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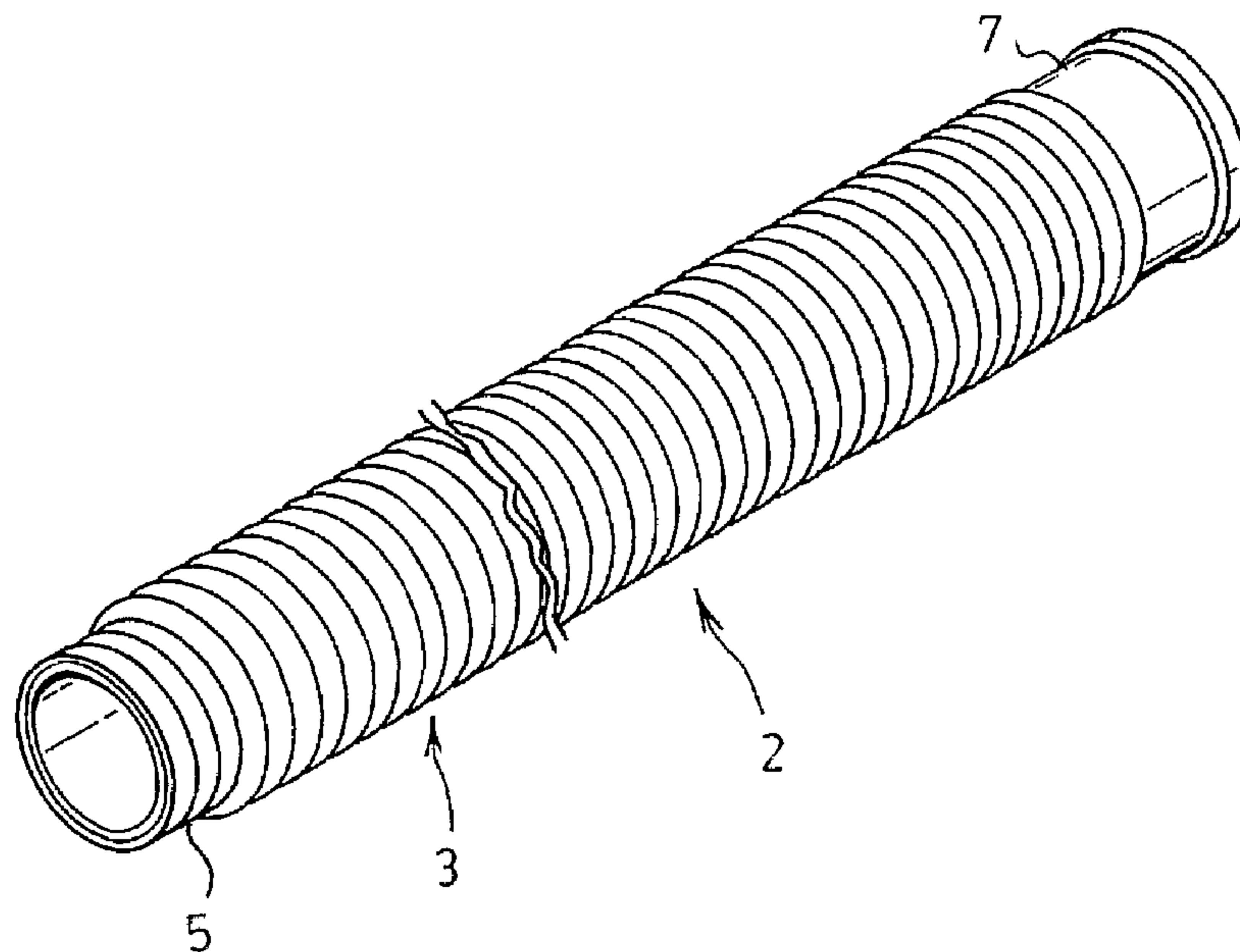
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(54) Titre : APPAREIL DE MOULAGE DOTE D'UN TUNNEL DE MOULAGE A MOUVEMENT ALTERNATIF ET CAPABLE DE PRODUIRE DIFFERENTES FORMES D'ARTICLES
(54) Title: MOLDING APPARATUS WITH RECIPROCATING MOLD TUNNEL CAPABLE OF FORMING DIFFERENT PRODUCTS SHAPES



(57) **Abrégé/Abstract:**

A molding apparatus comprises a moving mold tunnel formed by an upstream (23) and at least one downstream (37, 41) mold block, both of which move back and forth along a mold path. The apparatus further includes an extruder die (22) with at least one plastic flow channel (51, 53) having a channel mouth (52, 54) which feeds plastic to the mold tunnel. The upstream mold block (23) has first (25) and second (31) product shaping regions with the first product shaping region (25) being positioned to receive the plastic from the mouth (52) of the plastic flow channel (51) with the second plastic region (31) remaining upstream away from the mouth (52) of the plastic flow channel (51) in a first molding stage of the apparatus. In a second molding stage of the apparatus, both the first (25) and the second (31) product shaping regions of the upstream mold block (23) are positioned to receive the plastic from the mouth (52) of the plastic flow channel (51). The downstream mold block (37) has product shaping regions to accept the product shaped in both the first (25) and the second (31) product shaping regions of the upstream mold block (23).

