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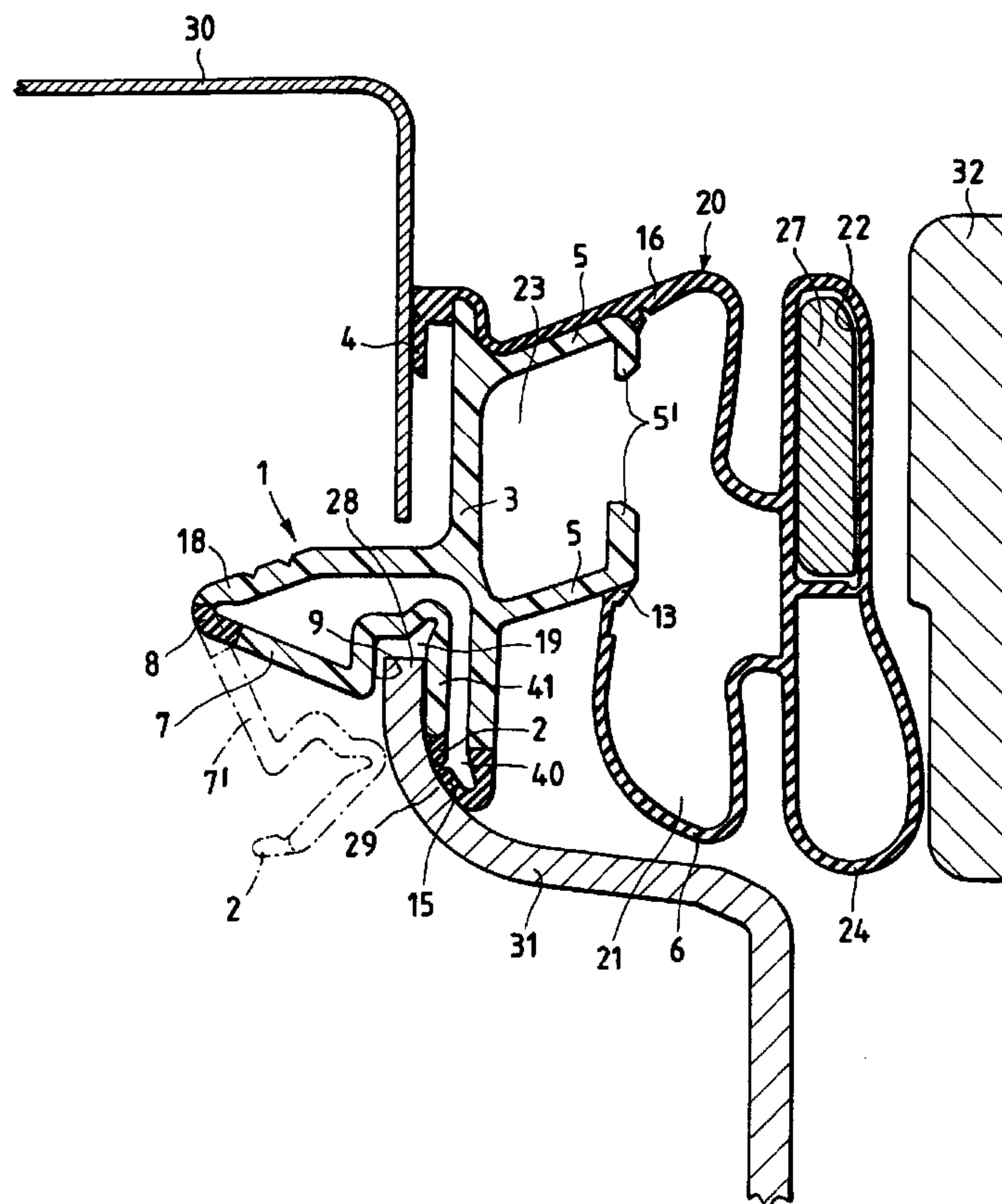
(72) Inventeurs/Inventors:
CITTADINI, PAOLO, IT;
MERLA, ADRIANO, IT

(73) Propriétaire/Owner:
INDUSTRIE ILPEA S.P.A., IT

(74) Agent: MARKS & CLERK

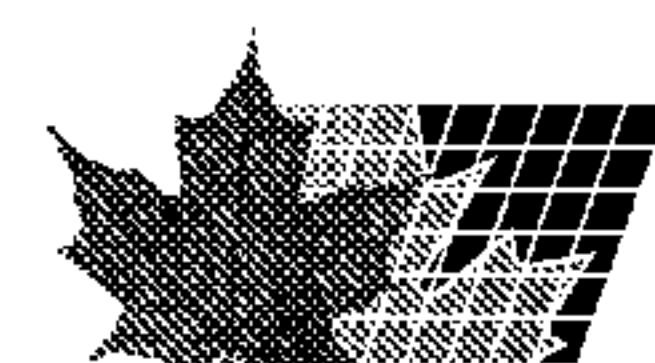
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(54) Title: IMPROVED SEALING ASSEMBLY FOR REFRIGERATOR CABINETS AND THE LIKE WITH A PROFILE MADE OF PLASTIC MATERIAL



(57) Abrégé/Abstract:

Sealing assembly comprising a bellows-seal gasket (20) and a profile (1) with a base (3) provided, at opposite ends, with sealing strips (4, 15) and a groove (23) for a replacement of the bellows-seal gasket (20); the profile (1) has at least one side branch (7)



(57) **Abrégé(suite)/Abstract(continued):**

terminating in a grooved seat (9) with a C-shaped cross-section for receiving an edge (28) of an inner door panel (31) against which a sealing strip (2) provided at the end of the grooved seat (9) is pressed under the action of elastic return of the side branch (7); the inner door panel (31) is bend with a radius that ensures an optimal contact with one of the sealing strips (15) of the base (3) of the profile (1). The bellows-seal gasket (20) and the profile (1) may be formed of plastic material in a single piece or fitted together.

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[IT/IT]; Via Campo dei Fiori, 16, I-21020 Luvinato-Varese (IT). **MERLA, Adriano** [IT/IT]; Via Milano, 18, I-21021 Angera-Varese (IT).

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(74) Agents: **COPPO, Alessandro** et al.; Via Borgonuovo, 10, I-20121 Milan (IT).

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(71) Applicant (for all designated States except US): **INDUSTRIE ILPEA S.P.A.** [IT/IT]; Viale Industria 887, I-21023 Malgesso-Varese (IT).

