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(54) **IMPROVEMENTS IN MOULDING SEGMENTS OF LINING FOR TUNNEL OR PIPELINE**

VERBESSERUNGEN BEIM GIESSEN VON AUSKLEIDUNGSELEMENTEN FÜR TUNNEL ODER
PIPELINE

AMELIORATIONS EN RAPPORT AVEC LE MOULAGE DE SEGMENTS DE REVETEMENT POUR
TUNNELS OU PIPELINES

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Description

Description of Invention

[0001] This invention relates to a moulding apparatus for moulding a segment of a lining for a tunnel, or a pipeline, in a settable material.

[0002] Moulds are known for moulding tunnel linings or pipeline segments. These comprise a base having a moulding recess into which concrete is poured. The recess is bounded by sides and ends at least one of which is configured so that the corresponding end and/or side edge of the concrete segment is provided with formations which are used in assembly of the segments to form the tunnel lining or pipeline. For example the end and/or side edges may be formed with grooves which receive sealing gaskets, and/or the end or side edges may be formed with formations which enable or facilitate connection of the segment to an adjacent segment in the tunnel lining or pipeline.

[0003] Thus at least one end or side of the moulding recess requires forming to a desired configuration.

[0004] Such known moulds are typically made in a material such as concrete, timber or metal.

[0005] To make a dedicated one-piece moulding apparatus for moulding a segment with a particular end or side edge configuration is a not an inexpensive investment. Moreover, a separate mould is required for each different segment configuration.

[0006] As is well known to those skilled in the art, it is usual for a tunnel lining or pipeline to be made up from a variety of different configuration tunnel lining/pipeline segments. Whilst the majority of segments for each of a plurality of rings of segments which are arranged end to end may be the same, to enable the ring to be completed, at least one, usually two or three of the segments need to be of different configurations. Thus to produce a ring of segments typically two or three different moulds are required to produce all the necessary alternative configuration segments.

[0007] Also known in the prior art are moulds which are constructed out of a kit of moulding apparatus parts in accordance with the exact form of the article to be moulded. However, these have to be disassembled to remove the moulded article from the mould. Hence they are time consuming to use as they require assembling and disassembling for each use.

[0008] EP 0 673 734 A discloses a moulding apparatus with the features of the preamble of claim 1.

[0009] According to one aspect of the invention we provide a moulding apparatus with the features claimed in claim 1.

[0010] Thus rather than forming ends or sides of a mould to produce an article with a desired edge formation, the inwardly facing surface or surfaces of the insert or inserts may be configured to produce an article with a desired edge formation. Thus it is unnecessary to have different moulds to produce articles with different edge

configurations, but rather articles with different edge configurations may be produced by changing the insert or inserts or selecting an appropriate insert or inserts.

[0011] The invention is exclusively applicable for producing articles which in plan view are generally rectangular in configuration, having pairs of opposed ends and sides, in which case there may be provided an insert configured to form at least one of the edges of the ends or sides with the desired formation, but preferably, a pair of inserts are provided in the moulding apparatus to form edges of both of one of a pair of end or side edges at least, with desired formations.

[0012] As the insert is removable after use preferably at least part of the insert is either re-usable, or the insert or part of the insert becomes permanently attached to the settable material. In each case, the insert may be made of a suitable plastics material, such as a fibre reinforced resin, so that the surface thereof which faces inwardly of the moulding recess may readily be configured. The insert may include a gasket which becomes attached to the settable material, e.g. to facilitate subsequent sealing between two adjacent articles.

[0013] In one example, the inwardly facing surface of the insert includes a recess so that the corresponding end or side edge of the resultant article will have a protuberance. Alternatively or additionally, the inwardly facing surface of the insert may have a protuberance so that the corresponding end or side edge of the resultant article will have a recess. Where the insert includes a gasket, the protuberance may include an outwardly extending anchor means which anchors the gasket in the suitable material.

[0014] The insert may be a unitary structure, or may be made up of insert parts which together form the insert. For example, the insert may have a main body and one or more auxiliary parts and the main or one of the auxiliary parts may become attached to the suitable material whilst the auxiliary or main parts may be removable subsequent to moulding.

[0015] Thus by selecting and using appropriate main and auxiliary insert parts in conjunction with the main insert body, the inwardly facing surface may be provided with a variety of configurations. Thus it is unnecessary to provide a different insert for each insert configuration.

[0016] By utilising inserts substantial cost savings can be made compared to having to produce a concrete or steel mould for a particular article configuration, and by utilising auxiliary insert parts, further cost savings can be made by not having to make an individual monolithic insert for each article configuration. Furthermore from a technical viewpoint, there are advantages in making an insert or insert part in a plastics material to the close tolerances required, over providing a mould end or side edge with a desired formation.

[0017] The primary part is monolithic having a base and integral mould edges, and the mould edge of the primary part along which the inset extends and the adjacent edge of the insert, may be configured, e.g. plain,

to permit and facilitate the moulded article and insert to be removed together from the primary part when the settable material has set. Preferably the insert will extend along substantially the full extent of the mould edge.

[0018] The invention has been developed for use where the article to be moulded is a tunnel lining or pipeline segment which is four sided, e.g. generally rectangular in plan view, but in which the base of the primary part is curved. Thus appropriately curved end edges of the segments may be provided with desired formations using inserts, whilst straight mould edges may bound the moulding recess to form side edges of the segments which are adapted to co-operate with side edges of adjacent segments.

[0019] The insert or inserts may include or support fixings during moulding which fixings become embedded in the settable material of the segment during moulding, and are subsequently used to connect or facilitate connection of the segment to another segment.

[0020] The settable material is typically concrete.

[0021] According to a second aspect of the invention, we provide a method of moulding a tunnel lining segment in a settable material with the steps claimed in claim 13. The moulding apparatus may have any of the features of the moulding apparatus of the first aspect of the invention.

The invention will now be described with reference to the accompanying drawings in which:

FIGURE 1 is a perspective illustrative view of a moulding apparatus for use in the invention;

FIGURE 2 is a view similar to figure 1 but showing a pair of inserts prior to their placement in the moulding apparatus;

FIGURE 3 is a view similar to figure 2 but with the pair of inserts in place;

FIGURES 4a, 4b, and 4c are illustrative cross sectional views of an insert adapted to provide three alternative formations in an article to be cast.

FIGURE 5 is an illustrative view of a segment made in a moulding apparatus of the invention.

Referring to the drawings there is shown a moulding apparatus 10 which in this example is made in concrete from a concrete master generally of the configuration of an article to be made using the moulding apparatus 10. The moulding apparatus 10 is for moulding a tunnel lining segment of the kind which, together with a plurality of similar segments, may be assembled together to produce a ring of segments. The tunnel lining is made up of a plurality of such rings of segments arranged end to end. However it will be appreciated by those skilled in the art that a similar moulding apparatus to that shown at 10 may be utilised to produce pipeline segments.