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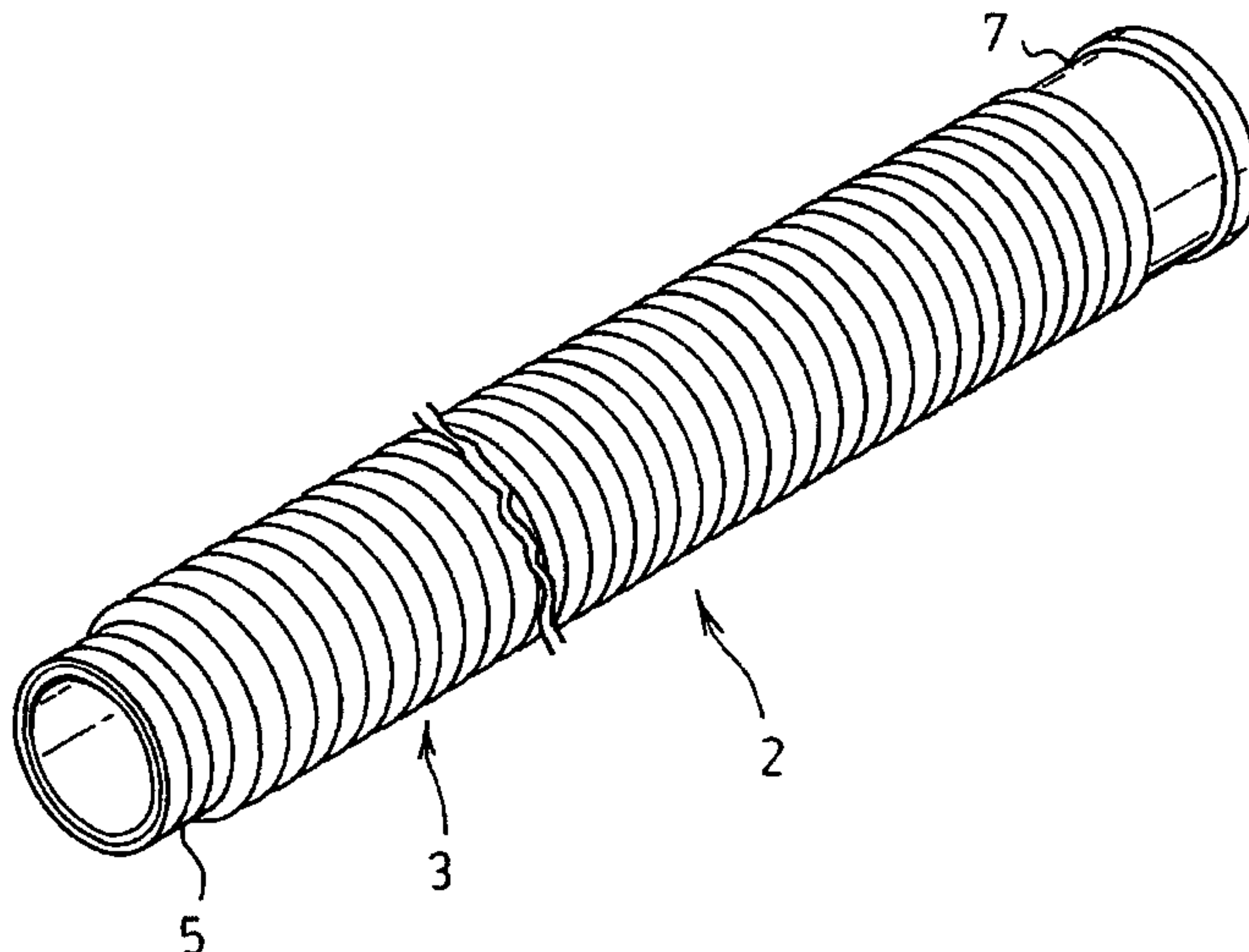
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(57) Abstract: A molding apparatus comprises a moving mold tunnel formed by an upstream (23) and at least one downstream (37, 41) mold block, both of which move back and forth along a mold path. The apparatus further includes an extruder die (22) with at least one plastic flow channel (51, 53) having a channel mouth (52, 54) which feeds plastic to the mold tunnel. The upstream mold block (23) has first (25) and second (31) product shaping regions with the first product shaping region (25) being positioned to receive the plastic from the mouth (52) of the plastic flow channel (51) with the second plastic region (31) remaining upstream away from the mouth (52) of the plastic flow channel (51) in a first molding stage of the apparatus. In a second molding stage of the apparatus, both the first (25) and the second (31) product shaping regions of the upstream mold block (23) are positioned to receive the plastic from the mouth (52) of the plastic flow channel (51). The downstream mold block (37) has product shaping regions to accept the product shaped in both the first (25) and the second (31) product shaping regions of the upstream mold block (23).



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TITLE: MOLDING APPARATUS WITH RECIPROCATING MOLD TUNNEL
CAPABLE OF FORMING DIFFERENT PRODUCTS SHAPES

FIELD OF THE INVENTION

5 The present invention relates to a molding apparatus having a moving mold tunnel formed of a plurality of reciprocating mold blocks which constantly remain along the molding path of the apparatus.

10

BACKGROUND OF THE INVENTION

A number of years ago, Corma Inc. of Toronto, Ontario, Canada, developed and patented a plastic pipe molding apparatus having a moving mold tunnel formed by reciprocating mold blocks. This apparatus is well
15 described in United States Patent 5,744,091.

The above patented apparatus is specifically designed to form a continuous length of pipe having
20 uniform cross section along the length of the pipe. In order to vary the cross section of the pipe, e.g. to add a coupler or the like further pipe handling apparatus are required.

25

SUMMARY OF THE PRESENT INVENTION

The present invention relates to a molding apparatus of the type having a moving mold tunnel formed by reciprocating mold blocks for forming product having
30 regions of varying shapes lengthwise along the product.

More specifically, the molding apparatus of the present invention comprises a moving mold tunnel formed by an upstream and at least one downstream mold block,
35 both of which move back and forth along a mold path. The apparatus further includes an extruder die with at least

one plastic flow channel having a channel mouth which feeds plastic to the mold tunnel. The upstream mold block has first and second product shaping regions with the first product shaping region being positioned to receive the plastic from the mouth of the plastic flow channel and the second plastic region remaining upstream away from the mouth of the plastic flow channel in a first molding stage of the apparatus. In a second molding stage of the apparatus, both the first and second product shaping regions of the upstream mold block are positioned to receive the plastic from the mouth of the plastic flow channel.

The at least one downstream mold block has product shaping regions to accept the product shaped in both the first and second product shaping regions of the upstream mold block.

In accordance with the molding apparatus of the present invention, product e.g. plastic pipe or the like can be formed with extended continuous lengths of the product having a uniform cross section by using only the first product shaping region of the upstream mold block and the at least one downstream mold block. If it is desired to vary the cross sectional shape of the product, the second product shaping region of the upstream mold block is then brought into use in cooperation with both the first product shaping region of the upstream mold block and the at least one downstream mold block.

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BRIEF DESCRIPTION OF THE DRAWINGS

The above as well as other advantages and features of the present invention will be described in greater detail according to the preferred embodiments of the present invention in which;

35

Figure 1 is a perspective view of a pipe section cut from a length of pipe made in a molding apparatus according to a preferred embodiment of the present invention;

5 Figure 2 is a cross sectional view of the pipe section of Figure 1;

 Figure 3 is a cross sectional view showing a continuous length of pipe from which pipe sections are cut according to a preferred embodiment of the present
10 invention;

 Figure 4 is a further sectional view showing a coupled joint made from the continuous length of pipe if Figure 3;

 Figure 5 is a sectional view through a molding
15 apparatus used to form the continuous length of pipe shown in Figure 3;

 Figures 6 through 11 show different stages of operation of the pipe molding apparatus of Figure 5;

 Figure 12 is a sectional view through the molding
20 apparatus also showing product formed in the apparatus;

DETAILED DESCRIPTION ACCORDING TO THE PREFERRED
EMBODIMENTS OF THE PRESENT INVENTION IN WHICH:

25

 Figure 1 shows a pipe sectional generally indicated at 2. This pipe section is made from an extended length of pipe generally indicated at 1 in Figure 3 and to be described later in greater detail.

30

 Returning to Figure 1, pipe section 2 includes a main body portion formed by corrugations 3 having smaller corrugations 5 at one end thereof and a larger belled or coupling member 7 at the other end of the pipe section.

35

 Figure 2 shows that pipe section 1 has a double

wall construction formed by an outer layer 9 from which all of the corrugations and the coupler are shaped and an inner wall 11 lying flat against the troughs of the corrugations in the outer wall.