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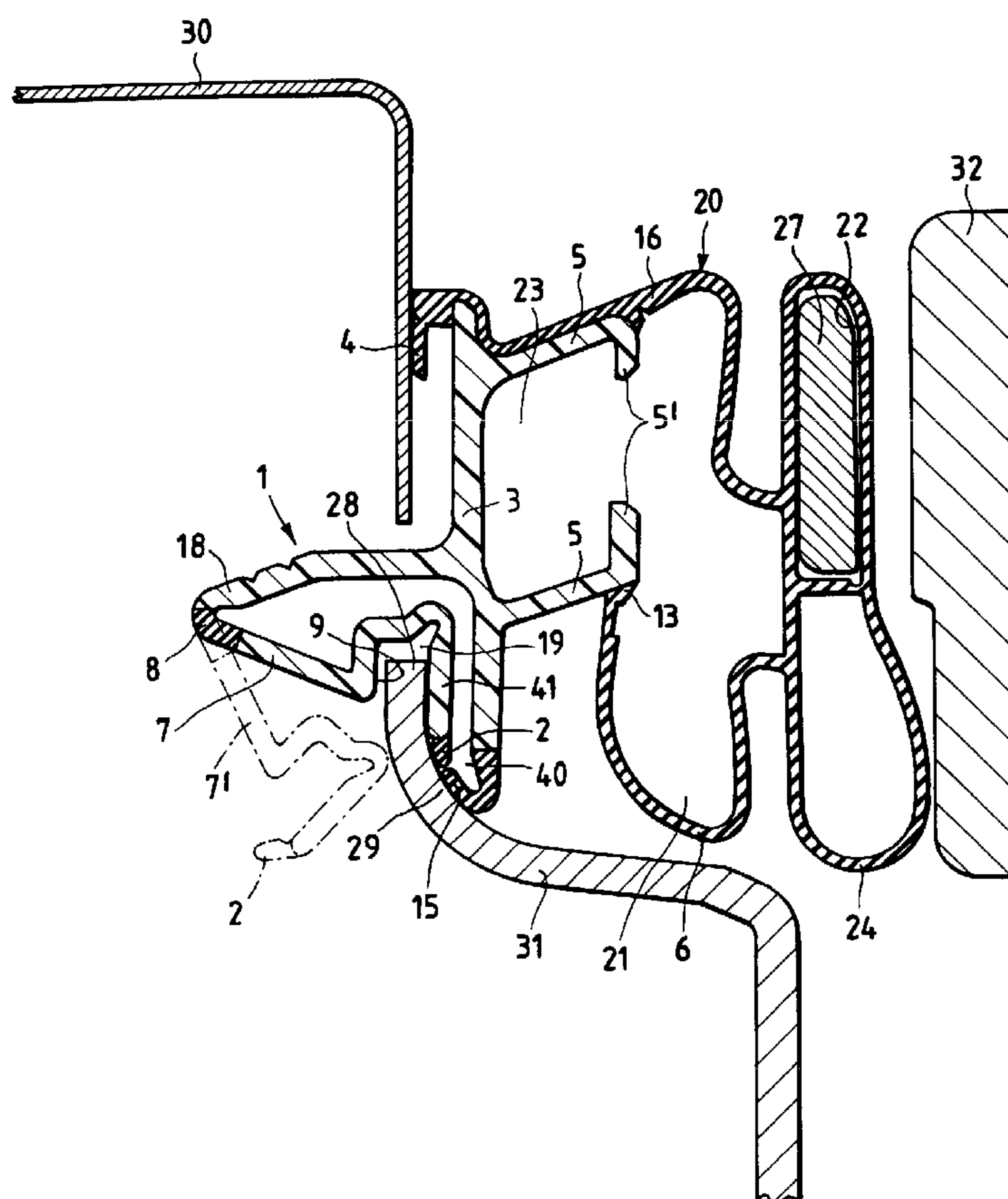
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(72) Inventors; and

(75) Inventors/Applicants (for US only): **CITTADINI, Paolo**

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(54) Title: IMPROVED SEALING ASSEMBLY FOR REFRIGERATOR CABINETS AND THE LIKE WITH A PROFILE MADE OF PLASTIC MATERIAL



(57) Abstract: Sealing assembly comprising a bellows-seal gasket (20) and a profile (1) with a base (3) provided, at opposite ends, with sealing strips (4, 15) and a groove (23) for a replacement of the bellows-seal gasket (20); the profile (1) has at least one side branch (7) terminating in a grooved seat (9) with a C-shaped cross-section for receiving an edge (28) of an inner door panel (31) against which a sealing strip (2) provided at the end of the grooved seat (9) is pressed under the action of elastic return of the side branch (7); the inner door panel (31) is bent with a radius that ensures an optimal contact with one of the sealing strips (15) of the base (3) of the profile (1). The bellows-seal gasket (20) and the profile (1) may be formed of plastic material in a single piece or fitted together.

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IMPROVED SEALING ASSEMBLY FOR REFRIGERATOR CABINETS AND
THE LIKE WITH A PROFILE MADE OF PLASTIC MATERIAL

The present invention relates to an improved
5 sealing assembly for refrigerator cabinets and the like
with a profile made of plastic material.

It is known from the Italian Patent No. 1281660
held by the present applicant, a profile made of
plastic material for refrigerator cabinets and the
10 like, where the said refrigerator cabinets are equipped
with a door and an inner door panel constrained to the
structure, said profile having a bellows-type gasket
portion which provides a sealed closing between the
door and the cabinet. In this embodiment, the profile
15 and the gasket portion are coupled together or form a
single integrated piece produced by co-extrusion of two
materials having different degrees of rigidity so as to
enable, if necessary, convenient detachment of the
gasket portion from the profile along the area of their
20 connection. In addition, the profile has at least one
elastically compliant side branch which acts as a
spring to connect together by snap action the profile
and the inner door panel. In the aforesaid profile, a
groove is present which is identified by a pair of
25 walls that extend vertically or obliquely from a base
which, in the operative position of coupling, overlaps

the door and the inner door panel along their line of coupling.

For its installation, the profile, which carries the co-extruded gasket, is conveniently arranged in the form of a frame and is supplied to the manufacturer of the refrigerator cabinet in this form. As further references to the prior art, the following European patents held by the present applicant may be cited: EP 0 146 994 and EP 0 319 087.

10 The frame made of the profile is caused to descend, for example by means of an appropriate mechanical arm, towards the inner door panel, which is, for instance, suitably positioned on a support that blocks it in place. As soon as the arm of the side branch comes into
15 contact with the edge of the inner door panel, under the thrust of the said edge it yields and starts to bend elastically inwards like a spring about its own flexible fulcrum. Once the compliant side branch has completed its travel along the edge of the inner door
20 panel and when the said edge has reached the height of the above-mentioned groove, the branch, as a result of its own elastic return, snaps into position engaging the edge of the inner door panel, so blocking the said edge. Insertion of the frame welded on the inner door
25 panel may be achieved with great ease even manually, provided that care is taken to engage first the

corners, two at a time, and then complete the insertion in the points of the perimeter where the edge of the inner door panel has not yet completely entered the groove of the side branch.

5 The profile and the inner door panel thus assembled are then rested on the door (for example, by means of a robotized system), and the entire assembly is blocked by means of foam-injection into the gap between the door and the inner door panel, with functions of
10 thermal insulation.

 In the profile in question, the base extends on a single plane or on planes that are slightly staggered with respect to one another. The base terminates laterally with a pair of sealing strips made of a soft
15 material co-extruded together with the rigid material of the profile. The said strips constitute the gaskets containing the foam. In particular, the sealing strip provided to ensure operative sealing on the inner door panel is made in such a way as to compensate for the
20 distance between the base of the profile and the inner door panel itself, between which there remains identified a gap for the elastic return of the engaging tooth of the side branch, and in such a way as to facilitate the movement of engagement of the said
25 branch on the inner door panel. The said sealing strip consequently also has the function of facilitating said

movement of the side branch because it maintains the distance between the base of the profile and the inner door panel, leaving free play for said engagement tooth in the useful gap referred to above.

5 It should in any case be emphasized that leakage of foam along the perimeter of the door is very rare, whereas it is precisely the area of the corners where welding is carried out that proves particularly critical.

10 It has in fact been noted that in the welded corner, the side branch, which terminates with a grooved seat, must remain elastically mobile in order to guarantee functionality of the profile, and consequently must not be welded. To avoid welding, the
15 side branch must be cut 2-3 mm more than the cutting plane of the entire section of the profile. Albeit preventing the branch from being welded, this solution, in the step of welding of the four sides of the frame, leads to the presence of a 2-3 mm slit along the entire
20 length of the side branch.

 If the dimensional tolerances of assembly of the three components making up the door - namely, inner door panel, frame, and steel-metal shell - are not optimal, this slit leads to leakage of foam. In an
25 attempt to prevent such leakage, the slit is closed with adhesive tape by means of an operation that

requires time and involves loss of productivity.

An object of the present invention is to further improve tightness of the seal to prevent any foam from leaking during the step of foam-injection in a profile
5 of the type referred to.

The above requirement derives from the fact that the parts to be assembled, and in the first place the profile and inner door panel, are manufactured with dimensional tolerances that preferably tend to be
10 increasingly wide.

It should therefore once again be emphasized that the sealing strip that extends from the base of the profile towards the inner door panel, as described in the Italian Patent No. 1281660 referred to previously,
15 proves in practice frequently insufficient to contain the foam when the dimensional tolerances between the door and the inner door panel exceed a certain limit. This is especially true when the foam is injected in the liquid phase according to the system known as "foam
20 chamber" system, the said chamber being closed and inclined on its longer side or on its shorter side. In this case, the liquid pours, in fact, immediately onto the side opposite to the one into which the foam is injected, and the seal between the elastic side branch
25 of the profile and the inner door panel may prove insufficient.

