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(54) **Molded case and cover arrangement for current limiting circuit breakers.**

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EP-A- 0 003 736
AU-B- 482 990
DE-U- 8 807 464
FR-A- 2 386 899
GB-A- 530 353

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Description

This invention relates to a unique insulating enclosure for low voltage current limiting circuit breakers and, more specifically, to the inter-connection between the case and the cover of the enclosure to allow the enclosure to strongly resist the overpressure caused by gases generated during the interruption process.

As already know, particularly high circuit currents generate gas pressure in the order of some bars in the arc chambers of current limiting circuit breakers due to gases generated by the contacts of the circuit breakers as well as the other components contributing to the arc extinction process.

The standard insulating molded plastic enclosure for such low voltage circuit breakers consists of an enclosure, which contains the circuit breakers components, provided with a cover having openings for an operating handle.

The cover is usually attached to the case by screws passing through the cover itself to engage threaded openings in the case. Additionally, the cover includes projecting ridges for accurate alignment with the case.

The high gas pressure, generated when a short circuit occurs, exerts a strong mechanical stress to the side walls of the case which ordinarily is incapable of resisting such a high pressure. Accordingly, it is considered beneficial to transfer such a stress from the side walls of the case to the cover which is more capable of resisting stress because of the reduced height and increased thickness thereof.

One prior attempt to transfer the stress from the circuit breaker case to the cover provided a step on the upper edge of the side walls of the case having a lower portion towards the exterior of the case and an upper portion towards the interior of the case. A complementary step was also provided on the lower edge of the side walls of the cover. This arrangement allowed for cases and covers of equal thickness but required a decrease in the thickness of the steps themselves which ultimately reduced the overall resistance of the enclosure to stress. Increasing the thickness of the steps caused the overall dimensions of the enclosure to become increased and also interfered with the rapid venting of the gases to the exterior of the enclosure.

Another know method of reinforcing the enclosure consisted of providing a number of metal pins in the edge of the cover received whithin corresponding recesses formed in the cross-section of the side walls of the case. The method was effective for increasing the resistance of the enclosure to stress but resulted in an increase in the overall cost of manufacturing the cover and the case.

1. Document GB-A-530 353 discloses an enclosure for circuit breaker, comprising a cover, and a case, in which said case includes a pair of opposing side walls having a plurality of projections extending therefrom and said cover includes a pair of side walls having a corresponding plurality of recesses formed therein, said recesses being shaped to accept said projections. This enclosure, however, cannot provide good resistance against possible high pressure gas developped in the circuit breaker because:

   i) the circuit breaker there disclosed is not a current limiting circuit breaker, because at the application date of the above document (June 22, 1939) such a class of circuit breakers was unknown, in fact, not having available current limiting features, the circuit breaker was provided with fuse assembly;

   ii) there are no means making abut the side walls of the base against the lower edge of the cover, so that the cover cannot help the walls themselves in resisting against gas pressure;

   iii) the cover is not particularly reinforced to resist said pressure; and

   iv) the end shields are secured to the cover by just two hook-like lugs not particularly efficient in case of presence of high pressure gas and, at any rate, the end shields, being external with respect to the enclosure formed by the cover and the base, cannot be affected by any kind of gas coming therefrom.

Another prior art document (FR-A-2 386 899) discloses a method for connecting, by means of tenons and mortises members of a composite socket having the purpose of housing electric devices such as relays and circuit breakers, but cannot suggest the transmission of stresses due to gas pressures from a member to another one. Furhter the tenons and the mortises are each other coupled in the tightest way the possible so that such a couplement cannot suggest in any way to vent the gas developped in a circuit breaker.

The invention regards a circuit breaker enclosure comprising a molded plastic case and a molded plastic cover in which said cover includes a pair of opposing side walls having a plurality of dovetail projections extending therefrom and said case includes a pair of side walls having a corresponding plurality of recesses formed therein, said recesses being shaped to accept said dovetail projections, wherein said dovetail projections each comprise a pair of opposing internal and external surfaces, said external surfaces being larger than said internal surfaces and wherein said opposing internal and external surfaces are joined by tapering edges, said edges tapering inwards from said external surfaces to said internal surfaces.