The moulding apparatus 10 has a primary part 11 providing a recess 12. The primary part has a base 14 which is curved and of the shape of the segment to be produced, which curve is largely governed by the diameter of the

tunnel lining to be produced. Further the primary part has four mould edges 15-18, which bound the base 14 and which with the base 14 define the recess 12. The primary part 11 of the moulding apparatus 10 cannot be disassembled, and is monolithic i.e. made as a single piece.

Prior to the present invention, to produce a variety of segments with differing end and side edge configurations, a different mould has been required for each segment configuration. The recess 12 would have been a moulding recess into which concrete would be cast, and the mould edges 15, 17 would have been configured to provide the moulded article with sides of a desired configuration, e.g. having a recess to receive a sealing gasket, whilst the mould edges 16, 18 would have been configured to provide the moulded article with ends of a desired configuration, e.g. having both a recess later to receive a sealing gasket for sealing between two adjacent segments in use, and supporting fixings by means of which the segment may be connected end to end with an adjacent segment.

In accordance with the invention though, at least the end edges of the article to be moulded are configured with a desired formation or formations, by using a pair of mould inserts as indicated at 20 and 21. Each of the inserts 20, 21 may be made in a suitable plastics material such as a fibre reinforced resin to high tolerances, and each insert 20, 21 is thus provided with formations indicated at 25, 26 in a surface 28 thereof which in use faces inwardly of the recess 12 so that in the resultant segment end edge, there is provided a protuberance which may be received in a recess of the adjacent segment opposing end edge. Opposite outwardly facing sides 28a of the inserts 20, 21 are generally plain, as are the adjacent mould edges 16, 18, and thus are configured so that the inserts 20, 21 are removable from the primary part 11 of the moulding apparatus 10 with the resultant segment, when the concrete has set.

[0022] By replacing the inserts 20, 21 with inserts having differing formations on the inwardly facing surfaces 28 thereof, it will be appreciated that segments having differing end edge configurations may be produced using the same basic moulding apparatus 10.

[0023] In this example, the inserts 20, 21 are curved so as to extend along the curved base 14. The inserts 20, 21 are shown in figure 3 positioned alongside the adjacent mould edges 16, 18 and are thus supported by the mould edges 16, 18. However it will be appreciated that one or both of the inserts 20, 21 may be positioned inwardly of the adjacent mould edge 16, 18 so that segments of different lengths L may be produced, again using the same basic moulding apparatus 10. Moreover, it is common to produce segments with non-parallel ends, in particularly configured moulds, but using the invention and particularly configured inserts 20, 21 adequately supported in the recess 12 away from the adjacent mould edges 16, 18, again the same basic moulding apparatus 10 may be used to produce segments with a variety arrangements of non-parallel sides.

[0024] Referring to figures 4a to 4c, there is shown in cross section, examples of the insert 20.

[0025] The insert 20 may be modified to provide different configuration edge formations in the segment to be moulded, using auxiliary mould parts. Thus where a recess is required in the end edge of the segment to be moulded, an auxiliary mould part such as shown at 30 in figure 4b may be placed in a recess 25 of a main body part 31 of the insert 20, and extend outwardly of the recess 25 to form a recess in the segment end edge. It will be appreciated that the auxiliary insert part 30 may be shaped as desired, and in the example shown is chamfered as indicated at 35, so that the resultant recess in the end edge of the segment to be produced is particularly shaped to accommodate a sealing gasket of a corresponding configuration, but with a space around the sealing gasket into which the gasket may deform when a pair of segments are connected together edge to edge with a gasket between them.

[0026] In figure 4a the insert 20 is shown with a pair of alternative configuration auxiliary insert parts 46, 47 received in sides of the recess 25 of the surface 28 thereof. Between them, there is located a rubber gasket 36. The gasket 36 as the concrete is cast, becomes attached to the concrete, so that it is unnecessary later, to insert a gasket between two segments to be connected together.

[0027] The gasket 36 includes in this example, an integral anchor means A, which includes a formation which extends away from the recess 25 in the insert 20, into the moulding recess, the formation including a plurality of laterally extending tangs B which assist in anchoring the gasket 36.

[0028] In the arrangement shown, when the concrete has set, the auxiliary insert parts 46, 47 are removed to leave gaps to the sides of the gasket 36, into which the gasket 36 may be deformed when the segment is connected to another segment.

[0029] The gasket 36 may have hollows H to assist deformation, and may include a strip or strips of hydrophilic gasket material, to assist sealing in wet conditions.

[0030] Of course, other configurations of anchoring means may be provided as required for a particular gasket configuration.

[0031] Many other alternative insert 20, 21 configurations are possible, as are many other configurations of auxiliary insert part to be used in conjunction with a main body part 31 of the insert 20, 21, and/or with a gasket 36.

[0032] Referring to figure 5, there is shown a segment 50 moulded in the moulding apparatus 10 of the previous figures, the segment 50 having ends 16a, 18a and sides 15a, 17a, one of the ends 16a having a protuberance 51 and the other of the ends 18a having a corresponding recess 52, the protuberance 51 being adapted to be received in a recess 52 of an adjacent segment.

[0033] The ends 16a, 18a also have openings 53 to 55. Opening 53 extends throughout the length L of the segment 50 and is formed by placing a rod or the like in

the recess 12 of the moulding apparatus 10 so as to extend between and be supported in the moulding recess 12 by the pair of inserts 20, 21. Such a through opening 53 may be used to accommodate a connecting rod whereby the segment 50 may be connected end to end with an adjacent segment.

[0034] Opening 54 accommodates a receptor box 56 with which a T shaped connector may be engaged, again to enable the segment 50 to be connected to an adjacent segment. The receptor box 56 is placed in the moulding apparatus 10 and is supported by an insert 20 or 21 so as to extend inwardly of the moulding recess 12, whereby the receptor box 56 is embedded in the concrete when the concrete is introduced into the moulding apparatus.

[0035] Opening 55 accommodates an alternative configuration receptor 57 with which a fixing may engage to align and connect the segment 50 to an adjacent segment during construction of the tunnel lining, pipeline or other construction.

[0036] It will be appreciated that in practice a segment 50 would usually have only one kind of edge connector or connectors, and that the three alternative types have only been shown in one segment for illustrative purposes.

[0037] Other such connectors may include cast-in threaded inserts for curved connector bolts, simple dowels to aid location of adjacent segments, or bolts.