The fact that the foam comes out during the stage of foam injection between the door and the inner door panel may mean damage of an aesthetic nature (the foam that comes out is visible), but, above all, serious functional damage (the foam that leaks through the passages on account of insufficient sealing solidifies and causes serious imbalance in the set of the assembled door-inner door panel system).

The solution to the technical problem summarized above is afforded by the present invention by means of an improved sealing assembly for refrigerator cabinets and the like with a profile made of plastic material.

According to an aspect of the present invention there is provided a sealing assembly in combination with a door for a refrigerator cabinet, said door having an inner door panel with a curved surface, said sealing assembly having a bellows gasket for sealing between the door and the cabinet and having a profile made of a plastic material, said bellows gasket and said profile being co-extruded together, said profile having a means for receiving a replacement bellows gasket, said profile also having a base and at least one elastically compliant side branch which provides a snap-action connection between the profile and the inner door panel, said side branch terminating with a grooved seat which has a substantially C-shaped cross-section which receives an edge of said inner door panel, wherein said base includes first and second sealing strips, said first and second sealing strips sealing between said door and said base, wherein said grooved seat has a third sealing

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strip, wherein the elastically compliant side branch causes said third sealing strip to be compressed against the curved surface of the inner door panel, and wherein said curved surface of the inner door panel has a radius of curvature of 3 to 6 mm so as to ensure an effective seal with said third sealing strip.

The characteristics and advantages of an improved assembly for refrigerator cabinets and the like with a profile made of plastic material according to the present invention will emerge more clearly evident from the ensuing description, which is provided by way of non-limiting example illustrating embodiments and practical implementation, with reference to the attached figures, in which:

- Figure 1 is a schematic perspective view of a refrigerator cabinet with a door and inner door panel

to which a profile is applied to make up a sealing assembly according to the invention;

- Figure 2 is a cross-sectional view of the said assembly with the profile in the operative position of
5 assembly on the door and inner door panel, the section being taken along the line II-II of Figure 1;

- the pair formed by Figures 3 and 4 shows a detail of the embodiment of the assembly illustrated in Figure 2 in two different operative positions;

10 - the two pairs formed by Figures 5 and 6 and by Figures 7 and 8 show two further embodiments of the assembly according to the invention in similar operative positions; and

- the remaining Figures 9 and 10 show, instead, the
15 action contrast of the sealing strip with the inner door panel for different radiuses of curvature.

With reference to Figure 1, an improved sealing assembly for refrigerator cabinets and the like with a profile made of plastic material according to invention
20 is shown. In this assembly, a profile is provided, designated as a whole by 1. The profile 1 is operatively mounted between a door 30 and an inner door panel 31, and has a complex section which presents, on the side facing, in the operative position (Figure 2),
25 a cabinet 32 of a refrigerator, a base 3 which is substantially planar and extends on planes that are

slightly staggered with respect to one another. The base 3 terminates, on a side part, with a sealing strip 15 and, on the opposite part, with a sealing strip 4, both of the said sealing strips being made of soft material co-extruded with the rigid material of the profile 1. In an intermediate position, the section of the profile 1 assumes an irregular T shape as a result of a central rib 18 which extends vertically in the direction opposite to the direction facing the cabinet 32, assuming a slightly angled conformation inwards. From the end of the aforesaid rib 18 there extends a side branch 7, which is elastically compliant like a spring about a fulcrum 8 consisting of an insert made of soft material co-extruded with the rigid material of the profile 1.

The side branch 7 terminates with a grooved seat 19 having a substantially C-shaped cross-section which includes a tooth 41 designed for hooking onto the inner door panel 31.

In the opposite part of the profile 1, namely the one facing the cabinet in the operative position, there extend, from the base 3 in a substantially vertical direction, a pair of walls 5 terminating with a flanged edge 5', within which there thus remains identified a groove 23 designed to receive a replacement gasket.

In the example of Figure 2, the aforesaid vertical

walls 5 are also slightly inclined in the same direction so as to be oblique and parallel. Alternatively, they could be oblique but divergent, or else not be inclined. In the operative position of
5 coupling as illustrated in Figure 2, the base 3 of the profile 1 overlaps the door and inner door panel, on which it forms a seal with the above-mentioned sealing strips 4 and 15, respectively.

The profile 1 is made of rigid plastic material,
10 for example PVC, which is extrusion-moulded, cut and welded to the corners in the form of a frame that reproduces the perimeter of the door of the refrigerator cabinet to which it is to be applied.

Moulded together with the profile 1, by co-
15 extrusion, so as to form a single piece, is also a gasket 20, for example made of soft plasticated PVC. The said gasket 20 has a tubular section which identifies an extensible chamber 21 that functions as a bellows, and a top chamber 24 that runs alongside a
20 seat 22 designed to receive a bar of magnetic material, represented schematically and designated by 27. An internal side wall, designated by 6, of the gasket 20 is welded to the corresponding wall 5 of the profile in the point of co-extrusion 13, whilst an external side
25 wall, designated by 16, is welded in an integral way to the corresponding external wall 5 of the profile and

along the external side of the base 3.

As mentioned above, the side branch 7 of the profile operatively facing the inner door panel terminates with a grooved seat 19 having a substantially C-shaped cross-section. As is more clearly highlighted in Figures 3 to 8, the said C-shaped section comprises, in addition to the tooth 41 referred to above, also a bottom side 9 designed for resting of the inner door panel in the operative stage, as illustrated in Figure 4 or Figure 6.

In a first embodiment of the profile, illustrated in Figures 2, 3 and 4, in the grooved seat 19 having a C-shaped cross-section a sealing strip 2 made of soft co-extruded material is provided along the end of the tooth 41. In the two variants illustrated by the pairs of Figures 5-6 and 7-8, the sealing strip 2 is set in different points of the above-mentioned C-shaped cross-section. In particular, in the embodiment of the profile illustrated in Figures 5 and 6, the sealing strip 2 is made, at the bottom, in an intermediate point of the tooth 41, whilst in the embodiment of the profile illustrated in Figures 7 and 8, it is made on the bottom side 9 of the C-shaped cross-section. In a different embodiment of the profile, in an assembly according to invention not shown in the attached drawings, two or more sealing strips may be provided in

different points of the same seat 19 having a C-shaped cross-section.

The sealing strip 15 is made, above all, so as to compensate for the distance between the base 3 of the profile and the inner door panel 31, between which
5 there remains identified a gap 40 for the elastic return of the tooth 41 of the side branch 7, and so as to facilitate the movement of engagement of said side branch 7 on the inner door panel.

10 The sealing strip 15 has the function of facilitating said movement of the side branch 7 because it maintains the distance between the base of the profile and the inner door panel 31, leaving free play for the tooth 41 in the gap 40. The sealing strip 15
15 moreover has functions of an aesthetic nature because it covers from sight the underlying rigid profile, which can be made of any shade of colour, without this being detrimental to the appearance of the assembly.

In order to solve the technical problems of leakage
20 of foam, it has moreover been found that an area of bending, designated by 29, of the inner door panel 31, must be at right angles and must have a radius of at least 3 mm up to a maximum of 6 mm. In this way, it is possible to ensure an optimal action of contrast with
25 the sealing strip 15 made at the end of the base 3 of the profile 1. As a result, an effective and secure

sealing action against the inner door panel is achieved, preventing any leakage of foam.

Figure 2 shows how a radius of bending of 5 mm is used, whilst the last two Figures 9 and 10 show the
5 action of contrast of the sealing strip 15 with the inner door panel for different radiuses of curvature. It may readily be imagined that with a radius of 3 mm (Figure 9) the contrast is somewhat deficient, whereas with a radius of 6 mm (Figure 10) it is, perhaps,
10 excessive. A good action of contrast, and hence a good seal, against leakage of foam is obtained when the radius of bending of the inner door panel is between the aforesaid two limits. It is to be considered that all of the inner door panels currently used have in
15 that point a radius of bending of 1.5 to 2 mm.