5

Returning now to Figure 3, it will be seen how the pipe section 2 is formed as part of the pipe length 1. More particularly, this is a continuous length of pipe where, during its formation, the coupler 7 is in fact continuous with the corrugations 5 through pipe wall part 15. In forming pipe section 2 pipe wall 15 is cut away which then allows the coupler 7 at one end of one pipe section to telescopically engage the short corrugations 5 of a separate pipe section as shown in Figure 4 of the drawings. A sealing member 13 fits between the coupler 7 and one of the corrugations 5 to provide a liquid tight seal between the two pipe sections.

Figure 5 of the drawings shows the molding region generally indicated at 21 of an apparatus used to form the extended length of pipe 1 shown in Figure 3. This molding region receives plastic from an extruder which also forms part of the apparatus but which is not shown in Figure 5.

25

Molding region 21 comprises die equipment 22 feeding plastic from the extruder to a moving mold tunnel formed from mold block sections 23, 37 and 41. Mold block section 23 is located upstream relative to the two downstream mold blocks 37 and 41 in the direction of formation of pipe made in the molding apparatus.

The upstream mold block 23 has first and second product shaping regions 25 and 31 respectively. Product shaping region 25 comprises a plurality of tooth-like formations 26 separated by recesses 27. This same tooth

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and recess formation is repeated along much of mold block 37 and again in part of mold block 41. Teeth 26 and recesses 27 are used to form the relatively tall corrugations 3 in the outer wall of the pipe.

5

The second product shaping region of mold block 23 comprises an elongated recess 33 and further recesses 35 separated by tooth 36. Recess 33 is used to form the coupling bell in the outer pipe wall while tooth 36 in combination with recesses 35 is used to form the shorter corrugations 5 in the outer pipe wall.

Die equipment 22 comprises first and second plastic feed channels 51 and 53. Channel 51 terminates with a channel mouth 52 whereas, channel 53 terminates with a channel mouth 54.

The plastic, which is fed along the die equipment through channel 51 and out channel mouth 52, forms the outer pipe wall, while the inner pipe wall is formed by plastic which flows along channel 53 and out channel mouth 54.

As is described in the earlier Corma patent, mold blocks 23, 37 and 41 move together with one another in the downstream direction indicated by arrow A when forming pipe. To release the pipe, the mold block sections open from the closed position of Figure 5 and travel separately from one another in the reverse or upstream direction. The mold blocks never move off of the molding path.

Molding region or tunnel 21 operates in a first and a second stage. The first stage of operation is described having reference to Figures 6 through 8 of the drawings. The second stage of operation is described

having reference to Figures 9 through 11 of the drawings.

Referring specifically to Figures 6 through 8, the plastic fed from the die equipment and specifically from the mouth 52 of channel 51 feeds directly onto the profiled surfaces of each of the mold blocks. In the first stage of operation used to form strictly the taller corrugations 3 on the pipe, the mold block sections will move downstream relative to the die equipment only to the point that the teeth 26 and recesses 27 of the first product shaping region of the upstream mold block are exposed to channel mouth 52. In this first stage of operation, the second product shaping region of the upstream mold block always remains upstream of the plastic flow from the channel mouth. Figure 6 shows mold block 23, 37 and 41 moving downstream relative to die equipment 22 and Figure 7 shows the farthest downstream position reached by the mold blocks in the first molding stage. Once the mold blocks reach the Figure 7 position, they return to the Figure 8 position to continue for the molding of corrugations 3 and the flat inner pipe wall along the main length of the pipe. To the point thus far described, only the corrugated region of the pipe has been formed in the molding operation.

25

In the second stage of operation of the molding apparatus which only occurs intermittently during the formation of the pipe as shown in Figures 9 through 11 all three of the mold blocks will travel sufficiently far in the downstream direction such that the second product shaping region 31 of the upstream mold block 23 is exposed to the plastic flow emanating from mouth 52 of plastic flow channel 51. This is well shown in Figure 10 of the drawings. When the upstream mold block reaches the Figure 10 position, the bell coupling as well as the shorter corrugations 5 are formed in the length of pipe.

35

From here on, the apparatus will return to the first stage of operation until it is once again time to form a further coupling region in the pipe.

5 The two downstream mold blocks 37 and 41 are configured to accept either one of the pipe shapes formed in the upstream mold block. This is best described having reference to Figure 12 of the drawings.

10 More particularly, the first molding stage is used strictly to form the corrugations 3. These corrugations are initially shaped along the profiled surface defined by teeth 26 and recesses 27 in the first product shaping region of the upstream mold block. All of the mold
15 blocks move downstream with one another with the plastic starting to set in the shaping region 25 of mold block 23.

 Mold block 23 will then release the pipe and jump
20 back to its starting position for the formation of further corrugations 3. This then allows the mold block 37 to open and jump upstream against the face of mold block 23. Mold block 37 will then close on the pipe. As soon as this happens, mold block 41 stops its downstream
25 movement, opens to release the pipe and jumps back in the upstream direction against the face of mold block 37 to also close on the pipe. It is to be understood that corrugations 3 which have already been partially set in the pipe wall are accepted by the saw tooth profiles
30 defined by teeth 26 and recesses 27 in each of the mold blocks 37 and 41. In addition, each of these mold blocks has one large cavity defined by recesses 39 and 43 in the two mold blocks. These recesses will again accept the shape of the corrugation. They do not have to define the
35 actual shape of the corrugation because the corrugation shape has already been set at this point.

This same sequence of moving the mold blocks will continue during the corrugation forming stage of operation of the molding apparatus.

5

When it comes time to form the coupling part of the pipe, i.e. bell 7 and smaller corrugations 5, these, as earlier described, are shaped in recesses 33 and the saw tooth pattern defined by tooth 36 and recesses 35 in the second product shaping region of the upstream mold block. The upstream mold block will continue to move in a downstream direction with the other two mold blocks 37 and 41 to a point that the plastic has once again had an opportunity to set such that the plastic will at least hold its own shape. At this point, mold block 23 opens to release the pipe which continues to move downstream with the two mold blocks 37 and 41. Mold block 23 will then jump back up to a position to receive plastic in its first product shaping region to renew the formation of the larger corrugations 3 in the pipe wall. As soon as this happens, mold blocks 37 and 41 will again jump in sequence in the upstream direction and close on the shaped coupling region of the pipe wall. The actual bell portion of the coupling region will fit either the recess defined by recessed regions 39 and 43 cooperating with one another between mold blocks 37 and 41 or the larger recess 45 located strictly in mold block 41. The shorter corrugations 5 are easily accepted within any one of the recesses 27 and again because these shorter corrugations have already set sufficiently to hold their own shape they do not need to actually conform to the shape of these particular recesses.

Figure 12 of the drawings shows how the taller corrugations, the bell shaped coupler and the shorter corrugations fit within any of the recesses of the

various different mold blocks.

It will now be understood from the description above how a reciprocating corrugator, i.e. a moving mold
5 tunnel made from reciprocating mold blocks can, in one stage of operation, form continuous lengths of corrugated pipe and in a second stage of operation add different shapes such as for example a coupler directly to the body of the pipe.