Particularly, in a preferred embodiment said recesses are flanked by intermediate projections having internal and external surfaces, said intermediate projections having tapering side walls and said side walls taper outwards from said internal to said external surfaces.

A further embodiment includes a metal tang embedded within the dovetails projections on the cover to provide increased stiffness to the dovetail projections.

FIGURE 1 is a top perspective view in isometric projection of a molded insulating enclosure featuring the interconnection between the case and cover according to the invention;

FIGURE 2 is a side view of the molded insulating enclosure shown in Figure 1;

FIGURE 3 is a plan view of the molded insulating enclosure of Figure 2;

FIGURE 4 is a enlarged sectional view of a part of the cover of Figure 1 containing a metal bracket embedded in the cover; and

FIGURE 5 is a cross-section view along the plane 5-5 of the cover depicted in Figure 4.

The molded plastic insulating enclosure 10 shown in Figure 1 is designed for a current limiting circuit breaker, according to the invention and consists of a case 12 which houses the components of the low voltage circuit breaker (not shown) and a cover 14. The case includes two side walls 16 and 18 which occur upon short circuit interruption whereby the gases developed in the arc chambers of the circuit breaker generate such a high internal pressure that side walls would otherwise camber and move away from each other. The upper edges of the side walls 16 and 18 have, at both ends, areas defined at 23, 24, 26 and 28 respectively which are separated by recesses 20a, 20b, 20c, 20d, 20e, 20f, 20g and 20h, alternated with outwardly tapered protrusions 22a, 22b, 22c, 22e, 22f and 22g. Each of the protrusions is defined by a narrow exterior surface and a wider interior surface.

The cover is provided with a pair of opposing side walls 30A, 30B. A plurality of dovetail-shaped projections 32a, 32b, 32c, 32d alternate with recesses 34a, 34b, 34c which reciprocally align with the protusions 22a-d of the corresponding side wall 16 as best seen by referring to Figure 2.

A pair of thru-holes 36 and 38 on one end of the cover 14 aligns with the corresponding threaded holes 44 and 46 in the case 12, for attaching the cover to that side of the case 12. A similar pair of thru-holes 52 and 54 on the opposite side of the cover aligns with a corresponding pair of threaded holes 64 and 66 in the case for attaching the opposite end of the cover to the case as shown in Figure 1. The remaining thru-holes 40, 42, 56 and 58 in the cover respectively align with corresponding thru-holes 48, 50, 60 and 62 in the case to allow for attaching the circuit breaker within a panelboard.

Means for providing additional support to the dovetail projections 32a-d on the side walls 30A, 30B of the cover 14 are shown in Figures 4 and 5.

Such additional support consists of a U-shaped sheet metal bracket 70 embedded in the top and side walls of the cover itself.

The U-shaped bracket includes a first leg 72, exending from the interior to the exterior of the cover, a bight 74 and second leg 76 extending from the exterior to the interior of the cover. The legs 72, 76, and bight 74 are embedded in the molded top part of the cover 14 so that the entire braket 70 is embedded in the insulating plastic material forming the cover as indicated at 80.

For good adhesion between the bracket 70 and the plastic material 80 a plurality of holes 82 are formed in the metal sheet of the bracket. The holes become filled with the plastic material 80 during the molding process.

A tail piece or tang 84, best seen in Figure 5, protrudes from yoke or bight 74 of the bracket 70 which extends into the protrusions of the lateral wall of the cover to enhance the strength of the dovetail projections as depicted at 32a in Figure 5. As described earlier, the dovetail projections such as 32a, 32b in Figure 4 are provided with tapered edges 88, 90 which complement corresponding tapered edges 92, 94 and the recesses 20a-d in the side walls of the case 12.

As depicted in Figure 2, the gaps between the tops 96 of the dovetail 32a-d of the cover 14 and the bottoms 98 of the recesses 20a-d of the case 12 permit a limited amount of gas venting from the enclosure 10.

There are no gaps between the tops 100 of the prostrusions 22a-d of the case and the bottoms 102 of the recesses 34a-d of the cover in order to insure that the cover sits solidly on the case.