The above solution moreover makes it possible to keep the sealing strip 15 of a length such as it does not prevent rotation of the side branch 7 with the grooved seat 19. The radius mentioned above ensures a
20 good action of contrast between the sealing strip 15 and the inner door panel even in sub-optimal conditions of tolerance between the components of the door.

For installation, the profile 1 carrying the co-extruded gasket 20 is conveniently prepared in the form
25 of a frame, and in this form supplied to the manufacturer of the refrigerator, as described in the

European patents held by the present applicant already cited above. Coupling of the above frame to the inner door panel may be obtained either manually or using a robotized system. If the operation is carried out manually, it is necessary to push the perimetral edge of the inner door panel against the compliant side branch, first in the corners and then in the perimetral points.

If a robotized system is used, the frame formed with the profile 1 is made to descend, for example by means of an appropriate mechanical arm, towards the inner door panel 31, which is, for instance, suitably positioned on a support that blocks it in place. As soon as the arm of the side branch 7 (in the initial position indicated by the dashed outline 7' in Figure 2) comes into contact with an end edge 28 of the inner door panel 31, under the thrust of the said edge it yields and starts to bend elastically inwards like a spring about the fulcrum 8, which is in fact flexible. Once the compliant side branch 7 has completed its travel along the edge of the inner door panel 31 and when the said edge has reached the height of the groove 19, the branch 7, as a result of its own elastic return, snaps into position and engages the edge 28 of the inner door panel 31, so blocking the said edge.

In the embodiment of Figures 2, 3 and 4, it may

therefore be seen how the movement of approach and co-operation between the inner door panel 31 and the side branch 7 leads the sealing strip 2 to assume, in the final operative position, the conformation shown in
5 detail in Figure 4.

Figures 6 and 8 illustrate the final operative positions of the sealing strip 2 of the two further embodiments shown in the drawings.

In any case, the aforesaid final operative
10 positions show that, under the action of elastic return of the side branch 7, the sealing strip 2 is always compressed against the edge of the inner door panel 31, so that, in this way, an excellent seal is obtained.

In fact, the profile 1 and the inner door panel 31
15 thus assembled are then rested on the door 30 (for example, by means of a robotized system), and the entire assembly is blocked by foam-injection into the gap between the door and the inner door panel. Preferably, a counter-mould is positioned on top of the
20 door and inner door panel assembled together with the frame of the profile of the assembly according to the invention in such a way as to exert an adequate counter-thrust against the pressure of the foam material which is injected inside the gap defined
25 between the door and the inner door panel in order to provide thermal insulation.

Prevention of leakage of foam is ensured by the action of contrast between the sealing strip 15, bent to form an L, of the base and the area of bending at right angles 29, of the inner door panel 31, which has
5 a radius of curvature of between 3 and 6 mm.

The sealing strip provided in the grooved seat of the side branch according to the invention is such as to guarantee a sort of seal against a possible leakage of foam between the inner door panel and the profile
10 because the said sealing strip does not merely function as a so-called "static seal", i.e., one obtained by mere resting and contact between the parts in the possible points of leakage of the foam, but operatively works by compressing itself against the edge of the
15 inner door panel, thus deforming its own structure and so providing a seal of considerable and certain effectiveness.

Also the sealing strip 15, in order to create a seal on the inner door panel part with a radius of 3 to
20 6 mm, is compressed, partially or totally deforming the vertical branch of the L.

It may therefore be seen how the main purpose initially set, namely that of being able to guarantee sealing of the foam in the points of widest dimensional
25 tolerance in the door-inner door panel assembly is effectively achieved by means of the assembly proposed

by the present invention.

Optimization of the seal against leakage of foam is obtained substantially thanks to the pressure of the sealing strip 2 made of soft material co-extruded at
5 the end of the tooth 41 of the grooved seat 19 having a C-shaped cross-section, and by the sealing strip 15 having a reversed L shape positioned at the end of the base 3 in the area of bending at right angles 29, of the inner door panel 31, which has a radius of 3 to 6
10 mm.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A sealing assembly in combination with a door for a refrigerator cabinet, said door having an inner door panel with a curved surface, said sealing assembly having a bellows gasket for sealing between the door and the cabinet and having a profile made of a plastic material, said bellows gasket and said profile being co-extruded together, said profile having a means for receiving a replacement bellows gasket, said profile also having a base and at least one elastically compliant side branch which provides a snap-action connection between the profile and the inner door panel, said side branch terminating with a grooved seat which has a substantially C-shaped cross-section which receives an edge of said inner door panel, wherein said base includes first and second sealing strips, said first and second sealing strips sealing between said door and said base, wherein said grooved seat has a third sealing strip, wherein the elastically compliant side branch causes said third sealing strip to be compressed against the curved surface of the inner door panel, and wherein said curved surface of the inner door panel has a radius of curvature of 3 to 6 mm so as to ensure an effective seal with said third sealing strip.

2. The combination according to claim 1, wherein said third sealing strip is co-extruded with said profile.

3. The combination according to claim 1 or 2, wherein said third sealing strip is disposed along a distal end portion of said grooved seat.

4. The combination according to any one of claims 1 to 3, wherein said second sealing strip is made of a material co-extruded with a material of said base of said profile.

5. The combination according to any one of claims 1 to 4, wherein said means for receiving a replacement gasket comprises a pair of walls that extend from said base.

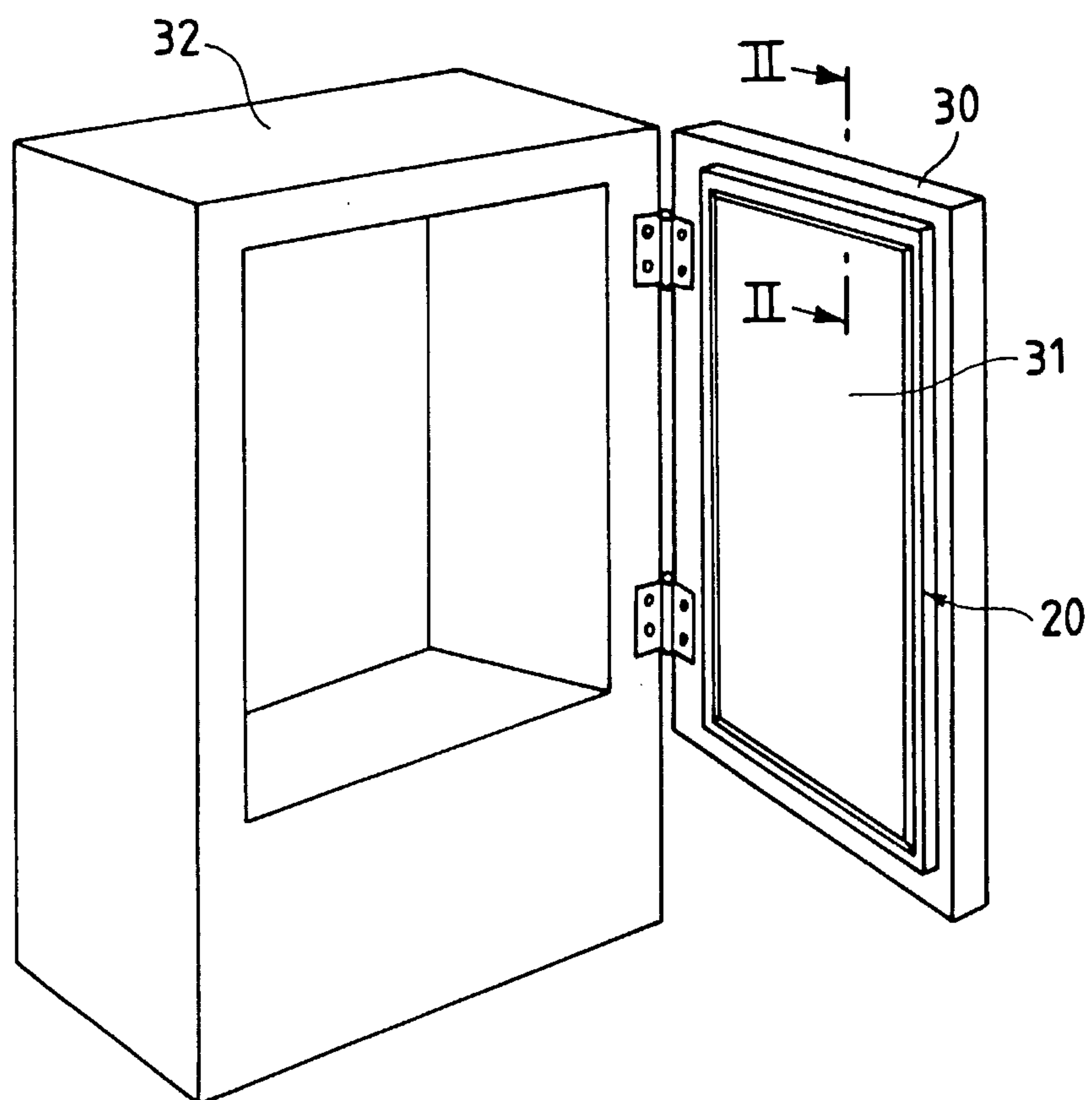
6. The combination according to any one of claims 1 to 5, wherein said side branch includes an insert which is made of a material which is more compliant than said plastic material of said profile and enables said side branch to pivot relative to said base.