10

Although various preferred embodiments of the present invention have been described in detail, it will be appreciated by those skilled in the art that variations may be made without departing from the spirit
15 of the invention or the scope of the appended claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE
PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

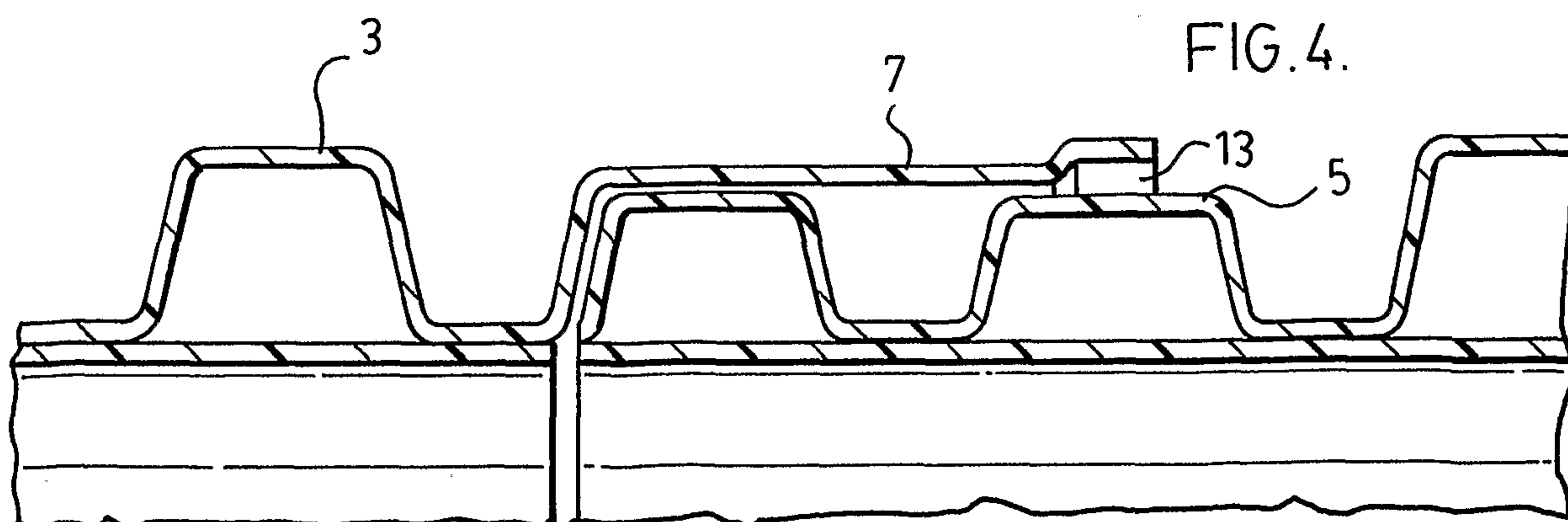
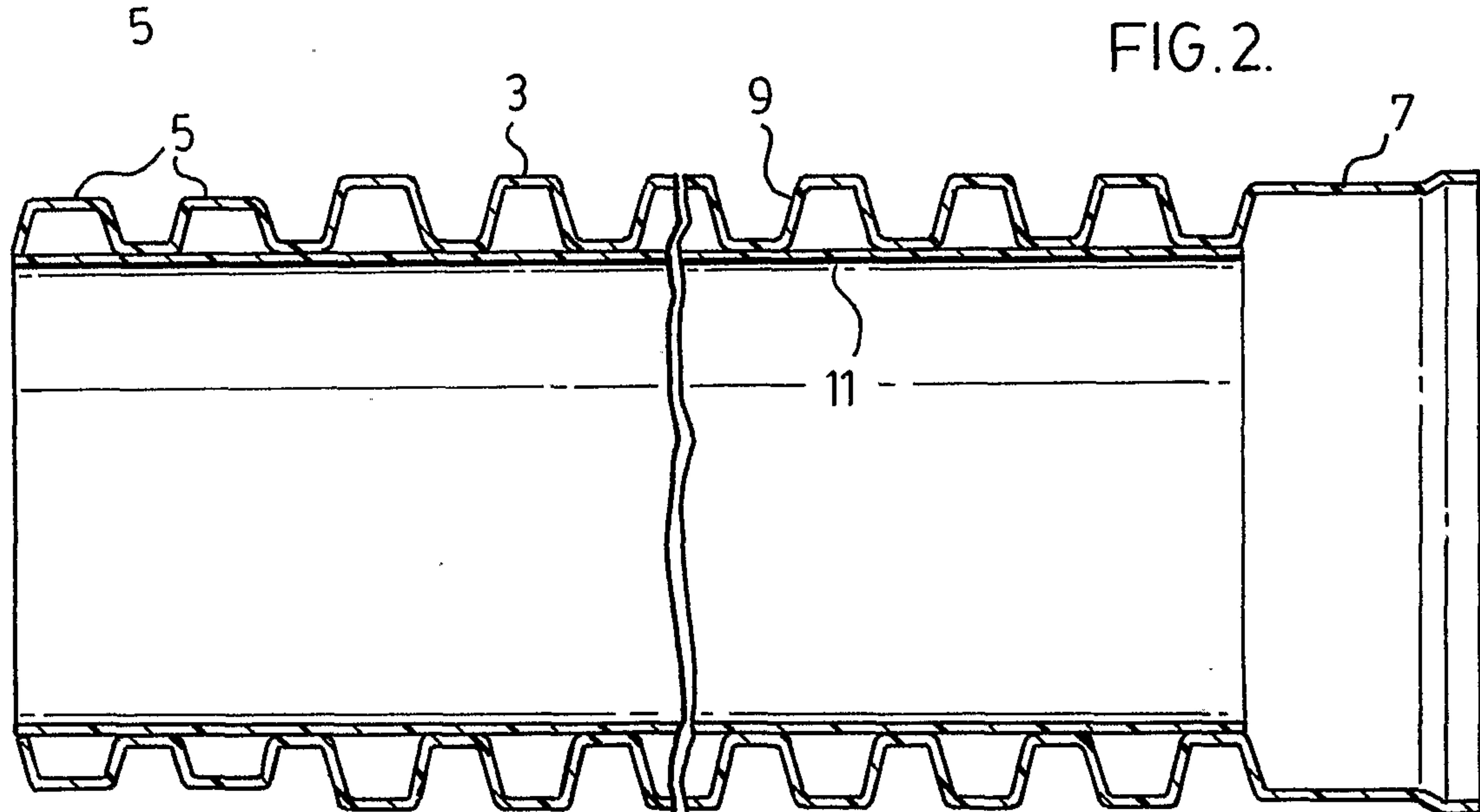
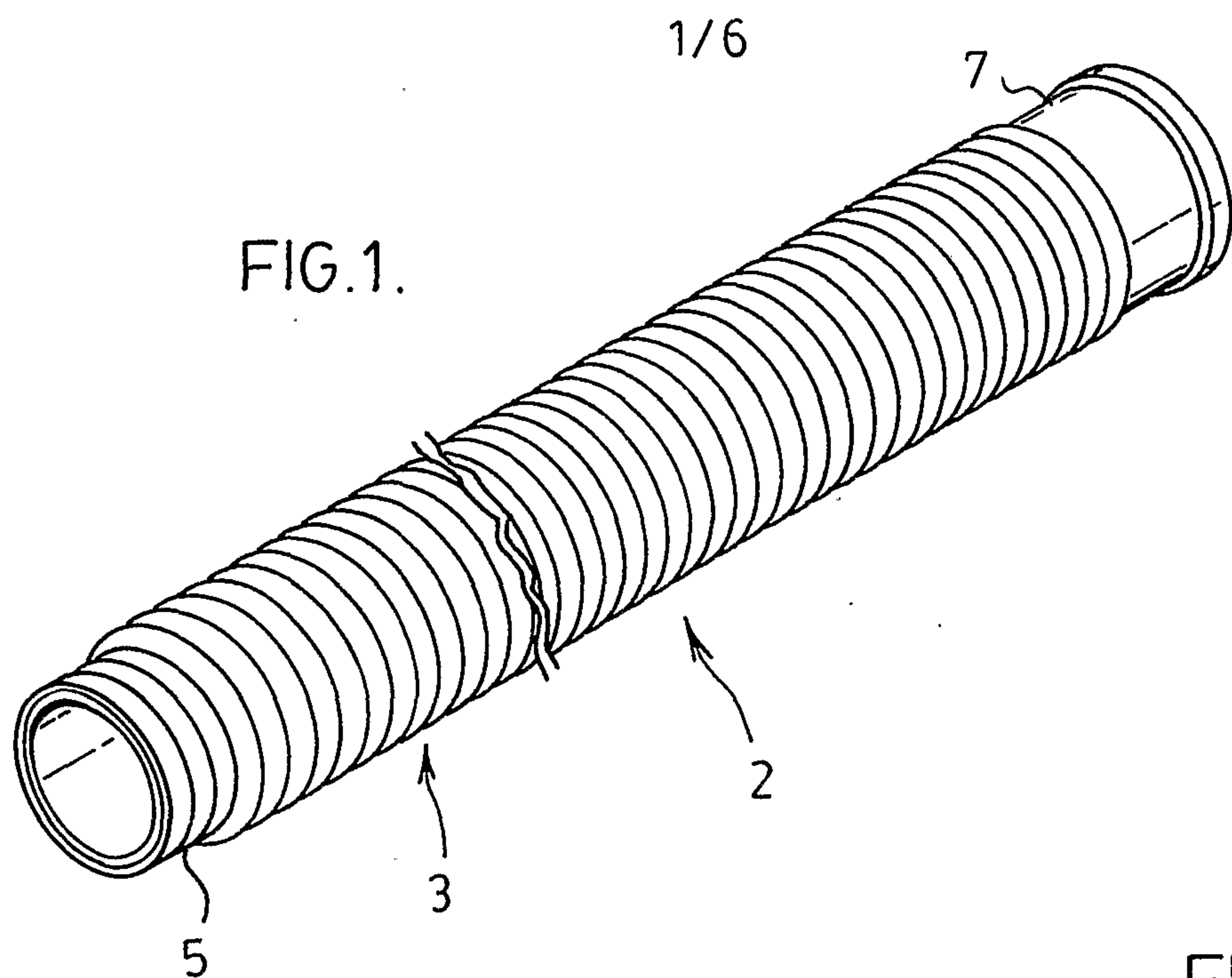
1. A molding apparatus comprising a moving mold
5 tunnel formed by an upstream and at least one downstream
mold block both of which move back and forth along a
mold path, an extruder die with at least one plastic flow
channel having a channel mouth which feeds plastic to the
mold tunnel, said upstream mold block having first and
10 second product shaping regions, the first product shaping
region being positioned to receive the plastic from the
mouth of the plastic flow channel with the second plastic
region remaining upstream thereof in a first molding
stage of said apparatus, and both said first and second
15 product shaping regions of said upstream mold block being
positioned to receive the plastic in a second molding
stage of the apparatus, said at least one downstream mold
block having product shaping regions to accept the
product shaped in both said first and second product
20 shaping regions of said upstream mold block.