The operation of the attachment between the cover and the case of the enclosure 10 of the invention is best understood by referring back to Figure 1. When a short circuit causes the opening of the contacts (not shown) within the arc extinguishing chambers 104a, 104b and 104c, the arc gases generated between the separated contacts exert a large gas pressure on the interior surface of the enclosure 10. The gas pressure against the side walls 16 and 18 of the case ordinarily causes the side walls to bend and could even cause the side walls to break in the immediate vicinity of the arc chambers. The enclosure of the invention, however, prevents this from occurring by transferring the gas pressure from the side walls of the case, over to the side walls of the cover. Since the side walls of the cover are shorter than the side walls of the case, they are more resistant to the gas pres-

sure than the case side walls. This transferral of gas pressure from the case to the cover is achieved by abutment between the tapered edges 92 and 94 of the recesses 20a-h of the side walls 16, 18 of the case against the tapered edges 88 and 90 of the projections 32a-d of the cover 14 as depicted in Figures 1 and 4. When excessively large gas pressures are expected, it is expedient to strengthen the dovetail projections 32a-d by insertion of the U-shaped brackets 70 described earlier with reference to Figures 4 and 5. The U-shaped brackets receive the gas pressure through the tail piece 84 when embedded in the body of the dovetail projections and transfer the gas pressure to the top 78 of the cover by means of legs 72 and 76. As depicted in figure 5, the operation of the bracket 70 is insured by an accurate positioning of the tang 84 inside the body of the dovetail projection 32a.

This positioning is obtained by using the folded tang 87 as a reference point which, in turn, allows the bracket 70 to be positioned within the mold during the manufacturing of the cover 14 itself.

Claims

1. An enclosure for a current limiting circuit breaker, comprising a molded plastic cover (14), and a molded plastic case (12), in which said cover (14) includes a pair of opposing side walls (30A, 30B) having a plurality of dovetail projections (32a-d) extending therefrom and said case (12) includes a pair of side walls (16, 18) having a corresponding plurality of recesses (20a-h) formed therein, said recesses (20a-h) being shaped to accept said dovetail projections (32a-d), wherein said dovetail projections (32a-d) each comprise a pair of opposing internal and external surfaces, said external surfaces being larger than said internal surfaces and wherein said opposing internal and external surfaces are joined by tapering edges (88, 90), said edges tapering inward from said external surfaces to said internal surfaces.

2. The circuit breaker enclosure of claim 1 characterized in that said recesses (20a-h), are flanked by intermediate projections (22a-g) having internal and external surfaces, said intermediate projections (22a-g) having tapering side walls (92, 94) and said side walls (92, 94) taper outwardly from said internal to said external surfaces.

3. The circuit breaker enclosure of claim 2 wherein said dovetail projections (32a-d) nest within said recesses (2Oa-h), characterized in that said tapering edges (88, 90) on said dovetail projections (32a-d) abut said tapering edges (92, 94) on said intermediate projections (22a-g).

4. The circuit breaker enclosure of claim 1 characterized by including metal reinforcing means (70) within said dovetail projections (32a-d).

5. The circuit breaker enclosure of claim 4 characterized in that said metal reinforcing means (70) comprises a U-shaped configuration.

6. The circuit breaker enclosure of claim 5 characterized in that said U-haped configuration includes a pair of planar side legs (72, 76), joined by a planar bight member (74).

7. The circuit breaker enclosure of claim 6, characterized by a tang (84) extending from said bight member (74) and projecting within one of said dovetail extensions (32a-d).

8. The circuit breaker enclosure of claim 5 characterized in that said U-shaped configuration defines a plurality of holes (82) for receiving plastic material during manufacture of said cover (14).

9. The circuit breaker enclosure of claim 8 characterized by a tang (87) extending from said U-shaped configuration for positioning said U-shaped configuration within said cover.

10. The circuit breaker enclosure of claim 3 characterized in that a bottom of each of said dovetail projections (32a-d), and a bottom of each of said recesses (20a-h) define a predetermined gap therebetween, said predetermined gap thereby allowing passage of gas from an interior to an exterior of said enclosure.

