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European Patent Office
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11 Publication number:

0 078 586
A1

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EUROPEAN PATENT APPLICATION

21 Application number: 82201378.5

51 Int. Cl.³: B 28 B 5/04, B 28 B 7/00,
B 28 B 15/00

22 Date of filing: 03.11.82

30 Priority: 04.11.81 NL 8104981

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43 Date of publication of application: 11.05.83
Bulletin 83/19

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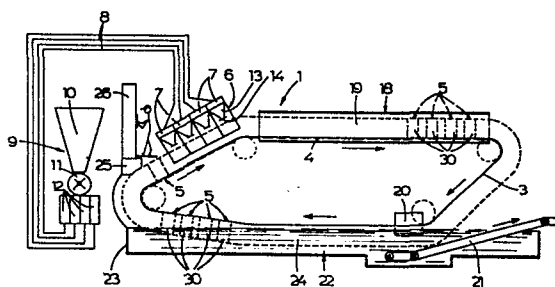
84 Designated Contracting States: AT CH DE LI NL SE

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54 Method and apparatus for producing stone strips or the like.

57 For producing stone strips a plurality of moulds (5) are filled with a concrete mixture for which the moulds (5) are continuously transported in a closed path passing a filling station (6) having supply means (7) for the concrete mixture, in which filling station (6) the moulds (5) are filled with the concrete mixture. Then, the moulds (5) pass through a setting distance (18) and arrive at a release station (20) in which the formed stone strips (2) are released from the moulds (5) after at least partially setting of the concrete mixture. Between the release station (20) and the filling station (6) the moulds (5) are conveyed through a heating distance (22) for heating the moulds (5).

The mould includes two elongated mould parts (27) guided on both sides in slots (29) by means of guiding pins (28), said slots (29) being formed in support plates (30) which can be coupled to the transport means (3) and which extend laterally of the mould parts (27), said mould parts being movable with respect to the support plates (30) between a first position, in which the mould (5) is closed and the mould parts (27) sealingly abut each other with their facing sides and enclose the stone strip form, and a second position in which the mould is opened and the formed stone strip (2) can be released from the mould (5).



Method and apparatus for producing stone strips or the like.

The invention relates to a method for producing stone strips or the like, wherein a plurality of moulds are filled with a concrete mixture and the formed stone strips, after at least partially setting of the concrete mixture, are released
5 from the moulds, and aims to provide an efficient method of this type, by means of which such stone strips can be economically produced in serial production.

To this end, the method according to the invention is characterized in that the moulds are continuously transported
10 along a closed path passing a filling station having supply means for the concrete mixture, in which the moulds are filled with the concrete mixture, after which the moulds pass through a setting distance and arrive at a release station, in which the stone strips are released from the moulds, while the moulds
15 are conveyed through a heating distance for heating the moulds between the release station and filling station.

In this manner it is obtained that the moulds have a relatively high temperature when they are filled with the concrete mixture, whereby the setting process of the concrete mixture can be substantially accelerated, so that the formed stone strips are sufficiently setted after a short time period to be released from the moulds. Thereby, when a quickly setting concrete mixture with a relatively long handling time is used, an economical serial production of the stone strips is nevertheless possible.
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According to the invention, the moulds are heated up to a temperature of at least 50°C. In this manner the formed stone strip can already be released from the mould after 120-420 s when a suitable concrete mixture is used.

30 Further, the invention relates to an apparatus for performing the above-described method, said apparatus according to the invention being characterized in that a transport means is supported in a closed path by a frame, which transport means carries a plurality of moulds disposed at mutually equal
35 spacings, wherein a filling station is mounted at the path of the transport means, having supply means for filling the moulds with the concrete mixture, while a release station is disposed at the path of the transport means, having means for

releasing the moulds, wherein a setting distance lies between the filling station and the release station and a heating distance is provided between the release station and the filling station.