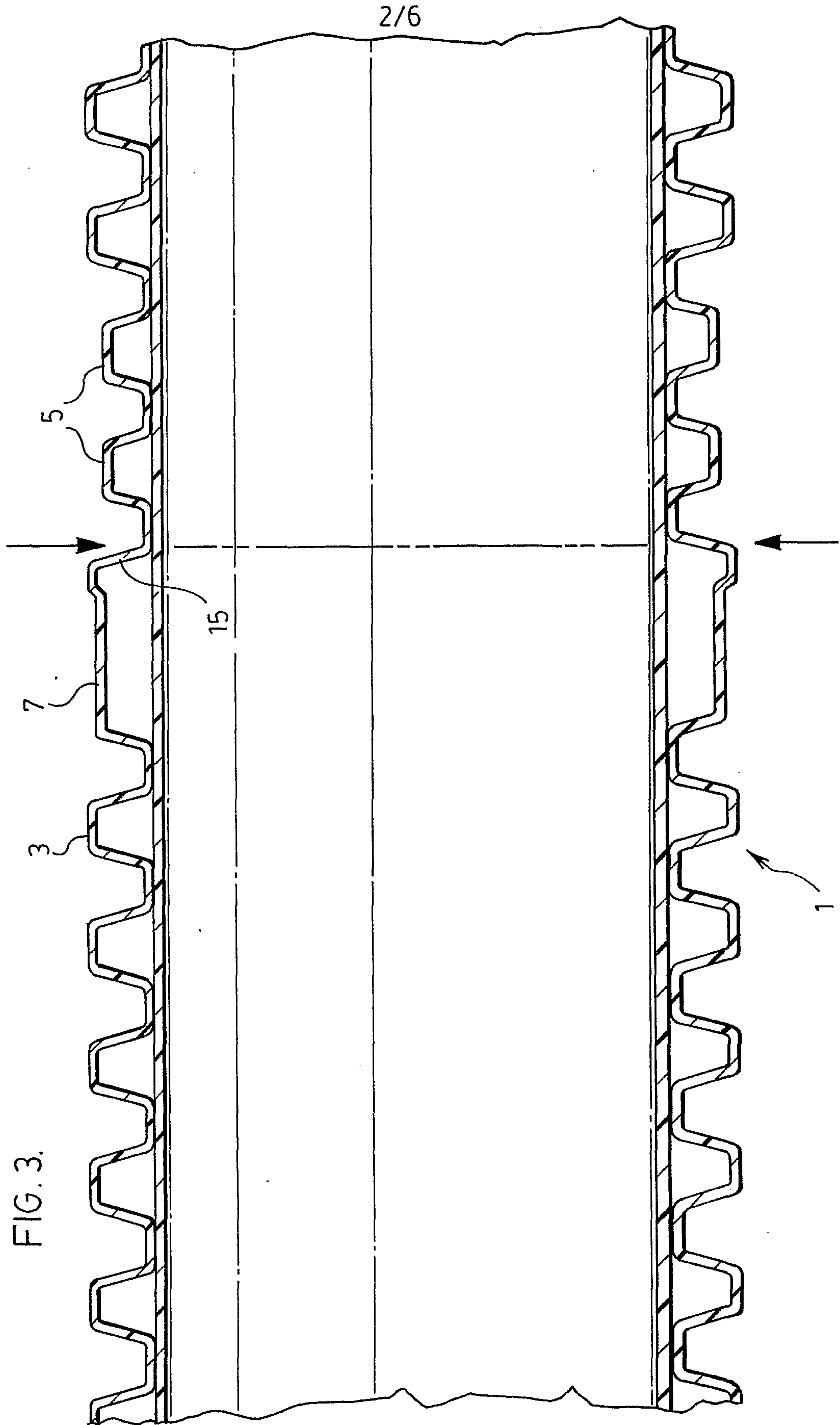
2. A molding apparatus as claimed in Claim 1, wherein
said mold blocks comprise pipe forming mold blocks and
wherein said first product shaping region of said
25 upstream mold block comprise a corrugated region and said
second region comprise a belled region.