Patentansprüche

1. Gehäuse für einen Strombegrenzungsschalter, der ein Formoberteil (14) aus Kunststoff und ein Formunterteil (12) aus Kunststoff aufweist, wobei das Oberteil (14) zwei gegenüberliegende Seitenwände (30A, 30B) mit mehreren davon ausgehenden schwalbenschwanzförmigen Vorsprüngen (32a-d) aufweist und das Unterteil (12) zwei Seitenwände (16, 18) aufweist, in denen eine entsprechende Anzahl von Aussparungen (20a-h) ausgebildet sind, wobei die Aussparungen (20a-h) zur Aufnahme der schwalbenschwanzförmigen Vorsprünge (32a-d) ausgebildet sind, die jeweils ein Paar gegenüberliegender interner und externer Ober-

flächen aufweisen, wobei die externen Oberflächen größer sind als die internen Oberflächen und die gegenüberliegenden internen und externen Oberflächen durch schräge Ränder (88, 90) miteinander verbunden sind, die von den externen Oberflächen zu den internen Oberflächen schräg nach innen verlaufen.

2. Schaltergehäuse nach Anspruch 1, dadurch gekennzeichnet, daß die Aussparungen (20a-h) von Zwischenvorsprüngen (22a-g) flankiert sind, die interne und externe Oberflächen und schräge Seitenwände (92, 94) aufweisen, die von den internen zu den externen Oberflächen schräg nach außen verlaufen.

3. Schaltergehäuse nach Anspruch 2, wobei die schwalbenschwanzförmigen Vorsprünge (32a-d) in den Aussparungen (20a-h) sitzen, dadurch gekennzeichnet, daß die schrägen Ränder (88, 90) auf den schwalbenschwanzförmigen Vorsprüngen (32a-d) an den schrägen Rändern (92, 94) auf den Zwischenvorsprüngen (22a-g) anliegen.

4. Schaltergehäuse nach Anspruch 1, dadurch gekennzeichnet, daß metallische Verstärkungsmittel (70) in den schwalbenschwanzförmigen Vorsprüngen (32a-d) vorgesehen sind.

5. Schaltergehäuse nach Anspruch 4, dadurch gekennzeichnet, daß die metallischen Verrstärkungsmittel (70) eine U-Form besitzen.

6. Schaltergehäuse nach Anspruch 5, dadurch gekennzeichnet, daß die U-Form zwei planare Seitenschenkel (72, 76) aufweist, die durch einen planaren Buchtteil (74) verbunden sind.

7. Schaltergehäuse nach Anspruch 6, dadurch gekennzeichnet, daß ein Schaft (84) von dem Buchtteil (74) ausgeht und in einen der schwalbenschwanzförmigen Vorsprünge (32a-d) vorsteht.

8. Schaltergehäuse nach Anspruch 5, dadurch gekennzeichnet, daß die U-Form mehrere Löcher (82) bildet zur Aufnahme von Kunststoffmaterial während der Fertigung des Oberteils (14).

9. Schaltergehäuse nach Anspruch 8, dadurch gekennzeichnet, daß ein Schaft (87) von der U-Form ausgeht zur Positionierung der U-Form in dem Oberteil.

10. Schaltergehäuse nach Anspruch 3, dadurch gekennzeichnet, daß ein Boden von Jedem der schwalbenschwanzförmigen Vorsprünge (32a-d) und ein Boden von Jeder der Aussparungen (20a-h) einen vorbestimmten Spalt dazwischen bilden, der den Durchtritt von Gas aus einem Innenraum zu einem Außenraum des Gehäuses gestattet.

Revendications

1. Boîtier pour disjoncteur de limitation de courant comprenant un couvercle moulé (14) en matière plastique et une boîte moulée (12) en matière plastique, dans lequel ledit couvercle (14) comprend une paire de parois latérales opposées (30A, 30B) comportant une pluralité de saillies (32a-d) en queue d'aronde s'étendant depuis lesdites parois et ledit boîtier (12) comprend une paire de parois latérales (16, 18) comportant une pluralité correspondante d'évidements (20a-h) qui y sont formés, lesdits évidements (20a-h) étant conformés de manière à loger lesdites saillies (32a-d) en queue d'aronde, lesdites saillies (32a-d) en queue d'aronde comprenant chacune une paire de surfaces intérieures et extérieures opposées, lesdites surfaces extérieures étant plus grandes que lesdites surfaces intérieures et lesdites surfaces intérieures et extérieures opposées étant reliées par des bords inclinés (88, 90), lesdits bords s'inclinant vers l'intérieur depuis lesdites surfaces extérieures jusqu'auxdites surfaces intérieures.