7. The combination according to any one of claims 1 to 6, wherein said bellows gasket overlaps an outer end portion of said profile along the entire length of the profile.

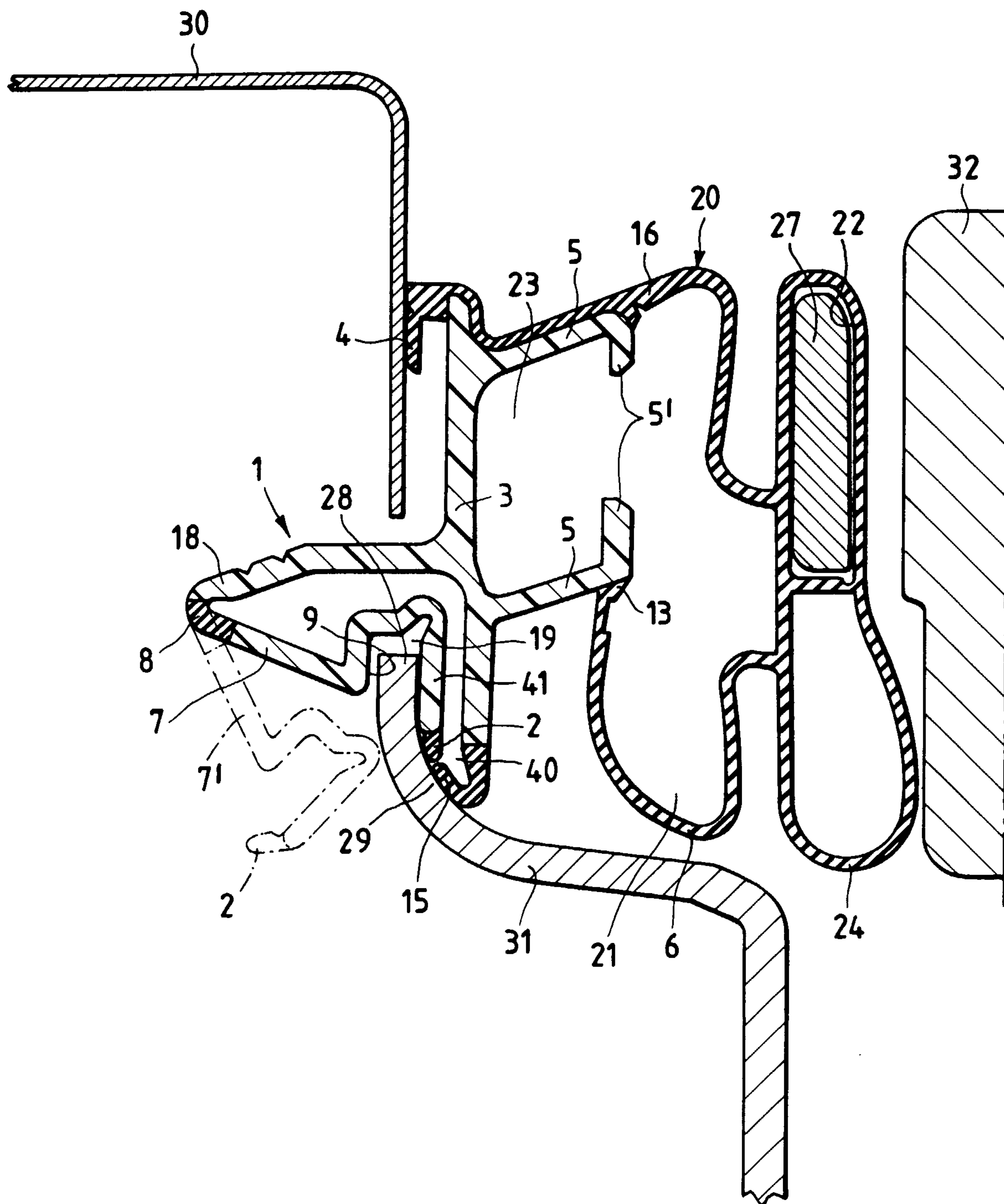
8. The combination according to any one of claims 1 to 7, wherein said base is generally contained in a single plane.

9. The combination according to any one of claims 1 to 7, wherein said base is contained in generally parallel planes that are staggered with respect to one another.