[0038] By virtue of using the inserts 20, 21 it will be appreciated that segments 50 with different arrangements of fixings embedded in the concrete can be produced using a common basic moulding apparatus 10, because different inserts or auxiliary insert parts may be used to support different fixings in different positions along the end edges 16, 18 of the moulding apparatus 10, as desired.

[0039] If desired, an insert may be provided along all of the mould edges 15-18. At least one of these inserts may become attached to the cast material, for example to envelope the edge of the cast article, for reinforcement of the concrete.

[0040] If desired, the moulding recess may be closed with a lid through an opening in which the concrete or other settable material may be introduced into the moulding recess. Such lid may be curved and correspond in shape to the base 14.

[0041] The inserts 20 need not be of plastic as described, but could be made of other materials such as steel, timber or even concrete.

[0042] The base 14 of the moulding recess 12 need not be smooth as shown, but may be configured to enable a coffered inwardly facing surface to be produced. Alternatively, an insert may be placed on smooth base 14, the insert having a inwardly facing surface with coffered type formations.

Claims

1. A moulding apparatus (10) for moulding a tunnel or

pipeline segment (50) in a moulding recess (12) using a settable material, the segment (50) being generally rectangular in plan view, the moulding apparatus (10) including a monolithic primary part (11) provided with a curved base (14) and with a plurality of integral mould edges (15-18), the moulding apparatus (10) further including at least one insert (20, 21) which is arranged to extend along one of the mould edges (15-18), the insert (20, 21) having a surface (28) which faces inwardly of the moulding recess (12), the surface being configured so that an adjacent edge of the segment (50) moulded in the moulding apparatus (10) is provided with a desired formation, the insert (20, 21) being removable from the primary part (11) with the moulded segment (50), the insert (20,21) including at least one of:

- i. a gasket (36) which becomes permanently attached to the settable material;
- ii. fixings (54, 55, 57) which are supported such that during moulding the fixings (54, 55, 57) become embedded in the settable material, the fixings (54, 55, 57) subsequently being usable to connect or facilitate connection of the segment to another segment;
- iii. in the inwardly facing surface (28) of the insert (20,21), a recess (25) so that the adjacent edge of the resultant segment (50) will have a protuberance which is receivable, in use, in a recess of an edge of an adjacent segment,

characterised in that the primary part (11) of the moulding apparatus (10) is provided with four integral mould edges (15-18) which, with the base (14), and the insert (20, 21) define the moulding recess (12) into which settable material can be introduced.

2. A moulding apparatus according to claim 1 **characterised in that** at least a part of the insert (20, 21) is re-usable.
3. A moulding apparatus according to any one of the preceding claims **characterised in that** the insert (20, 21) is made of a plastics material.
4. A moulding apparatus according to any one of the preceding claims **characterised in that** the inwardly facing surface (28) of the insert (20, 21) has a protuberance (30) so that the corresponding end or side edge of the resultant segment (50) will have a recess.
5. A moulding apparatus according to any one of the preceding claims **characterised in that** the insert (20, 21) is made up of insert parts which together form the insert.
6. A moulding apparatus according to claim 5 **characterised in that** the insert (20,21) has a main body

(31) and one or more auxiliary parts (30).

7. A moulding apparatus according to claim 6 **characterised in that** the main body (31) or one of the auxiliary parts (30) becomes attached to the settable material whilst the auxiliary parts (30) or main parts (31) may be removable subsequent to moulding.
8. A moulding apparatus according to any one of the preceding claims **characterised in that** the mould edges (15-18) of the primary part (11) along which the insert (20, 21) extends and the adjacent edge (28a) of the insert (20,21) are configured or spaced apart to permit the moulded segment (50) and the insert (20, 21) to be removed from the primary part (11) when the settable material has set.
9. A moulding apparatus according to any one of the preceding claims **characterised in that** the insert (20, 21) extends along substantially the full extent of the mould edge (15-18).
10. A moulding apparatus according to any one of the preceding claims **characterised in that** curved end edges (16, 18) of the segments (50) are provided with desired formations using inserts.
11. A moulding apparatus according to claim 10 **characterised in that** straight moulding apparatus edges (15, 17) bound the moulding recess (12) to form side edges of the segments (50) which are adapted to co-operate with side edges (28a) of adjacent segments (50).
12. A moulding apparatus according to any one of the preceding claim **characterised in that** the settable material is concrete.
13. A method of moulding a tunnel lining segment (50) in a settable material, the segment (50) being generally rectangular in plan view, using a moulding apparatus (10) forming a moulding recess (12) and including a monolithic primary part (11) provided with a curved base (14) and a plurality of integral mould edges (15-18), the method including placing into the moulding apparatus (10) at least one insert (20, 21) which is arranged to extend along a mould edge (15-18), and introducing into the moulding recess (12) settable material, the insert (20, 21) having a surface (28) which faces inwardly of the moulding recess (12), the surface being configured so that an adjacent edge of the article (50) moulded in the moulding apparatus (10) is provided with a desired edge formation, and once the settable material has set, removing the moulded article (50) and the insert (20, 21) together from the primary part (11), the insert (20,21) including at least one of:

- i. a gasket (36) which becomes permanently attached to the settable material;
- ii. or fixings (54, 55, 57) which are supported such that during moulding the fixings (54, 55, 57) become embedded in the settable material, the fixings (54, 55, 57) subsequently being usable to connect or facilitate connection of the segment (50) to another segment;
- iii. or in the inwardly facing surface (28) of the insert (20,21), a recess (25) so that the adjacent edge of the resultant segment (50) will have a protuberance which may be received in a recess of an edge of an adjacent segment,

the method being **characterised in that** the moulding recess into which the settable material is introduced is defined by four mould edges (15-18) which are integral with the primary part (II) of the moulding apparatus (10), the base (14) and insert (20, 21).

14. A method according to claim 13 **characterised in that** the mould edges (15-18) of the primary part (11) along which the insert (20, 21) extends and the adjacent edge (28a) of the insert (20, 21) are configured or are spaced apart so that the moulded article (50) and the insert (20, 21) are removable from the primary part (11).