2. Boîtier de disjoncteur selon la revendication 1, caractérisé en ce que lesdits évidements (20a-h) sont flanqués par des saillies intermédiaires (22a-g) comportant des surfaces intérieures et extérieures, lesdites saillies intermédiaires (22a-g) comportant des parois latérales inclinées (92, 94) et lesdites parois latérales (92, 94) s'inclinant vers l'extérieur depuis lesdites surfaces intérieures jusqu'auxdites surfaces extérieures.

3. Boîtier de disjoncteur selon la revendication 2, dans lequel lesdites saillies (32a-d) en queue d'aronde sont logées à l'intérieur desdits évidements (20a-h), caractérisé en ce que lesdits bords inclinés (88, 90) desdites saillies (32a-d) en queue d'aronde portent contre les bords inclinés (92, 94) desdites saillies intermédiaires (22a-g).

4. Boîtier de disjoncteur selon la revendication 1, caractérisé par le fait qu'il comprend un moyen métallique de renforcement (70) à l'intérieur desdites saillies (32a-d) en queue d'aronde.

5. Boîtier de disjoncteur selon la revendication 4, caractérisé en ce que ledit moyen métallique de renforcement (70) a une configuration en forme de U.

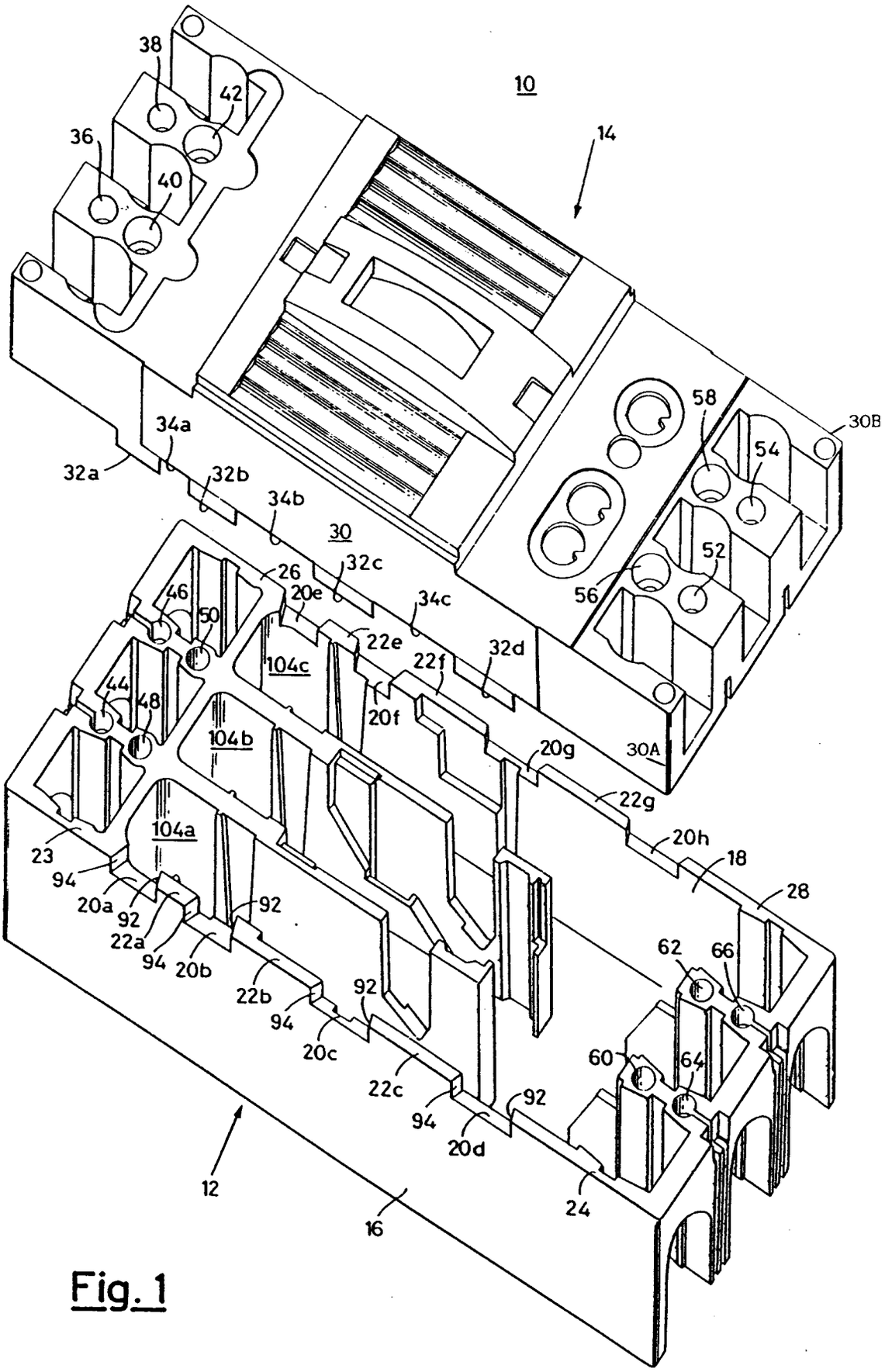
6. Boîtier de disjoncteur selon la revendication 5, caractérisé en ce que ladite configuration en forme de U comprend une paire d'ailes latérales planes (72, 76) reliées par un élément de liaison plan (74).