5 According to a simple embodiment of the invention the heating distance is formed by a trough disposed beneath a part of the path of the transport means, said trough containing a heated liquid, in which the moulds are immersed in an open position during the passage through the heating distance.
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 Preferably, the filling station and the release station are mounted on the frame backwardly and forwardly movable longitudinally of the path of the transport means between a starting position and an end position, wherein the filling station and the release station move with the moulds from their starting position at a speed equal to the transport speed of the transport means during filling and releasing the moulds, respectively, while the filling station and the release station return to their starting position after filling and releasing the moulds, respectively.
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 Finally, the invention relates to a mould to be used in combination with the above-described method and apparatus.

 According to the invention the mould is characterized by two elongated mould parts guided on both sides by guiding pins in slots formed in support plates, which can be coupled to the transport means and which extend laterally of the mould parts, said mould parts being movable with respect to the support plates between a first position, in which the mould is closed and the mould parts sealingly abut each other with their facing sides and enclose the stone strip form, and a second position, in which the mould is opened and the formed stone strip can be released from the mould.
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 The invention will be further described with reference to the drawings in which an embodiment of the apparatus according to the invention is shown.
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 Fig. 1 schematically shows an embodiment of the apparatus according to the invention.

 Fig. 2 shows a cross-section of the mould used in the apparatus of fig. 1 in a closed position.

40 Fig. 3 shows a cross-section of the mould of fig. 2,

wherein the mould is partially opened, in which position the mould can be filled.

Fig. 4 shows a cross-section of the mould of fig. 2 in opened position.

Fig. 5 shows a front view of a plurality of stone strips in a manner as they are used in practice.

Fig. 6 shows a cross-section according to the line VI-VI in fig. 5.

Fig. 1 shows very schematically a side view of an apparatus 1 for producing stone strips 2 or the like shown in fig. 5 and 6. The apparatus 1 is provided with a transport means 3 supported in a closed path by a frame 4, which is only schematically shown in the drawing. The transport means 3 carries a plurality of moulds 5 disposed at mutually equal spacings and shown in more detail in fig. 2-4.

A filling station 6 is mounted at the path of the transport means 3, which filling station 6 has four supply means 7 for filling the moulds 5 with a concrete mixture. The concrete mixture is feeded through conduits 8 to the filling station 6 by a mixing-metering unit 9 comprising a dry material mixer 10 and a continuous mixer 11, in which the dry mixture is mixed with water. The wet mixture from the mixer 11 is supplied to four concrete metering pumps 12, to which the conduits 8 are connected. Because the concrete mixture is mixed in two phases and because the amount of concrete in the concrete metering pumps is very small, a quickly setting concrete mixture can be used having a relatively short handling time of 5-10 minutes.

The concrete mixture is continuously feeded to the supply means 7 backwardly and forwardly movable laterally of the transport direction of the moulds 5, which supply means 7 discharge the concrete mixture equally distributed in filling funnels 13 which are closed by means of a valve 14. Besides the concrete mixture, glass fibres are also feeded to the supply means 7, which glass fibres are cutted into pieces and mixed with the concrete mixture, so that a concrete product reinforced with glass fibres is obtained. It is noted that the glass fibres can also be mixed with the concrete mixture in an other way, for example in the mixing-metering unit 9.

The moulds 5 continuously transported by the transport means 3 are filled from the filling funnels 13, wherein

the filling station 6 moves with the moulds 5 from a starting position at a speed equal to the transport speed of the transport means 3. As soon as the filling station 6 leaves its starting position, the filling funnels 13 move downwardly, whereas the moulds 5 are positioned with respect to the filling funnels 13, so that they correctly join the moulds 5. By opening the valves 14 the moulds 5 are filled with the concrete mixture mixed with the glass fibres, wherein the filling funnels 13 are vibrated by means of vibrators in a conventional manner. After filling the moulds 5 and closing the valves 14 the filling funnels 13 move upwardly again, after which the filling station 6 returns to its starting position.