Patentansprüche

1. Ein Formapparat (10) zum Formen eines Tunnel- oder Rohrsegments (50) in einer Formaussparung (12) unter Verwendung eines härtbaren Materials, das Segment (50), das allgemein bei Planansicht rechteckig ist, der Formapparat (10), der ein monolithisches Primärteil (11) enthält, das eine abgerundete Basis (14) und eine Mehrzahl von integralen Formrändern (15-18) hat, der Formapparat (10) enthält außerdem mindestens einen Einsatz (20, 21), der so angeordnet ist, dass er an einem der Formränder (15-18) entlang verläuft, wobei der Einsatz (20, 21) eine Fläche (28) hat, die an der Formaussparung (12) nach innen zeigt, und die Fläche ist so konfiguriert, dass ein angrenzender Rand des Segments (50), das im Formapparat (10) geformt wurde, eine gewünschte Formung enthält, und der Einsatz (20, 21) kann vom Primärteil (11) mit dem geformten Segment (50) entfernt werden, wobei der Einsatz (20, 21) mindestens eines der Folgenden enthält:

- i. eine Dichtung (36), die permanent am härtbaren Material befestigt wird;
- ii. Befestigungselemente (54, 55, 57), die so gestützt werden, dass die Befestigungselemente (54, 55, 57) während des Formens im härtbaren Material eingebettet werden, wobei die Befestigungselemente (54, 55, 57) daraufhin zur Ver-

bindung bzw. zur Erleichterung der Verbindung des Segments an einem anderen Segment verwendet werden können;

iii. an der nach innen zeigenden Fläche (28) des Einsatzes (20, 21) ist eine Aussparung (25), damit der angrenzende Rand des **dadurch** entstehenden Segments (50) einen Vorsprung hat, der bei der Verwendung in eine Aussparung des Randes eines angrenzenden Segments aufgenommen werden kann,

dadurch gekennzeichnet, dass das Primärteil (II) des Formapparats (10) vier integrale Formränder (15-18) hat, die zusammen mit der Basis (14) und dem Einsatz (20, 21) die Formaussparung (12) definieren, in die das härtbare Material eingebracht werden kann.

2. Ein Formapparat nach Anspruch 1, **dadurch gekennzeichnet, dass** mindestens ein Teil des Einsatzes (20, 21) wiederverwendbar ist.
3. Ein Formapparat nach einem beliebigen vorangehenden Anspruch, **dadurch gekennzeichnet, dass** der Einsatz (20, 21) aus Kunststoffmaterial gefertigt ist.
4. Ein Formapparat nach einem beliebigen vorangehenden Anspruch, **dadurch gekennzeichnet, dass** die nach innen zeigende Fläche (28) des Einsatzes (20, 21) einen Vorsprung (30) hat, so dass das korrespondierende Ende der Seitenkante des **dadurch** entstehenden Segments (50) eine Aussparung hat.
5. Ein Formapparat nach einem beliebigen vorangehenden Anspruch, **dadurch gekennzeichnet, dass** der Einsatz (20, 21) aus Einsatzteilen besteht, die zusammen den Einsatz bilden.
6. Ein Formapparat nach Anspruch 5, **dadurch gekennzeichnet, dass** der Einsatz (20, 21) ein Hauptteil (31) und ein oder mehrere Zusatzteile (30) hat.
7. Ein Formapparat nach Anspruch 6, **dadurch gekennzeichnet, dass** das Hauptteil (31) oder eines der Zusatzteile (30) am härtbaren Material befestigt wird, während die Zusatzteile (30) oder Hauptteile (31) nach dem Formen evtl. entfernt werden können.
8. Ein Formapparat nach einem beliebigen vorangehenden Anspruch, **dadurch gekennzeichnet, dass** die Formränder (15-18) des Primärteils (11), an denen entlang der Einsatz (20, 21) verläuft, und der angrenzende Rand (28a) des Einsatzes (20, 21) so konfiguriert oder in Abständen angebracht sind, dass das geformte Segment (50) und der Einsatz (20, 21) vom Primärteil (11) entfernt werden können, wenn das härtbare Material ausgehärtet ist.

9. Ein Formapparat nach einem beliebigen vorangehenden Anspruch, **dadurch gekennzeichnet, dass** der Einsatz (20, 21) im Wesentlichen die ganze Länge des Formrands (15-18) entlang verläuft.

10. Ein Formapparat nach einem beliebigen vorangehenden Anspruch, **dadurch gekennzeichnet, dass** die abgerundeten Ränder (16, 18) der Segmente (50) mithilfe von Einsätzen die gewünschte Formung enthalten.

11. Ein Formapparat nach Anspruch 10, **dadurch gekennzeichnet, dass** die geraden Ränder des Formapparats (15, 17), die die Formaussparung (12) umgeben, die Seitenränder der Segmente (50) bilden, die so angepasst sind, dass sie zu den Seitenrändern (28a) der angrenzenden Segmente (50) passen.

12. Ein Formapparat nach einem beliebigen vorangehenden Anspruch, **dadurch gekennzeichnet, dass** das härtbare Material Beton ist.

13. Eine Methode zum Formen eines Segments zur Tunnelauskleidung (50) aus einem härtbaren Material (50), das allgemein bei Planansicht rechteckig ist, unter Verwendung eines Formapparats (10), der eine Formaussparung (12) bildet und ein monolithisches Primärteil (11) enthält, das eine abgerundete Basis (14) und eine Mehrzahl von integralen Formrändern (15-18) hat, wobei die Methode beinhaltet, dass mindestens ein Einsatz (20, 21) in den Formapparat (10) gegeben wird, der so angeordnet ist, dass er an einem Formrand (15-18) entlang verläuft, und in die Formaussparung wird härtbare Material eingebracht, wobei der Einsatz (20, 21) eine Fläche (28) hat, die von der Formaussparung (12) nach innen zeigt, und die Fläche ist so konfiguriert, dass ein angrenzender Rand des Artikels (50), der im Formapparat (10) geformt wurde, eine gewünschte Randformung enthält, und wenn das härtbare Material ausgehärtet ist, werden der geformte Artikel (50) und der Einsatz (20, 21) zusammen vom Primärteil (11) entfernt, wobei der Einsatz (20, 21) mindestens eines der Folgenden enthält:

- i. eine Dichtung (36), die permanent am härtbaren Material befestigt wird;
- ii. oder Befestigungselemente (54, 55, 57), die so gestützt werden, dass während des Formens die Befestigungselemente (54, 55, 57) im härtbaren Material eingebettet werden, wobei die Befestigungselemente (54, 55, 57) daraufhin zur Verbindung bzw. zur Erleichterung der Verbindung des Segments (50) an einem anderen Segment verwendet werden können;
- iii. oder an der nach innen zeigenden Fläche (28) des Einsatzes (20, 21) befindet sich eine Aus-

sparung (25), damit der angrenzende Rand des **dadurch** entstehenden Segments (50) einen Vorsprung hat, der in eine Aussparung des Randes eines angrenzenden Segments aufgenommen werden kann,

wobei die Methode **dadurch gekennzeichnet ist, dass** die Formaussparung, in die das härtbare Material eingebracht wird, durch vier Formränder (15-18), die mit dem Primärteil (11) des Formapparats (10), der Basis (14) und den Einsätzen (20, 21) integral sind, definiert wird.