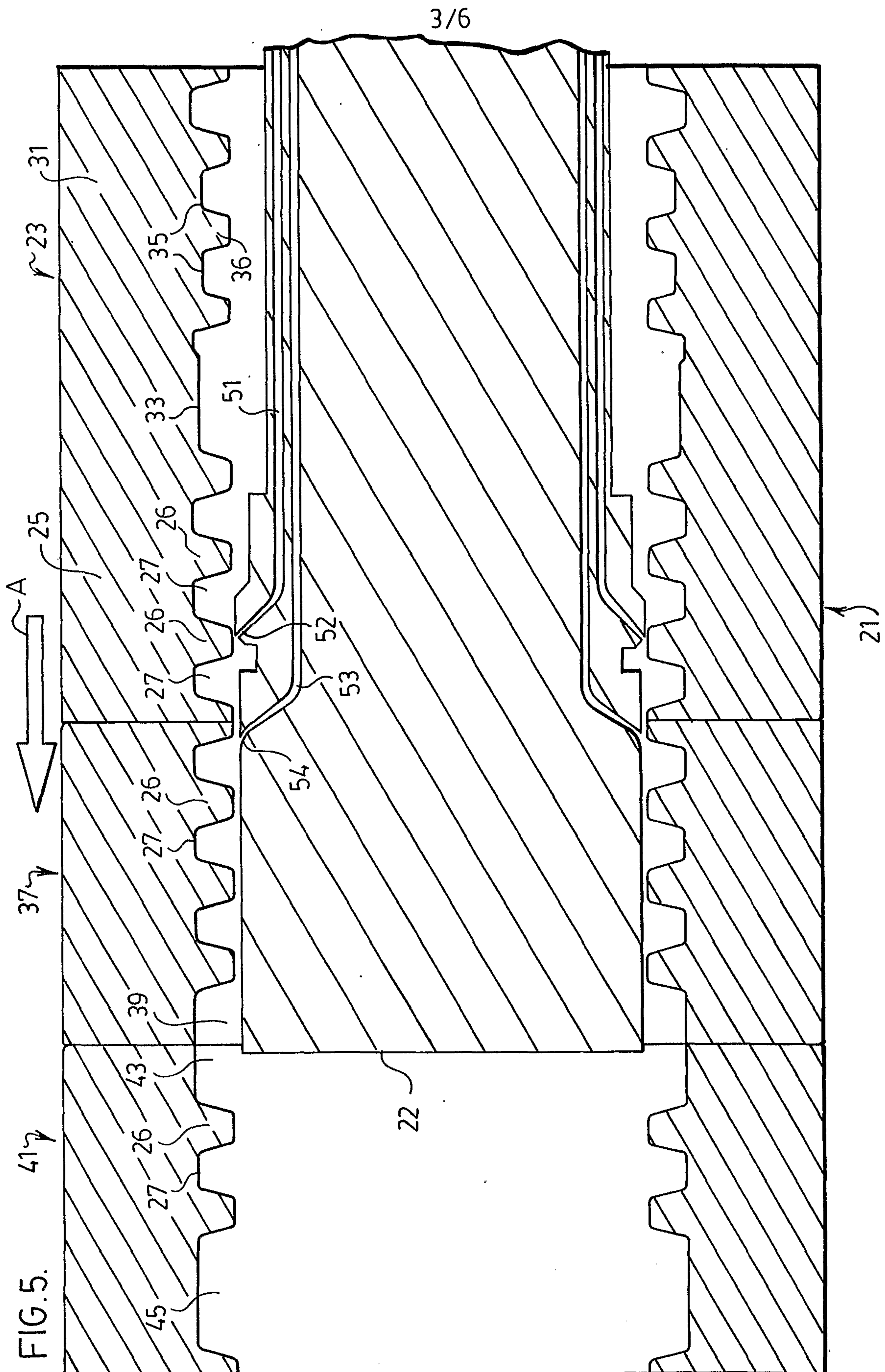
3. A molding apparatus as claimed in Claim 1,
including a plurality of said downstream mold blocks.
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4. A molding apparatus as claimed in Claim 2, wherein
said extruder die includes two plastic flow channels to
form double wall pipe.

5. A molding apparatus as claimed in Claim 3, wherein said upstream mold block is longer than any of said downstream mold blocks.