During the filling, the moulds 5 are in a filling position, in which the mould 5 is partially opened as shown in fig. 3. Of course, the open side of the mould 5 is directed upwardly to the filling funnel 13 in this case. In this filling position the mould 5 has a relatively wide entrance opening 15, whereby the mould 5 can be filled in a short time, while further a small excess of the concrete mixture can be discharged in the mould 5. Immediately after filling with the concrete mixture the moulds 5 are brought in the closed position shown in fig. 2, wherein a small amount of the concrete mixture is pressed to the outside at the side 16 of the mould 5. By filling the mould 5 in a partially open position with a small excess in this manner and subsequently gradually closing the mould 5, it is obtained that a complete filling of the mould 5 is guaranteed, wherein substantially no air-bubbles are enclosed.

As shown in fig. 1, the moulds 5 are in an oblique position during the filling, because the path of the transport means 3 contains an angle of for example 30° with the horizontal. In this oblique position the surface of the stone strip form 17 of the mould (see fig. 3) defining the surface of the stone strips 2 directed outwardly during use, is directed downwardly. In this manner it is obtained that substantially no micro pores are formed in this outwardly directed surface of the stone strips 2, whereby the stone strips 2 are resistant to all sorts of weather and a long operational life is guaranteed.

After filling and closing the moulds 5, they pass

through a setting distance 18, at least partially surrounded by a heat insulating tunnel 19. After passing the setting distance 18, the moulds 5 arrive at a release station 20, in which the formed stone strips 2 are released from the moulds 5 by bringing the moulds 5 in the open position shown in fig. 4. To this end, the release station 20 is mounted on the frame 4 backwardly and forwardly movable longitudinally of the path of the transport means 3 between a starting position and an end position also. The release station 20 having means for simultaneously releasing two moulds 5 moves with the moulds 5 from a starting position at a speed equal to the speed of the transport means 3 during releasing. After releasing the stone strips 2 from the moulds 5, the release station 20 returns back to the starting position.

As shown in fig. 1, the release station 20 cooperates with a transport unit 21 which receives the stone strips 2 released by the release station 20 and transports these stone strips 2 to a finishing machine not shown.

A heating distance 22 lies between the release station 20 and the filling station 6, the moulds 5 being heated up to a temperature of at least 50°C during passing said heating distance 22. Preferably, the moulds 5 are heated up to a temperature of about 75°C. At the embodiment shown in the drawings, the heating distance 22 is formed by a trough 23 disposed beneath a part of the path of the transport means 3, which trough 23 contains a heated liquid 24, for example water. During passing the heating distance 22 the moulds 5 are immersed in the liquid 24 in their open position (see fig. 4), whereby they are heated upto the desired temperature of about 75°C.

Between the heating distance 22 and the filling station 6, a station 25 is provided for oiling the moulds 5.

Because the moulds 5 are heated upto about 75°C during passing the heating distance 22, it is obtained that the setting process of the concrete mixture discharged in the moulds 5 by the filling station 6, is substantially accelerated so that the formed stone strips 2 are already sufficiently setted after a short time to be released from the moulds 5. At experiments it appeared that, when a quickly setting concrete mixture with a handling time of about ten minutes is

used, the stone strips are sufficiently setted to be released from the moulds 5 after 120-420 s already. This means that a relatively high transport speed can be applied without the necessity of a very great length of the path of the transport means
5 3 between the filling station 6 and the release station 20 in order to obtain a sufficient setting time. Thereby, an economical serial production of the stone strips 2 is possible.

It is noted that at the described embodiment of the invention 1 four different products can be produced together,
10 wherein, of course, the mutual sequence of the moulds 5 should not change. Of course, it is possible also to provide the filling station 6 with a different plurality of supply means 7 and filling funnels 13, wherein the plurality of concrete metering pumps 12 of the mixing-metering unit 9 can be adapted
15 in a corresponding manner.

The described apparatus 1 is controlled by means of a central controlling unit 26 in a not further described manner, said controlling unit comprising control and check means so that an operator can adjust and check centrally the operation
20 of the apparatus 1.