14. Eine Methode nach Anspruch 13, **dadurch gekennzeichnet, dass** die angrenzenden Ränder (15-18) des Primärteils (11), an denen entlang der Einsatz (20, 21) verläuft, und der angrenzende Rand (28a) des Einsatzes (20, 21) so konfiguriert oder in Abständen angebracht sind, dass der geformte Artikel (50) und der Einsatz (20, 21) vom Primärteil (11) entfernt werden können.

Revendications

1. Un appareil de moulage (10) pour la moulure d'un segment de canal ou de conduite (50) dans une cavité de moulage (12) en utilisant un matériau de prise, le segment (50) étant généralement rectangulaire de vue en plan, l'appareil de moulage (10) comprenant une partie primaire monolithique (11) pourvue d'un châssis incurvé (14) et avec une pluralité de bords de moulage intégraux (15-18), l'appareil de moulage (10) comprenant en outre au moins une pièce encastrée (20, 21) qui est disposée de manière à s'étendre le long de l'un des bords de moulage (15-18), la pièce encastrée (20, 21) ayant une surface (28) qui est tournée vers l'intérieur de la cavité de moulage (12), la surface étant configurée de manière à ce qu'un bord adjacent du segment (50) moulé dans l'appareil de moulage (10) soit pourvu d'une conformation souhaitée, la pièce encastrée (20, 21) étant amovible de la partie primaire (11) avec le segment de moulage (50), la pièce encastrée (20, 21) comprenant au moins l'un des éléments suivants :

- i. un joint statique (36) qui devient attaché en permanence au matériau de prise ;
- ii. des fixations (54, 55, 57) qui sont supportés de telle façon que durant le moulage, les fixations (54, 55, 57) deviennent incorporées dans le matériau de prise, les fixations (54, 55, 57) étant ultérieurement utilisables pour connecter ou faciliter la connexion du segment à un autre segment ;
- iii. dans la surface tournée vers l'intérieur (28) de la pièce encastrée (20, 21), une cavité (25) de manière à ce que le bord adjacent du seg-

ment résultant (50) ait une protubérance qui soit reçue, en cours d'utilisation, dans une cavité d'un bord d'un segment adjacent,

- caractérisée en ce que** la partie primaire (II) de l'appareil de moulage (10) est pourvue de quatre bords de moulage intégraux (15-18) qui, avec le châssis (14) et la pièce encastrée (20, 21) définissent la cavité de moulage (12) dans laquelle le matériau de prise peut être introduit. 5
2. Un appareil de moulage selon la revendication 1 **caractérisé en ce qu'**au moins une partie de la pièce encastrée (20, 21) est réutilisable. 10
3. Un appareil de moulage selon l'une des revendications précédentes **caractérisé en ce que** la pièce encastrée (20, 21) est faite en matière plastique. 15
4. Un appareil de moulage selon l'une des revendications précédentes **caractérisé en ce que** la surface tournée vers l'intérieur (28) de la pièce encastrée (20, 21) a une protubérance (30) de manière à ce que l'extrémité correspondante ou le bord latéral du segment résultant (50) aura une cavité. 20 25
5. Un appareil de moulage selon l'une des revendications précédentes **caractérisé en ce que** la pièce encastrée (20, 21) est composée de parties encastrées qui ensemble forment la pièce encastrée. 30
6. Un appareil de moulage selon la revendication 5 **caractérisé en ce que** la pièce encastrée (20, 21) a un corps principal (31) et une ou plusieurs parties auxiliaires (30). 35
7. Un appareil de moulage selon la revendication 6 **caractérisé en ce que** le corps principal (31) ou l'une des parties auxiliaires (30) devient attaché(e) au matériau de prise tandis que les parties auxiliaires (30) ou le corps principal (31) peuvent être amovibles suite au moulage. 40
8. Un appareil de moulage selon l'une des revendications précédentes **caractérisé en ce que** les bords de moulage (15-18) de la partie primaire (11) le long de laquelle la pièce encastrée (20, 21) s'étend et le bord adjacent (28a) de la pièce encastrée (20, 21) sont configurés ou espacés pour permettre au segment moulé (50) et à la pièce encastrée (20, 21) d'être retirés de la partie primaire (11) une fois que le matériau de prise a durci. 45 50
9. Un appareil de moulage selon l'une des revendications précédentes **caractérisé en ce que** la pièce encastrée (20, 21) s'étend sensiblement sur toute la longueur du bord de moulage (15-18). 55

10. Un appareil de moulage selon l'une des revendications précédentes **caractérisé en ce que** les bords d'extrémité incurvés (16, 18) des segments (50) sont pourvus des conformations souhaitées en utilisant des pièces encastrées.

11. Un appareil de moulage selon la revendication 10 **caractérisé en ce que** les bords droits de l'appareil de moulage (15, 17) sont reliés à la cavité de moulage (12) pour former les bords latéraux des segments (50) qui sont adaptés pour concourir avec les bords latéraux (28a) des segments adjacents (50).

12. Un appareil de moulage selon l'une des revendications précédentes **caractérisé en ce que** le matériau de prise est du béton.

13. Une méthode de moulage d'un segment de revêtement d'un canal (50) dans un matériau de prise, le segment (50) étant généralement rectangulaire de vue en plan, en utilisant un appareil de moulage (10) formant une cavité de moulage (12) et comprenant une partie primaire monolithique (11) pourvue d'un châssis incurvé (14) et avec une pluralité de bords de moulage intégraux (15-18), la méthode comprenant le placement dans l'appareil de moulage (10) d'au moins une pièce encastrée (20, 21) qui est disposée de manière à s'étendre le long d'un bord de moulage (15-18), et l'introduction dans la cavité de moulage (12) du matériau de prise, de la pièce encastrée (20, 21) ayant une surface (28) qui est tournée vers l'intérieur de la cavité de moulage (12), la surface étant configurée de manière à ce qu'un bord adjacent du segment (50) moulé dans l'appareil de moulage (10) soit pourvu d'une conformation de bords souhaitée et une fois que le matériau de prise a durci, le retrait du segment moulé (50) et de la pièce encastrée (20, 21) en même temps que la partie primaire (11), la pièce encastrée (20, 21) comprenant au moins l'un des éléments suivants :

- i. un joint statique (36) qui devient attaché en permanence au matériau de prise ;
- ii. ou des fixations (54, 55, 57) qui sont supportées de telle façon que durant le moulage, les fixations (54, 55, 57) deviennent incorporées dans le matériau de prise, les fixations (54, 55, 57) étant ultérieurement utilisables pour connecter ou faciliter la connexion du segment (50) à un autre segment ;
- iii. ou, dans la surface tournée vers l'intérieur (28) de la pièce encastrée (20, 21), une cavité (25) de manière à ce que le bord adjacent du segment résultant (50) ait une protubérance qui soit reçue dans une cavité d'un bord d'un segment adjacent.

la méthode étant **caractérisée en ce que** la cavité

de moulage dans laquelle le matériau de prise est introduit est définie par quatre bords de moulage (15-18) qui font partie intégrante de la partie primaire (II) de l'appareil de moulage (10), du châssis (14) et de la pièce encastrée (20, 21).