7. Boîtier de disjoncteur selon la revendication 6, caractérisé par une partie arrière ou queue (84) s'étendant depuis ledit élément de liaison (74) et faisant saillie à l'intérieur d'un desdits prolongements (32a-d) en queue d'aronde.

8. Boîtier de disjoncteur selon la revendication 5, caractérisé en ce que ladite configuration en forme de U définit une pluralité de trous (82) destinés à recevoir une matière plastique pendant la fabrication dudit couvercle (14).

9. Boîtier de disjoncteur selon la revendication 8, caractérisé par une partie arrière ou queue (87) s'étendant depuis ladite configuration en forme de U pour positionner cette configuration en forme de U à l'intérieur dudit couvercle.

10. Boîtier de disjoncteur selon la revendication 3, caractérisé en ce que la base de chacune des saillies (32a-d) en queue d'aronde et le fond de chacun desdits évidements (20a-h) forment entre eux un intervalle prédéterminé permettant le passage d'un gaz depuis l'intérieur jusqu'à l'extérieur dudit boîtier.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38
42
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40
58
54
30B
34a
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20e
34c
50
22e
32d
104c
22f
44
48
20f
104b
30A
20g
22g
104a
20h
23
18
94
28
20a
92
92
22a
62
66
94
20b
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20c
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22c
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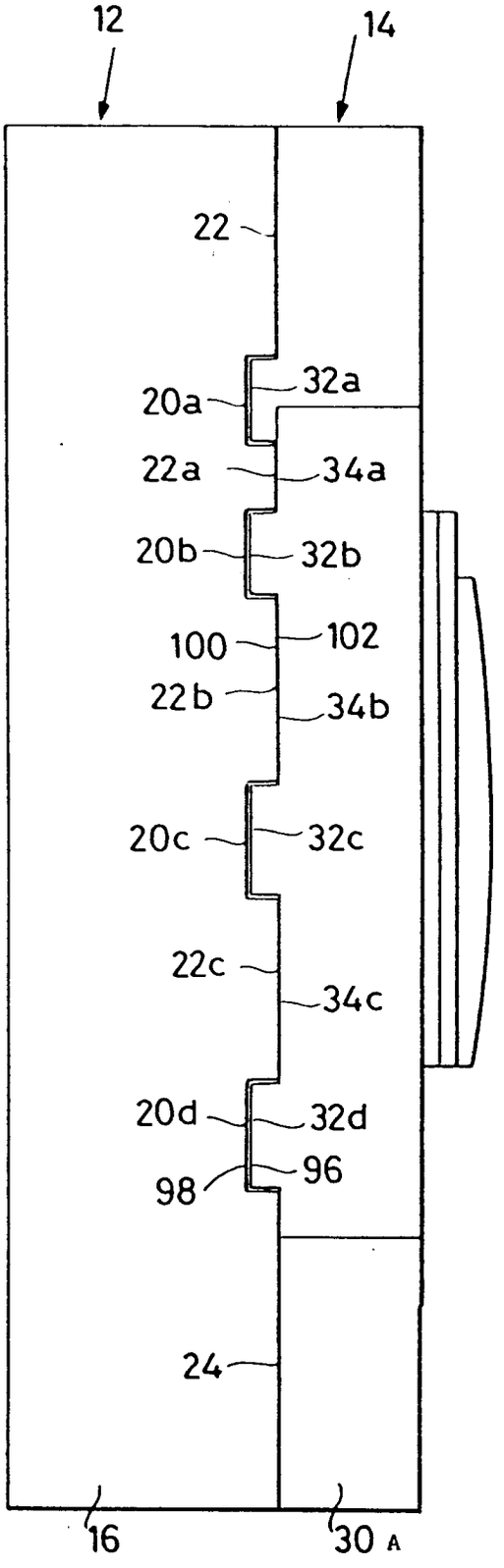
94
20d
12
24
16