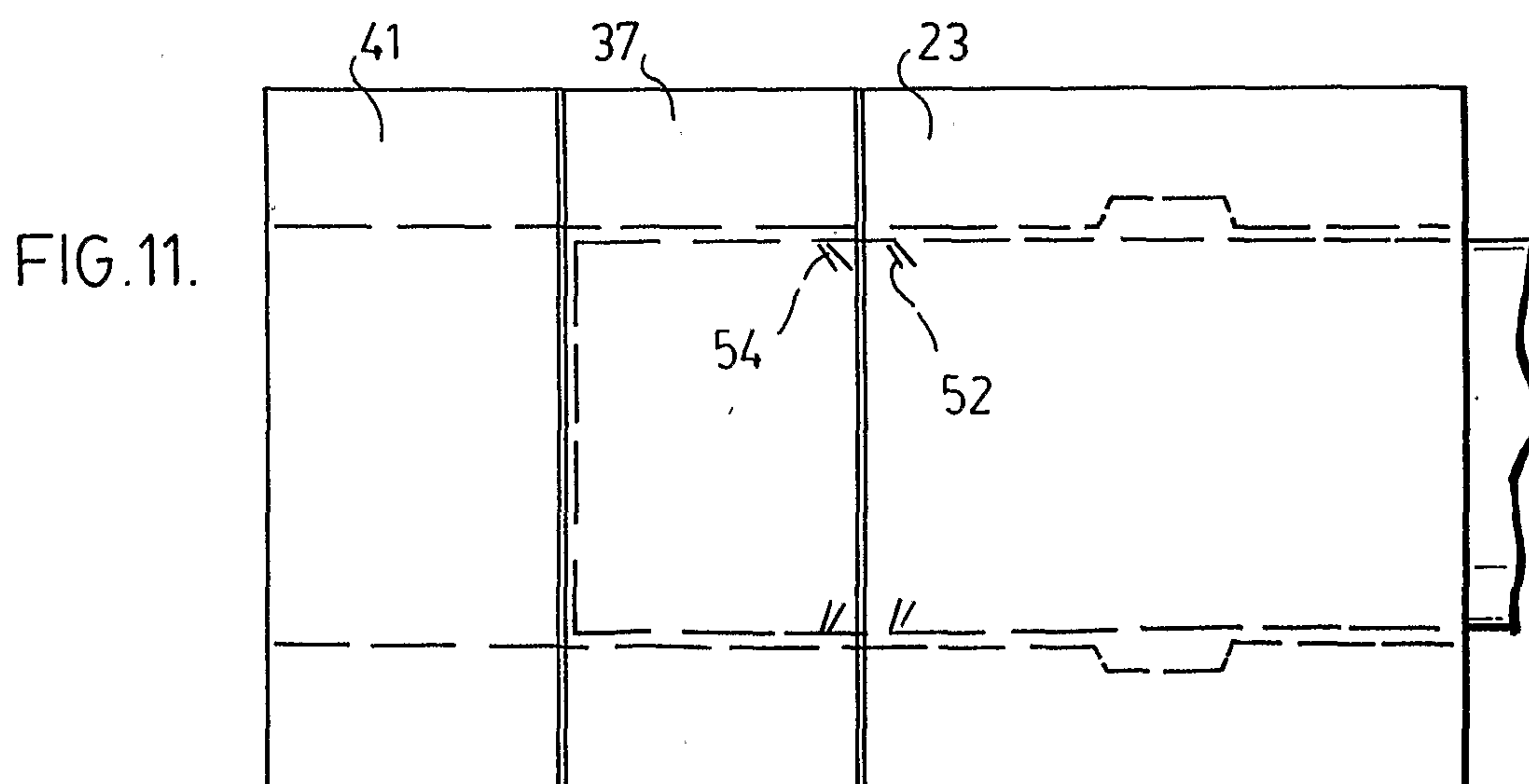
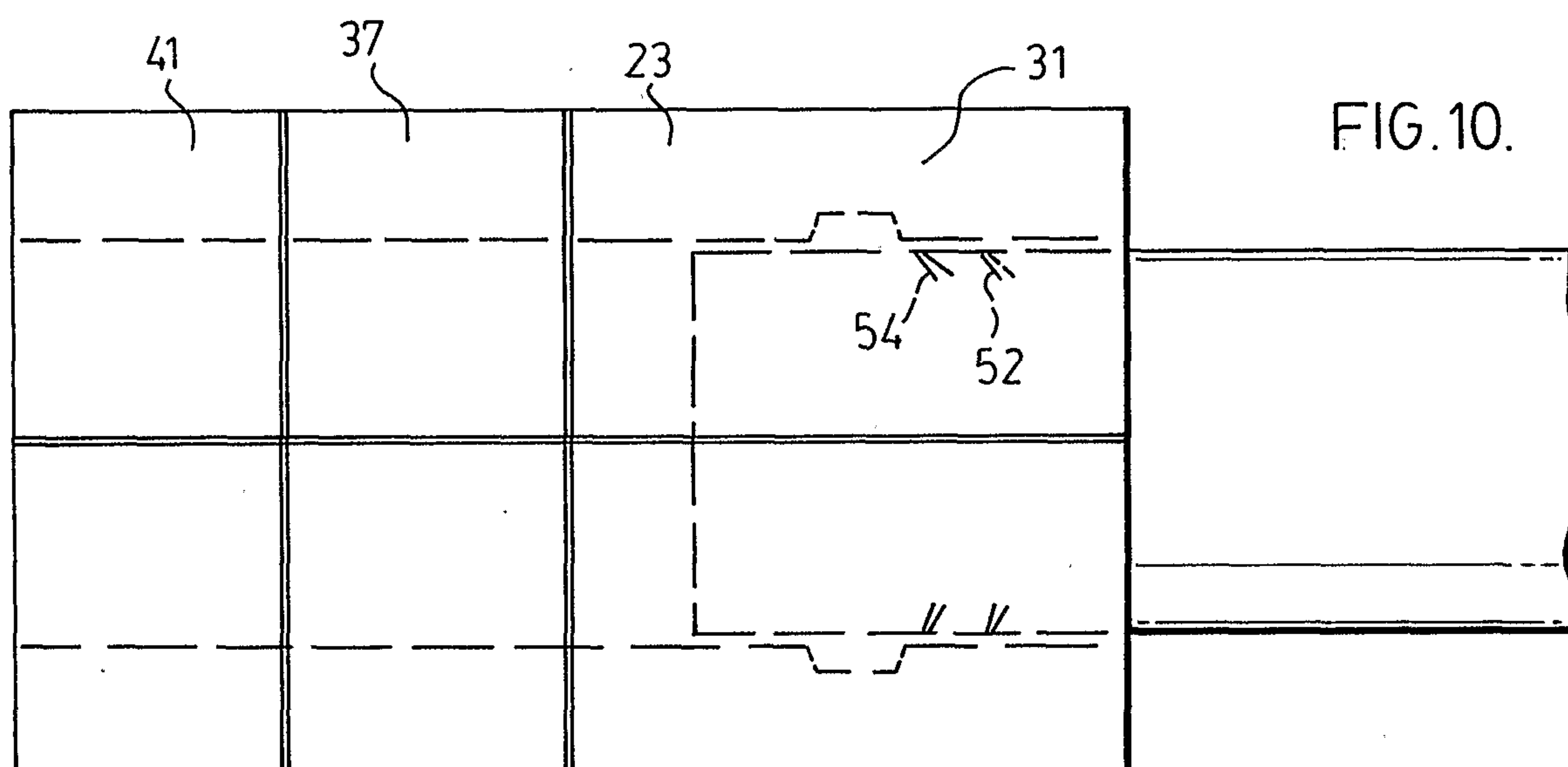
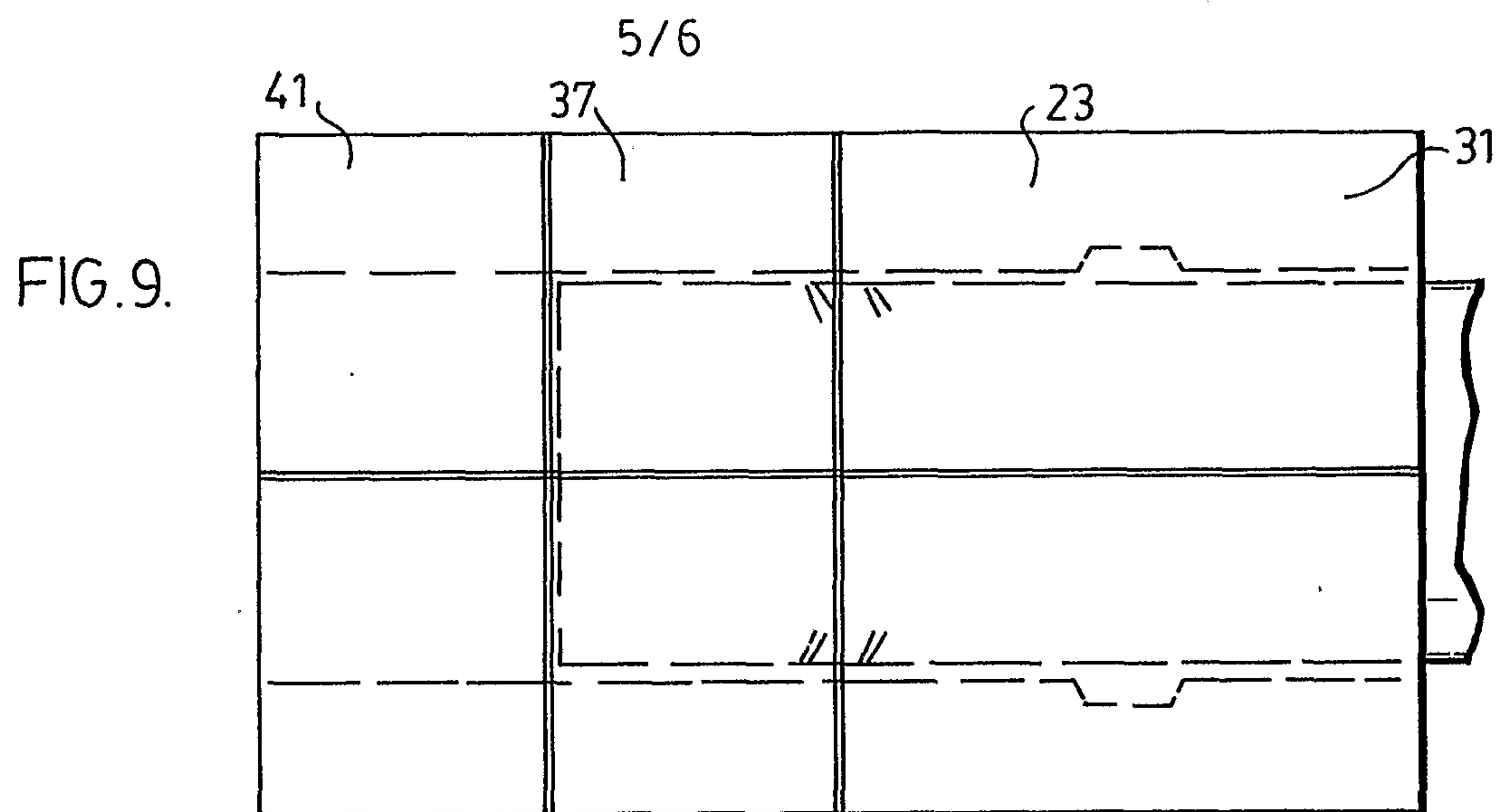
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FIG. 7