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- 14.** Une méthode selon la revendication 13 **caractérisée en ce que** les bords moulés (15-18) de la partie primaire (11) le long de laquelle la pièce encastrée (20, 21) s'étend et le bord adjacent (28a) de la pièce encastrée (20, 21) sont configurés ou sont espacés de manière à ce que le segment moulé (50) et la pièce encastrée (20, 21) soient amovibles de la partie primaire (11).

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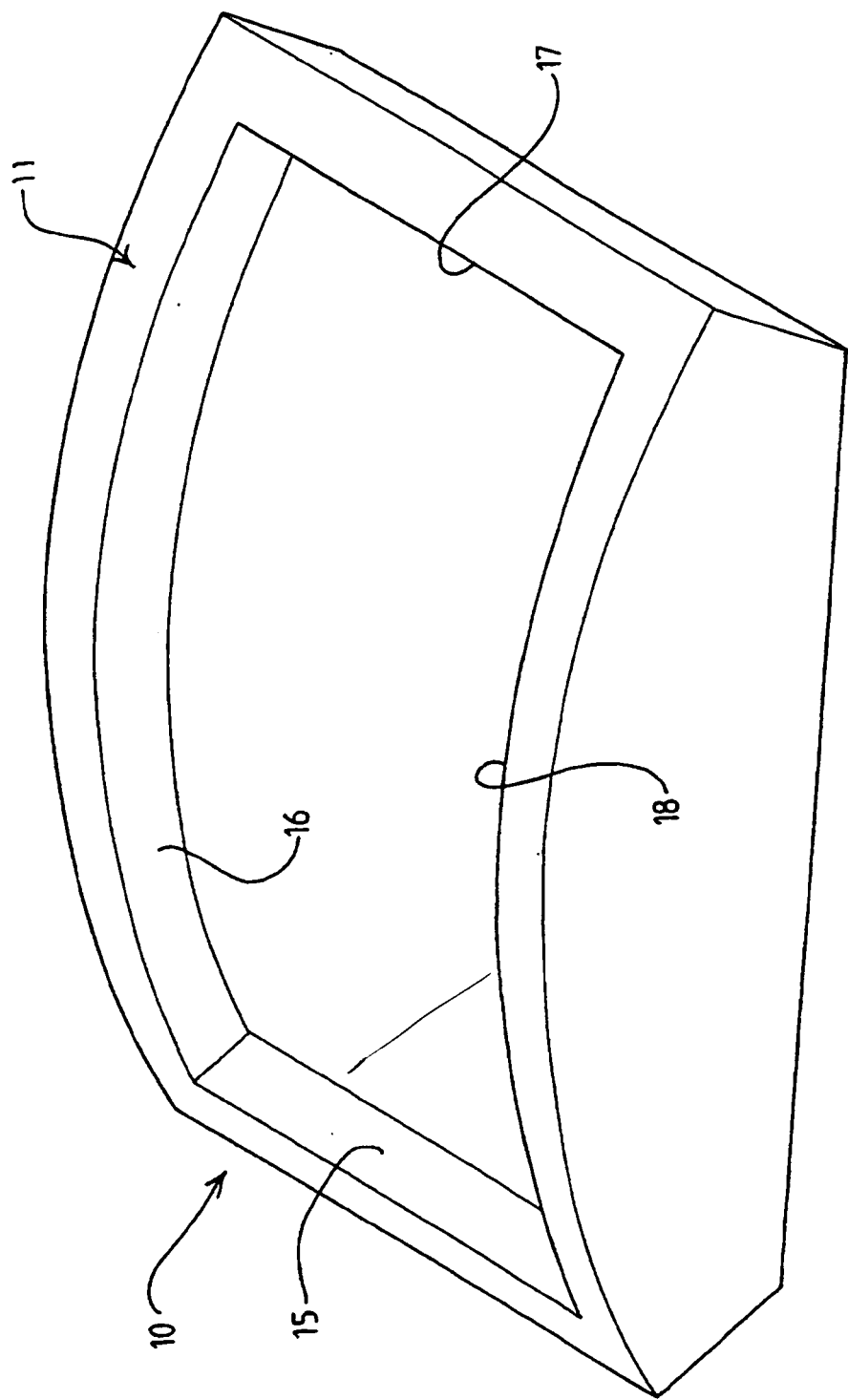