Fig. 2-4 show a mould 5 in cross-section in three different positions. The mould 5 comprises two elongated mould parts 27 guided on both sides by guiding pins 28 in slots 29. The slots 29 are formed in support plates 30, which extend
25 laterally of the mould parts 27 and can be coupled to the transport means 3 (see fig. 1). The mould parts 27 are movable with respect to the support plates 30 between a first position shown in fig. 2, in which the mould 5 is closed and a second position shown in fig. 4, in which the mould 5 is opened. In the closed
30 position of the mould 5, the mould parts 27 sealingly abut each other with their facing sides and enclose the stone strip form 17. In the open position of the mould 5, the stone strip 2 can be released from the mould 5, as indicated in fig. 4.

The stone strips 2, which can be built up to a wall
35 in a manner shown in fig. 5 and 6, each are provided with four stone strip parts 31 which look like a stone and are separated from each other by a gap 32. The stone strip parts 31 are interconnected by a support 33 integral with the stone strip parts 31. The support 33 comprises an enlargement 34 at its upper side,
40 which enlargement 34 is received in a cavity 35 when building

up a wall, said cavity 35 being formed by means of a protrusion 36. Thereby, a completely closed wall can be built up with the stone strips 2.

In order to be able to readily release the relatively complicatedly formed stone strips 2 from the moulds 5, the mould parts 27 consist of a relatively flexible material resistant to the concrete mixture used, the temperatures involved, the liquid 24 and the oil used. A suitable material is for example a polyurethanelastomer. Rigid elements 37 are included in the material of the mould parts 27 with a mutual spacing, said rigid elements 37 extending in the longitudinal direction of the mould parts 27. The elements 37 may consist of an iron alloy, for example. Each element 37 is guided on both sides by at least one guiding pin 28 in the slots 29. Only the elements 37 lying at the upper side in fig. 2-4, are guided by two guiding pins 28 in the slots 29. Longitudinally extending slots 39 are formed between the rigid elements 37 in the sides 38 of the mould parts 27 facing away from each other. The slots 29 lie precisely at the height of the lower edge of the stone strip parts 31, at the height of the cavity 36 and the protrusion 36 and precisely under the upper edge of the stone strip parts 31, respectively. The slots 29 in the support plates 30, in which the guiding pins 28 are guided, each consist of two rectilinear portions 40 and 41, wherein the first portions 40 are mutually parallel and the second portions 41 joining the first portions 40 diverge with a sharp angle.

By the described predetermined positions of the slots 39 in the mould parts 27 and the intermediate rigid elements 27 it is obtained that at displacing the mould parts 27 with respect to the support plates 30, the stone strip 2 can be released from the mould 5 without any damage. The rigid elements 27 are interconnected by a plurality of strips 42 of an inextensible, flexible material, which strips 42 extend laterally to the longitudinal direction of the mould parts 27. Thereby, the rigid elements 37 can not move laterally with respect to each other so that the stone strip form 17 are completely fixed.

Further, the rigid elements 37 lying at the upper side in fig. 2-4 are coupled with each other by a plurality of mainly cylindrical pins 43 distributed along the longitudinal direction of the mould parts 27, only one of said pins 43 being shown in fig. 2-4. The pin 43 is fixed to the rigid

element 37 of one of the mould parts 27, while a bore 44 is formed in the other mould part 27, in which the pin 43 extends in the closed position of fig. 2. The portion 45 of the pin 43 extending in the bore 44 is partially fittingly received in the bore 44 and tapers subsequently. The mould parts 27 are maintained in the mutual correct position by means of the pins 43.

It is noted that the guiding pins 28 of the mould parts 27 protrude outwardly through the slots 29 in the support plates 30. After leaving the liquid 24 in the trough 23, the moulds 5 can be readily brought in the filling position and subsequently in the closed position by providing guiding rails (not shown) along the path of the transport means 3 cooperating with the protruding parts of the guiding pins 28. As already noted above, the moulds 5 are gradually closed in this manner after filling with a small excess of concrete mixture, whereby the concrete mixture in the stone strip form 17 is pressed in the direction of the side 16 and indeed partially to the outside. Thereby, a complete filling of the mould 5 is guaranteed.