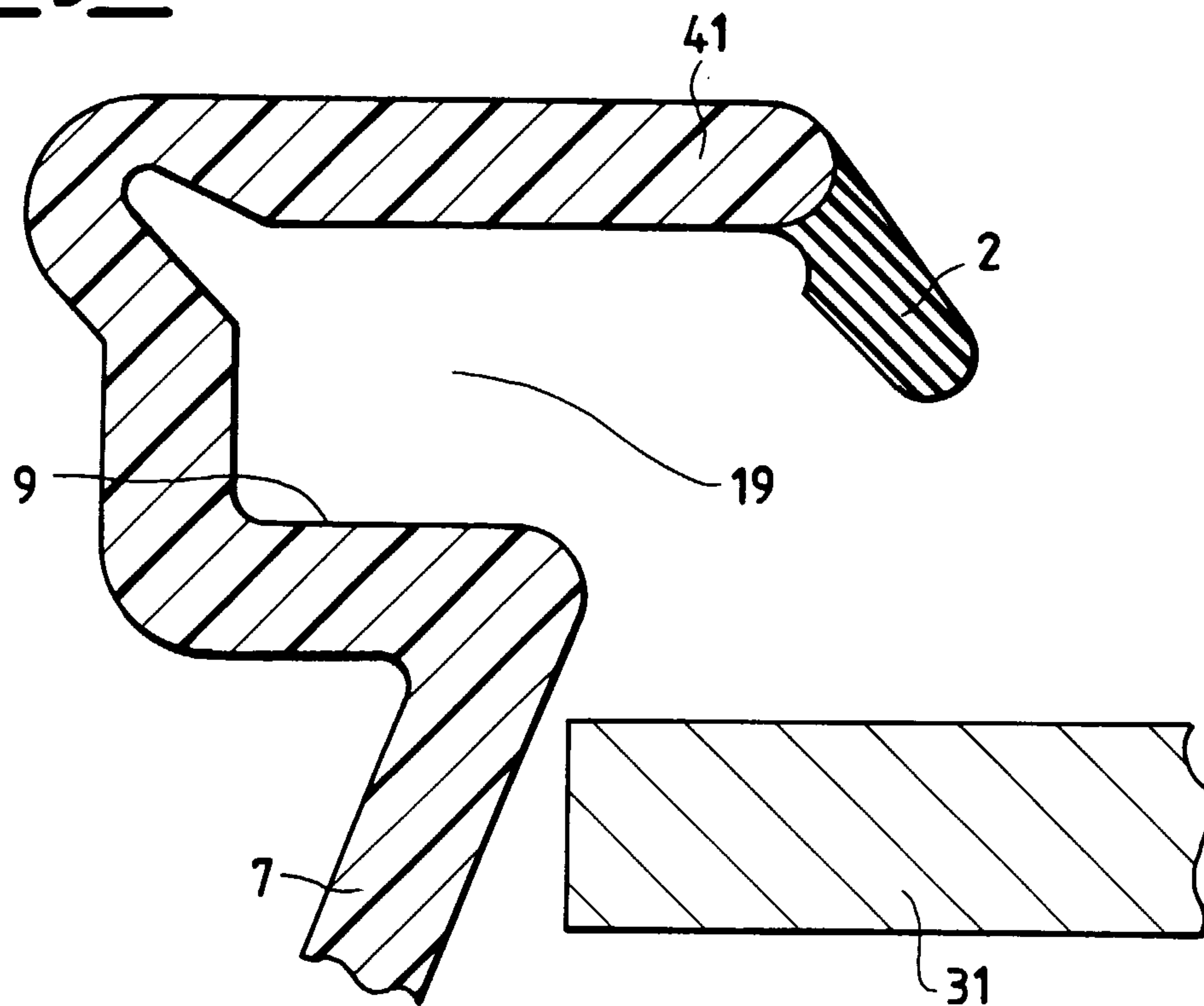
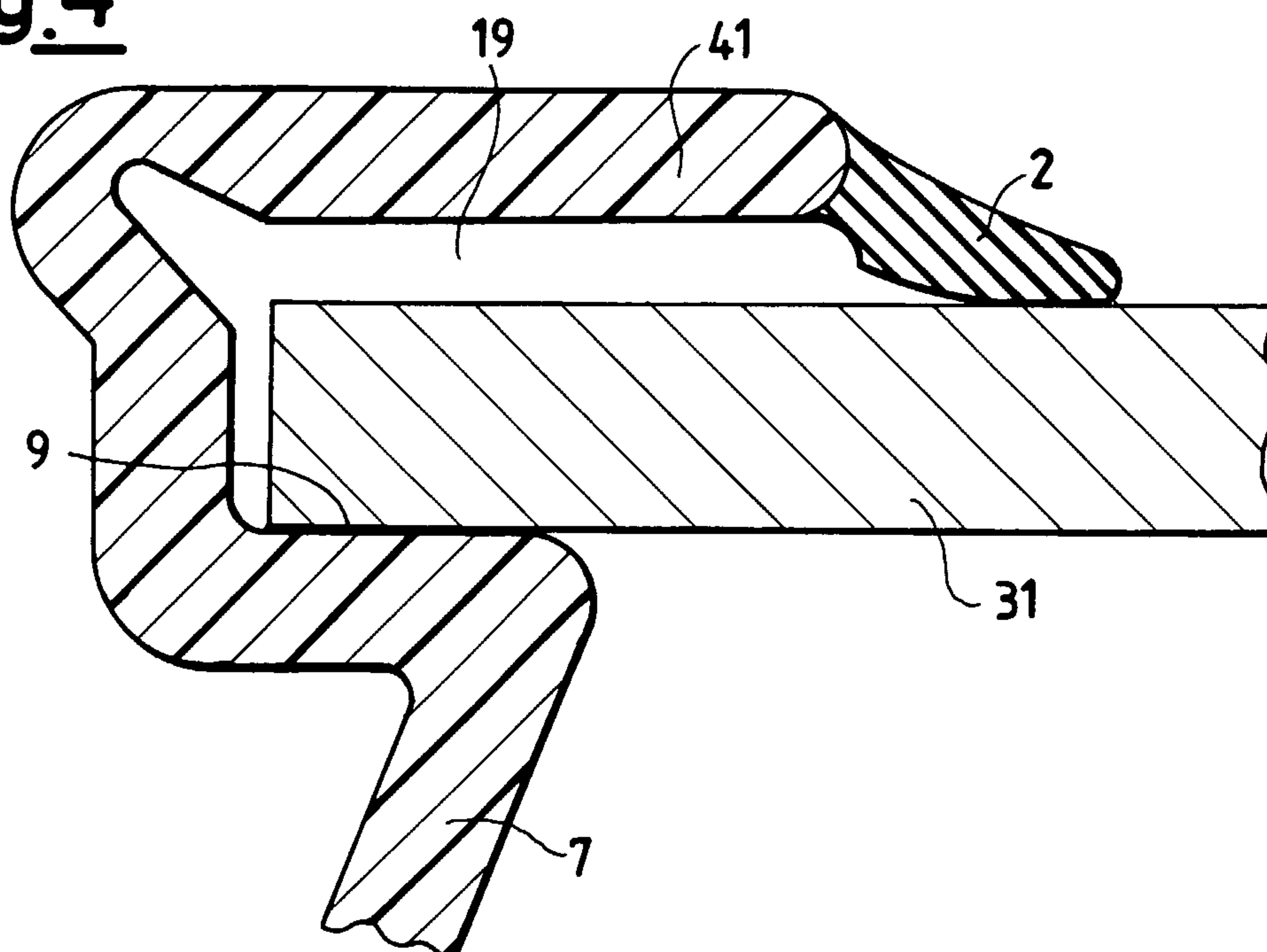
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Fig.1