FIG. 1

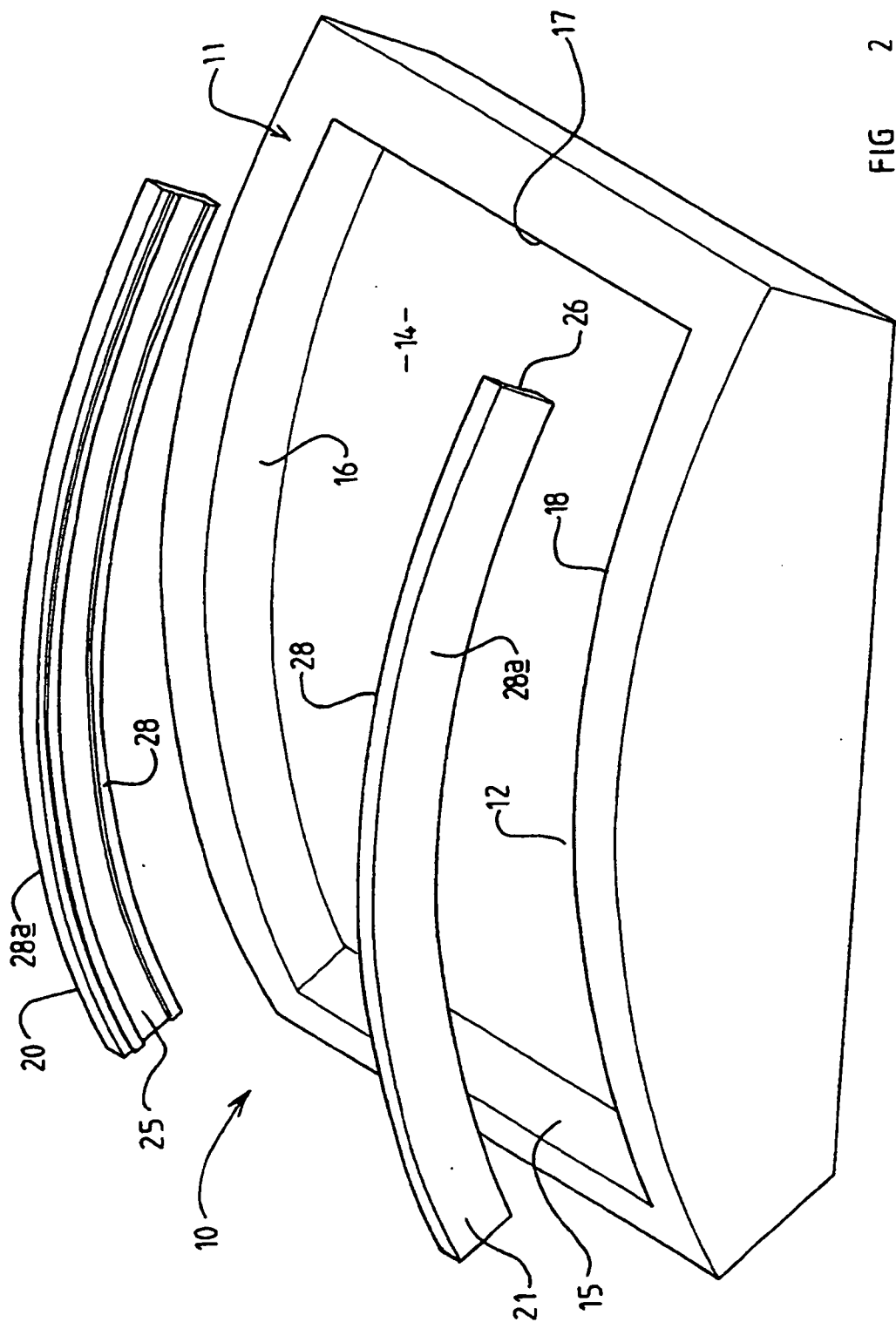


FIG 2

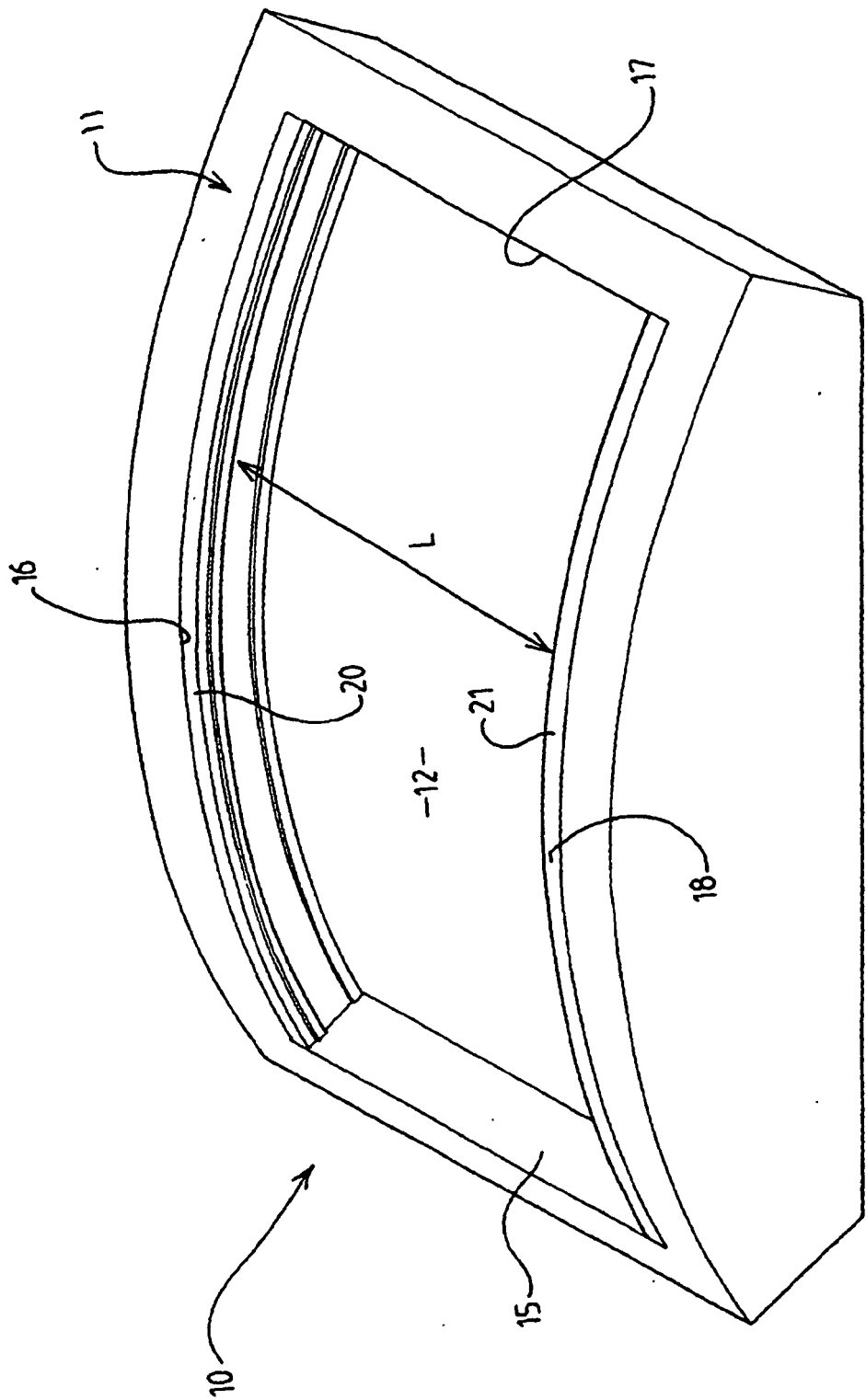


FIG. 3

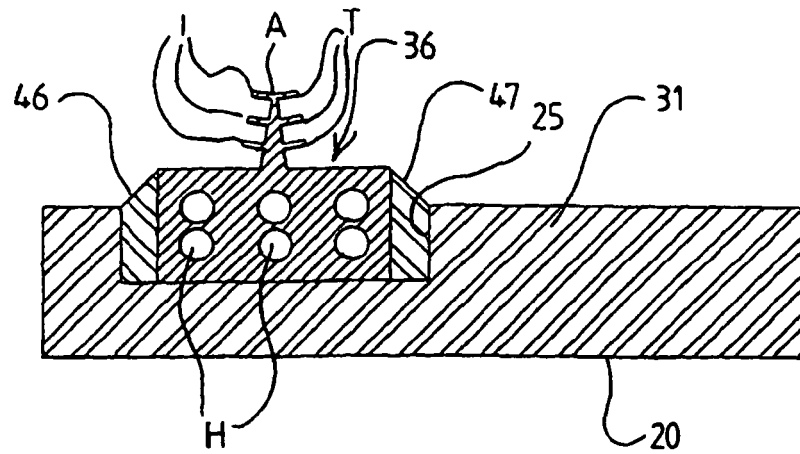