Fig. 1

Fig.2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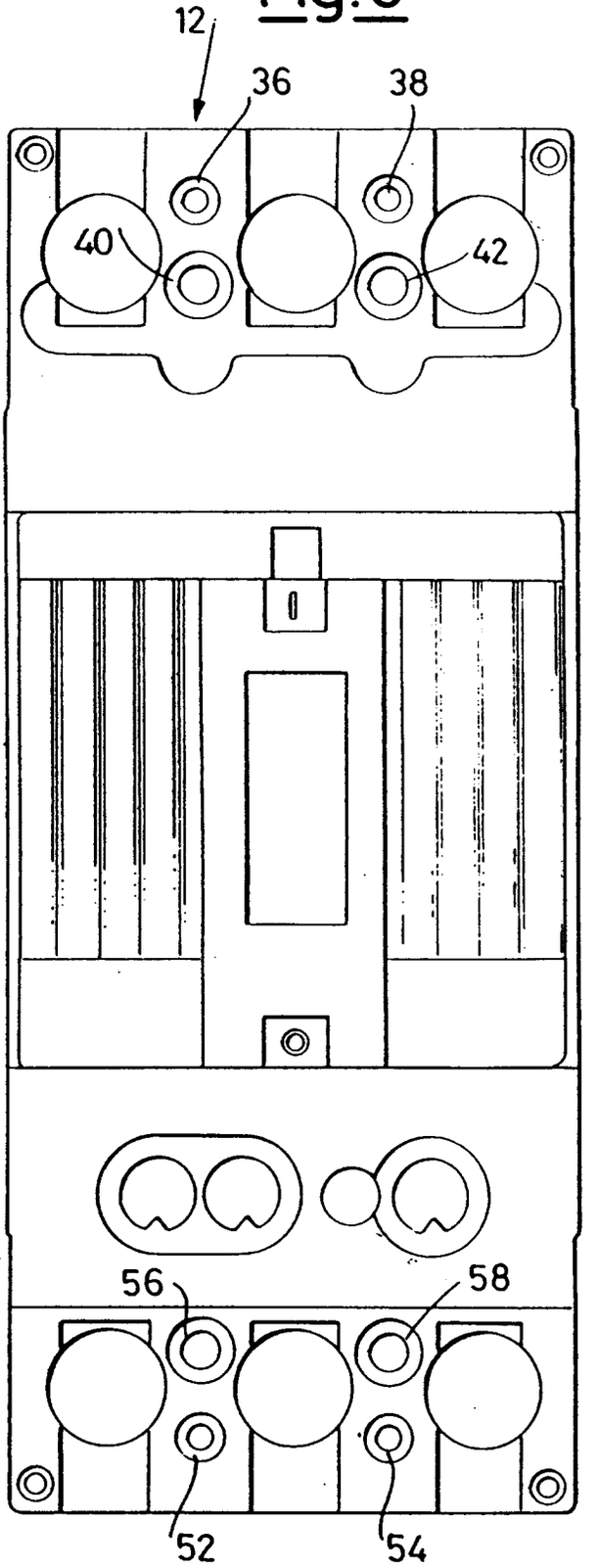
96
24
16
30 A