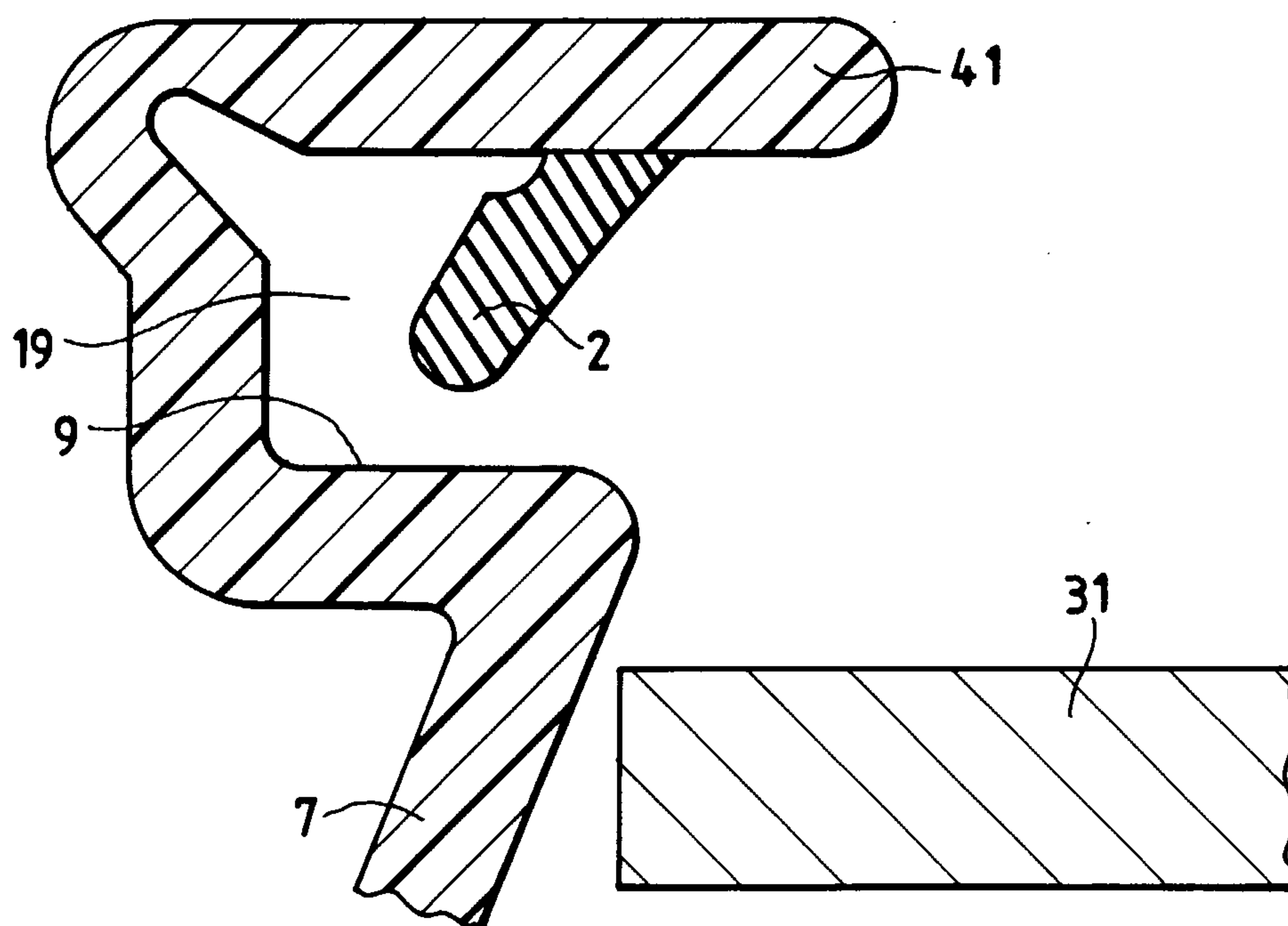
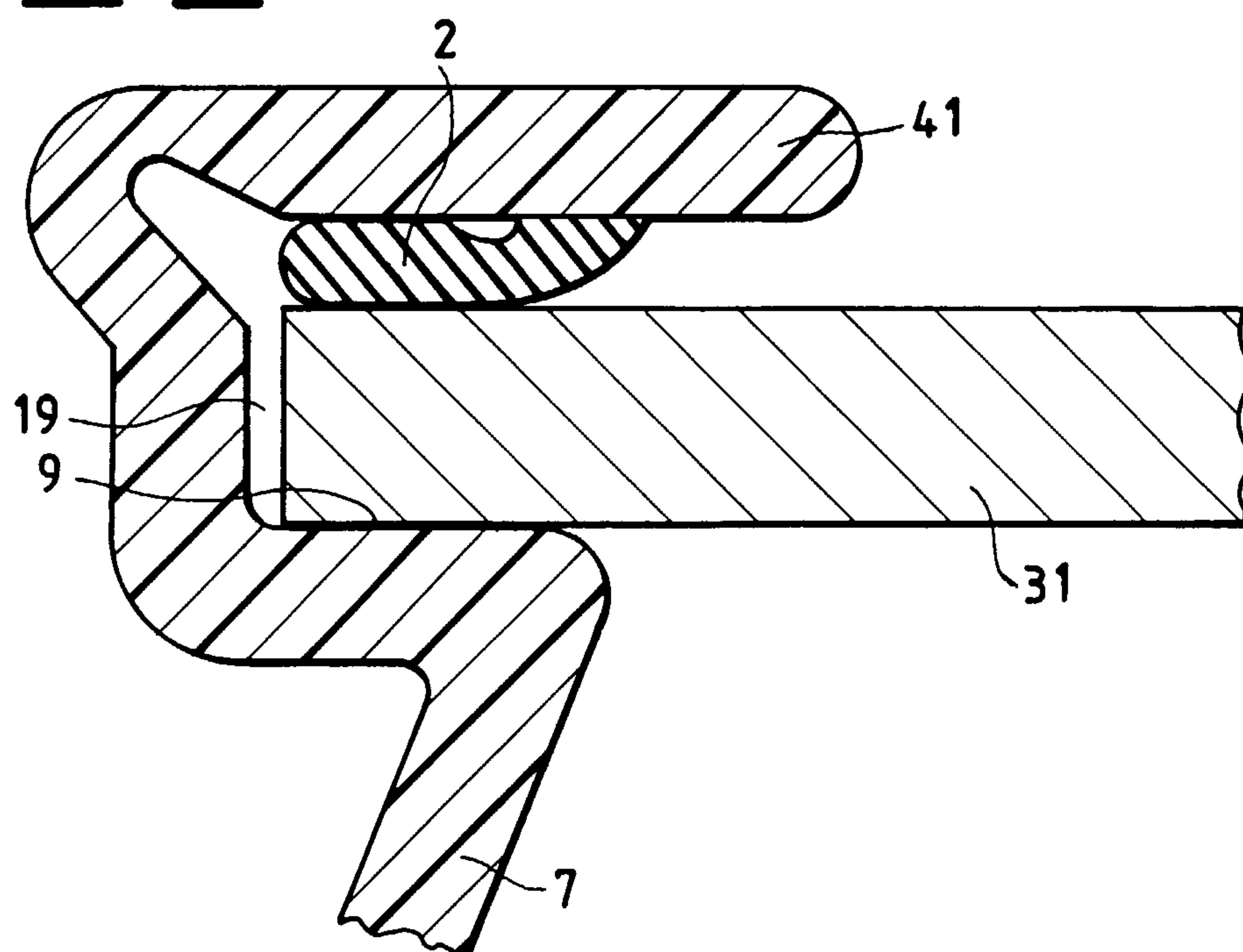
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Fig.2