FIG 4a

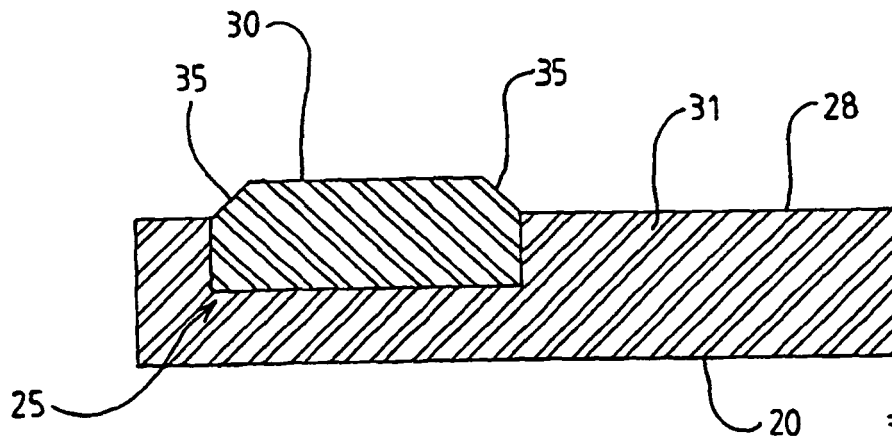


FIG 4b

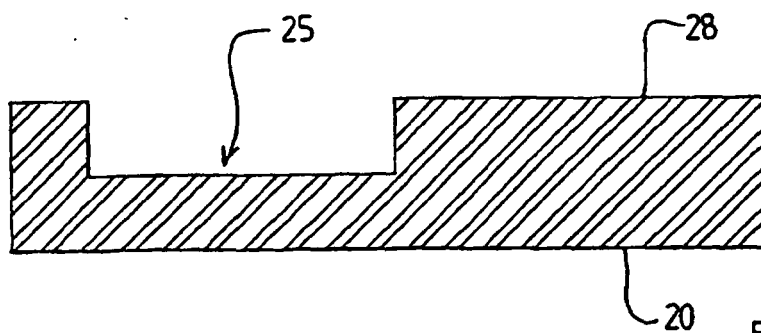


FIG 4c

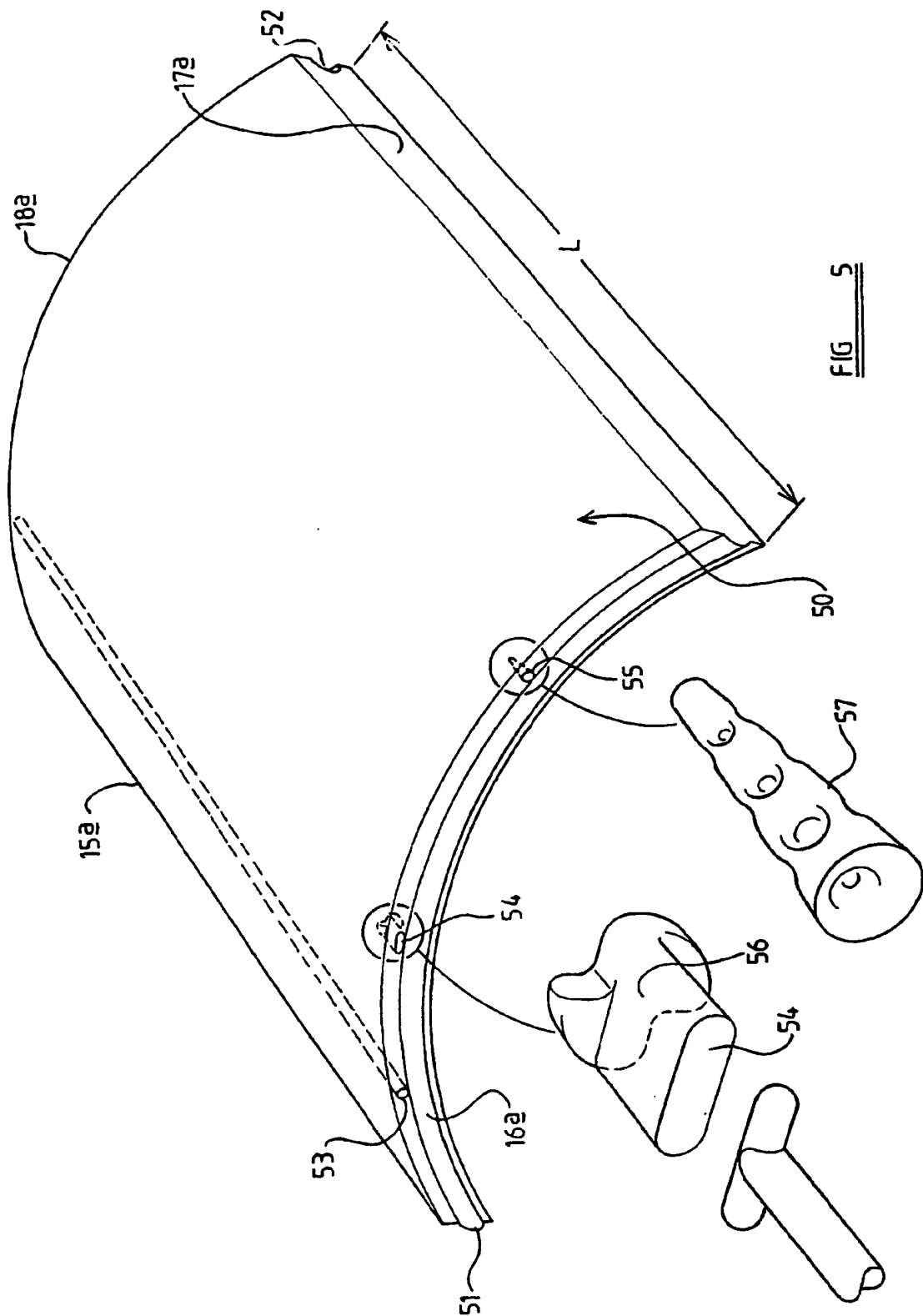


FIG 5