41 37 25 23 54 52

FIG. 8.

FIG. 8 is a schematic diagram of a device. It features a central rectangular region 22. This region is bounded by vertical lines 41, 37, and 25, and horizontal lines 23. A dashed line 54 is shown within the region, and a dashed line 52 is shown below it. A horizontal arrow points to the right above the region.



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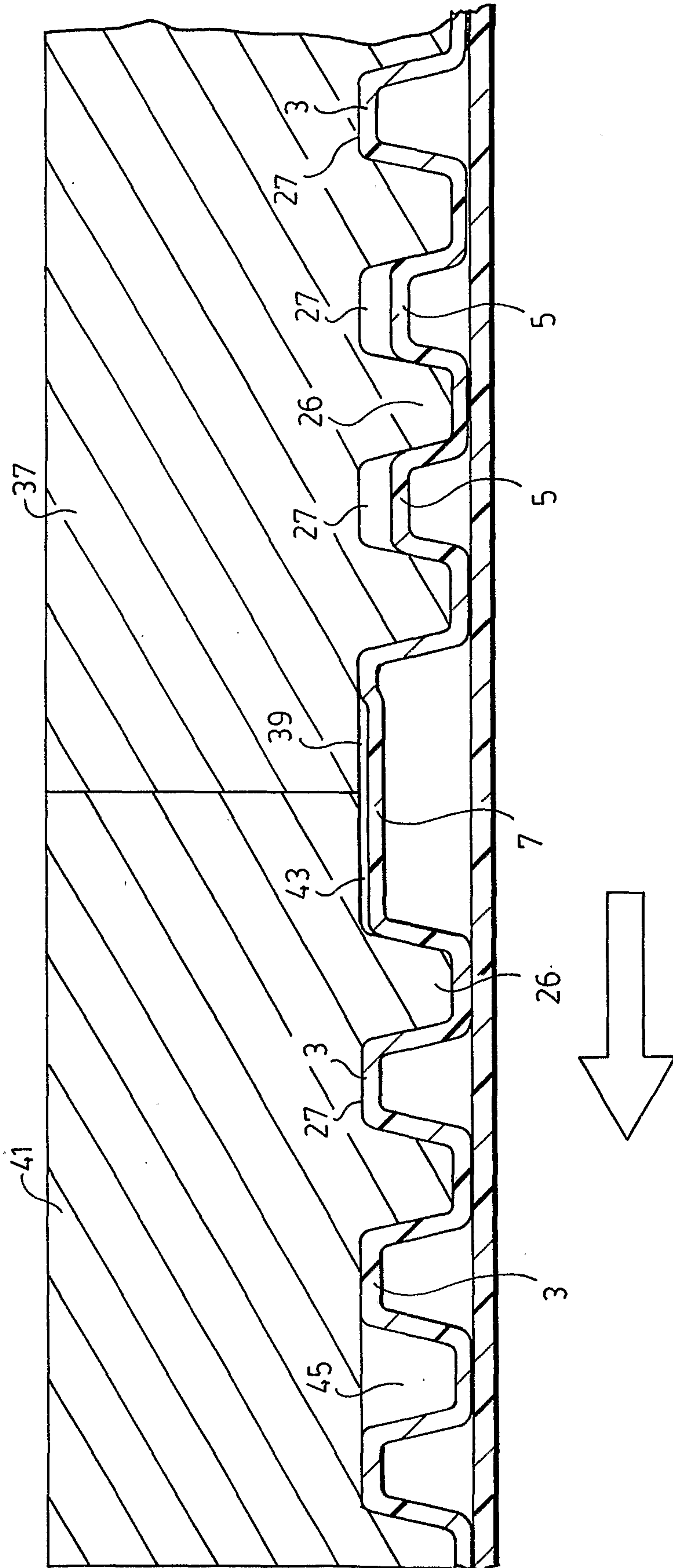


FIG. 12.