Fig.3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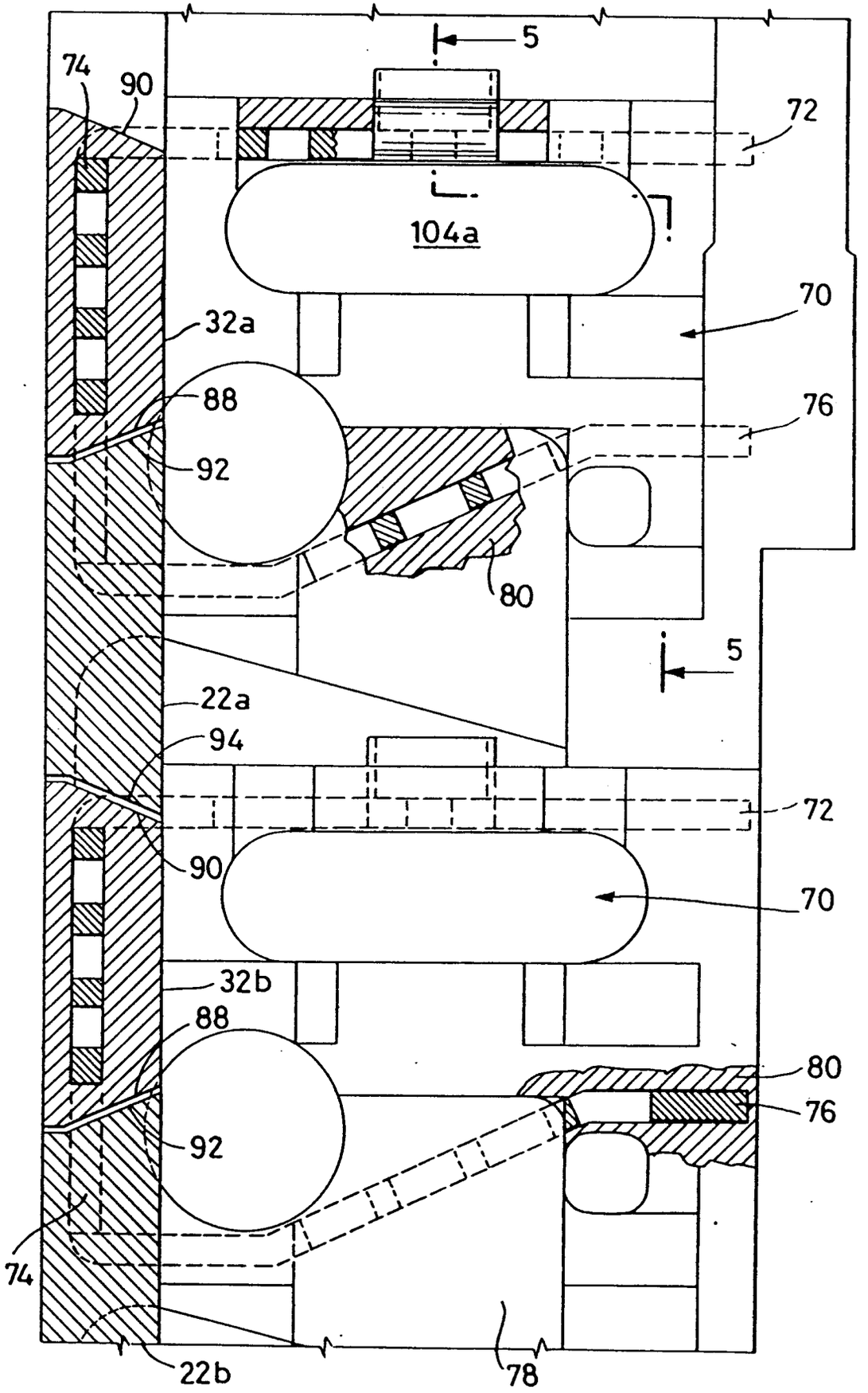
52
54

Fig.4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80
76
92
74
22b
78

Fig.5