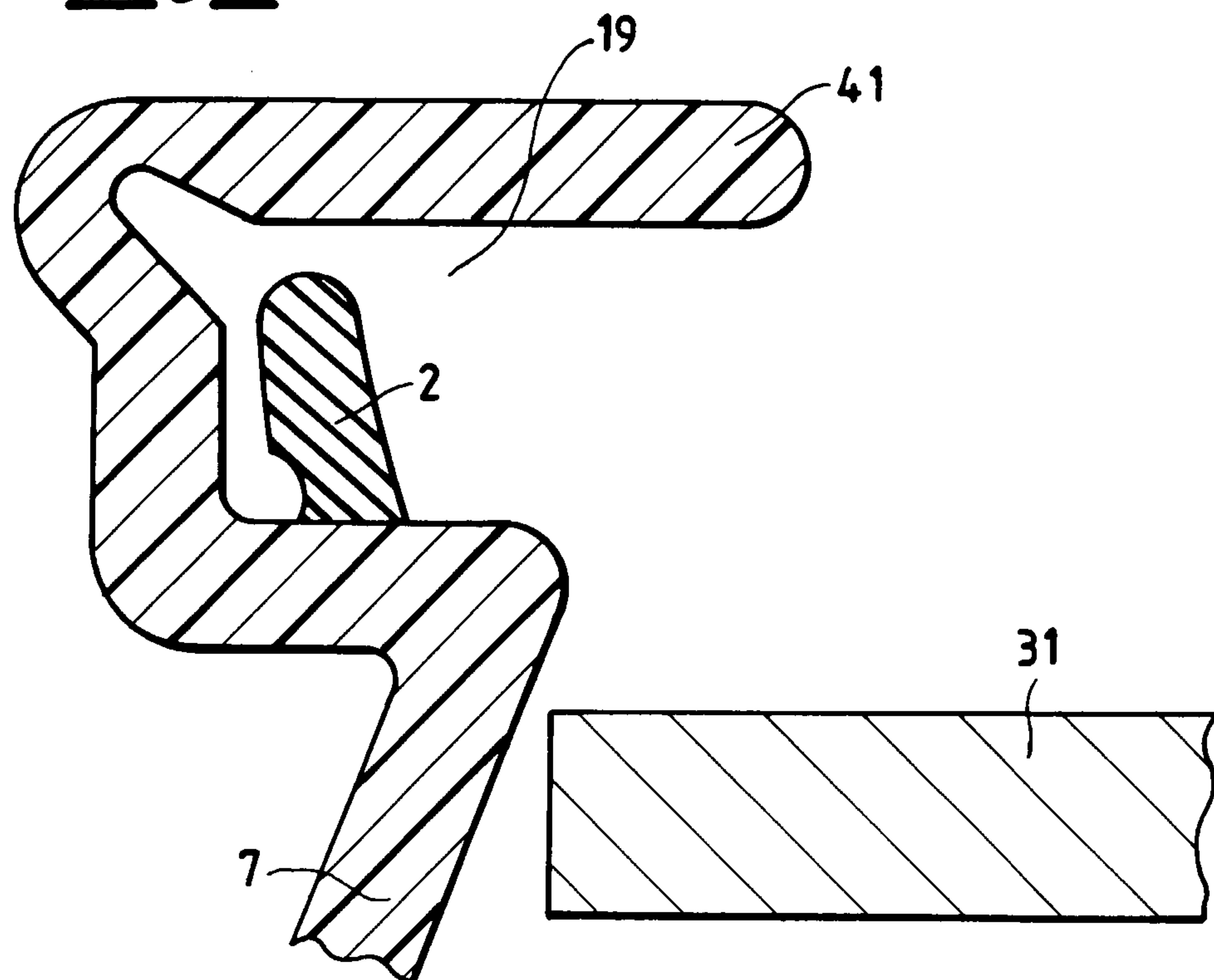
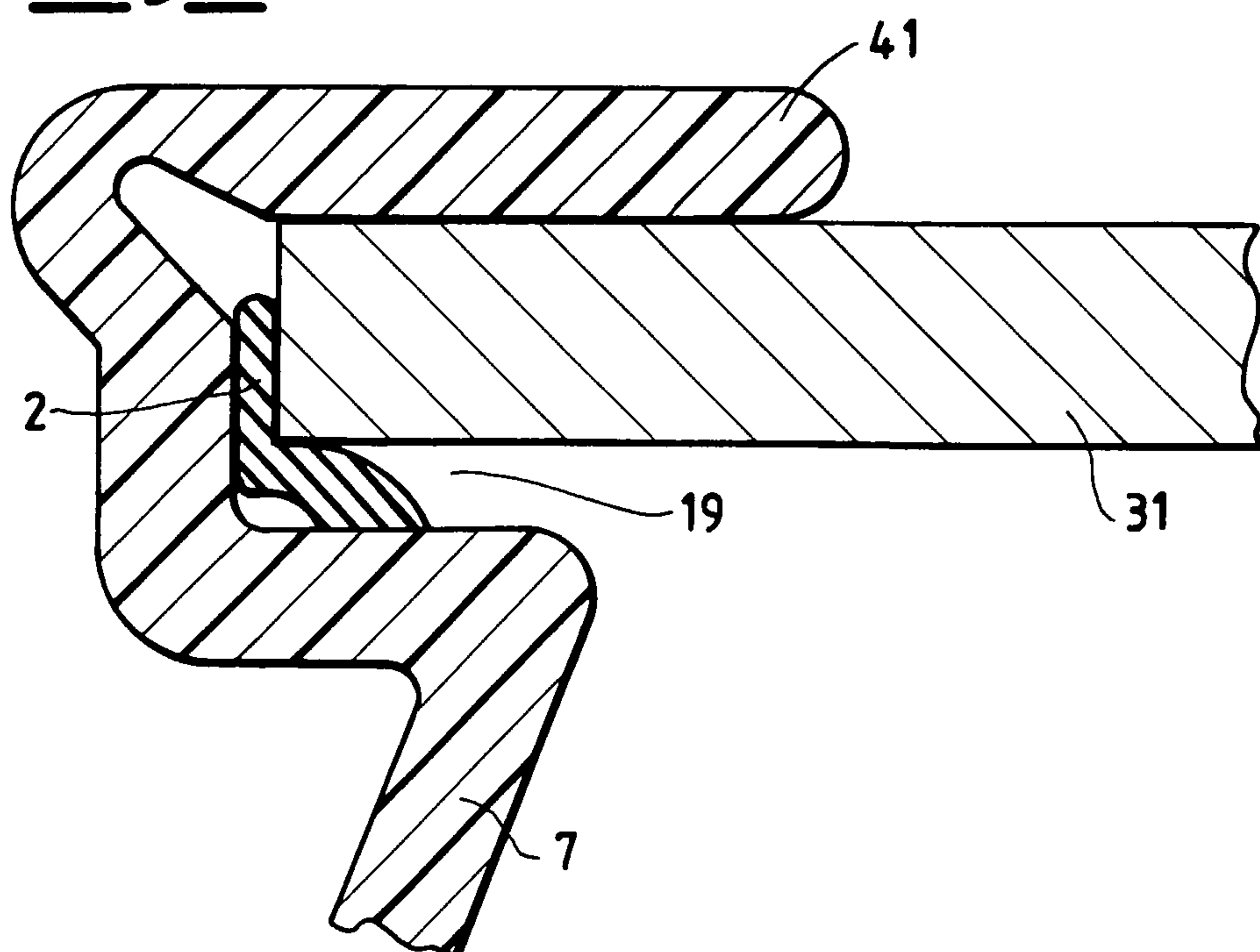
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Fig.3Fig.4

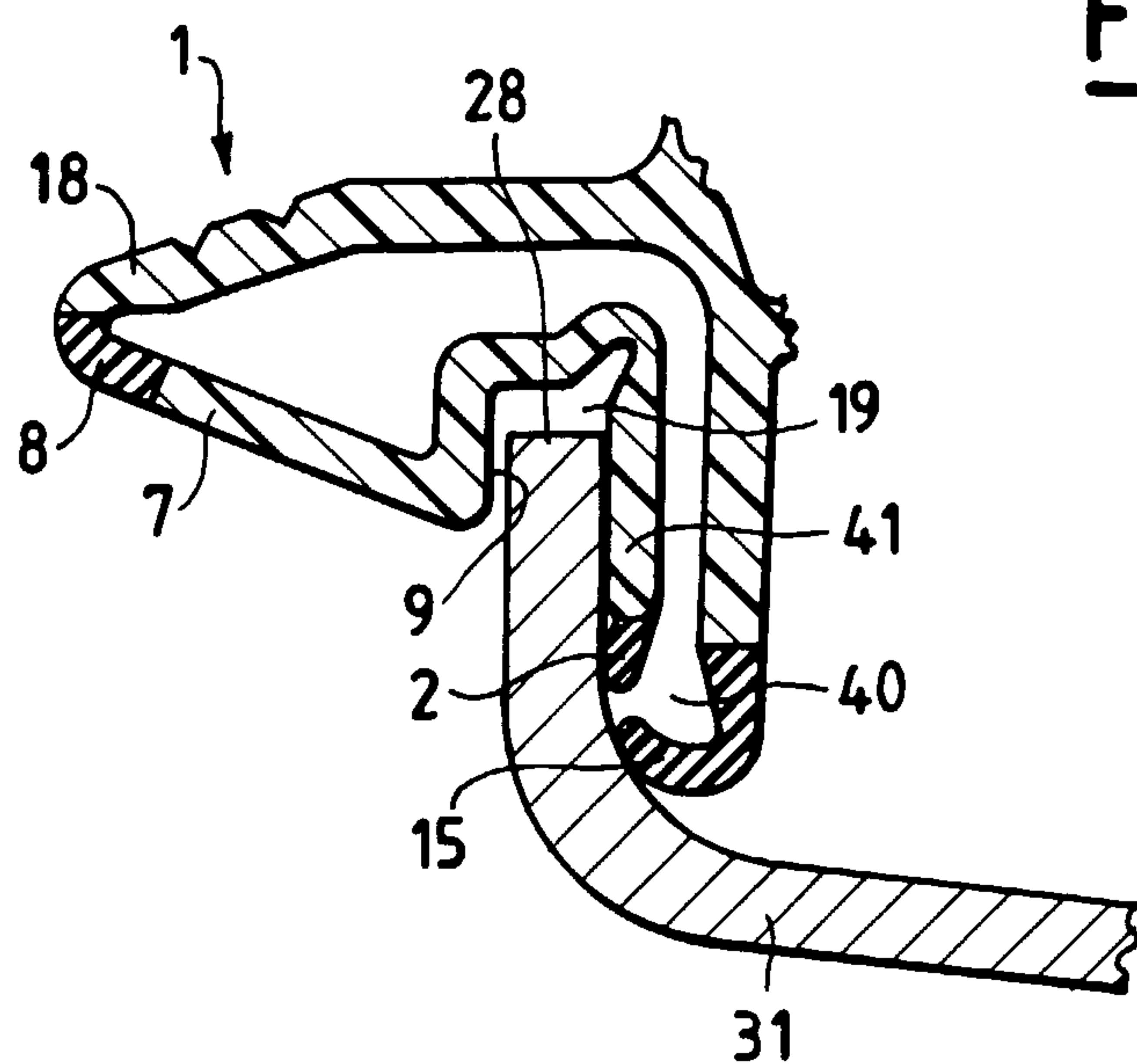
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Fig.5Fig.6

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Fig.7Fig.8

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Fig.9Fig.10