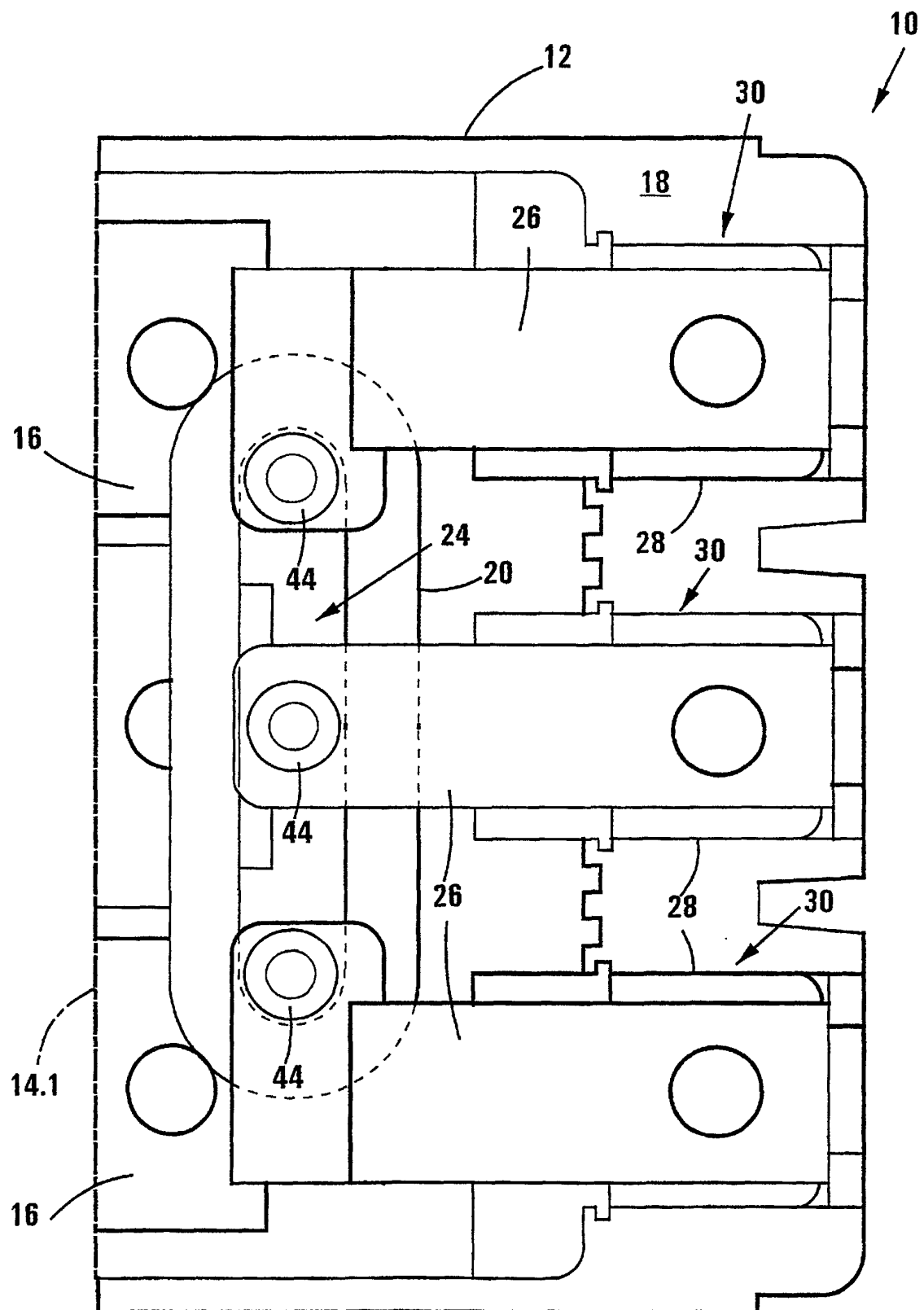


FIG 2