The invention is not restricted to the embodiment described hereinabove, which can be varied within the scope of the invention in a number of ways.

Claims

1. Method for producing stone strips or the like, wherein a plurality of moulds are filled with a concrete mixture and the formed stone strips, after at least partially setting of the concrete mixture, are released from the moulds, 5 characterized in that the moulds are continuously transported along a closed path passing a filling station having supply means for the concrete mixture, in which the moulds are filled with the concrete mixture, after which the moulds pass through a setting distance and arrive at a release station, in which 10 the stone strips are released from the moulds, while the moulds are conveyed through a heating distance for heating the moulds between the release station and filling station.

2. Method according to claim 1, characterized in that the moulds are heated during the passage of the heating dis- 15 tance by means of a liquid.

3. Method according to claim 1 or 2, characterized in that the moulds are heated up to a temperature of at least 50°C.

4. Method according to claim 1, 2 or 3, characterized 20 in that the moulds are conveyed along the filling station in an oblique position in such a manner that the surface of the stone strips facing outwardly during use is directed downwardly.

5. Method according to anyone of the preceding claims, 25 characterized in that the moulds are filled in a partially open position by the filling station with an excess of concrete mixture, wherein the moulds are gradually closed immediately after filling.

6. Method according to anyone of the preceding claims, 30 characterized in that the moulds are oiled in a station lying between the heating distance and the filling station.

7. Apparatus for performing the method of anyone of the preceding claims, characterized in that a transport means is supported in a closed path by a frame, which transport 35 means carries a plurality of moulds disposed at mutually equal spacings, wherein a filling station is mounted at the path of the transport means, having supply means for filling the moulds with the concrete mixture, while a release station is

disposed at the path of the transport means, having means for releasing the moulds, wherein a setting distance lies between the filling station and the release station and a heating distance is provided between the release station and the filling station.

8. Apparatus according to claim 7, characterized in that the heating distance is formed by a trough disposed beneath a part of the path of the transport means, said trough containing a heated liquid, in which the moulds are immersed in an open position during the passage through the heating distance.

9. Apparatus according to claim 8, characterized in that the trough extends upto beneath the release station, wherein a transport unit cooperating with the release station is provided for receiving the released stone strips and transporting the stone strips out of the trough.

10. Apparatus according to claim 7, 8 or 9, characterized in that a station for oiling the moulds is provided between the heating distance and the filling stations.

11. Apparatus according to anyone of the claims 7-10, characterized in that the filling station and the release station are mounted on the frame backwardly and forwardly movable longitudinally of the path of the transport means between a starting position and an end position, wherein the filling station and the release station move with the moulds from their starting position at a speed equal to the transport speed of the transport means during filling and releasing the moulds, respectively, while the filling station and the release station return to their starting position after filling and releasing the moulds, respectively.

12. Apparatus according to claim 11, characterized in that the path of the transport means extends obliquely at least between the start and end positions of the filling station, wherein the moulds are disposed perpendicular to the path of the transport means.

13. Apparatus according to anyone of the claims 7-12, characterized in that a mixing-metering unit is connected to the filling station for continuously supplying the concrete mixture to the filling station, wherein the filling station includes at least one filling funnel for receiving the concrete mixture, which filling funnel can be closed off by a valve.

14. Apparatus according to anyone of the claims 7-13, characterized in that the path of the transport means is surrounded by a heat insulating tunnel along at least a part of the setting distance.

5 15. Mould to be used in combination with the method and apparatus according to anyone of the preceding claims, characterized in that the mould comprises two elongated mould parts guided on both sides by guiding pins in slots formed in support plates, which can be coupled to the transport means
10 and which extend laterally of the mould parts, said mould parts being movable with respect to the support plates between a first position, in which the mould is closed and the mould parts sealingly abut each other with their facing sides and enclose the stone strip form, and a second position, in which the mould
15 is opened and the formed stone strip can be released from the mould.

 16. Mould according to claim 15, characterized in that each of said slots in a support plate consists of two rectilinear portions, wherein the first portions are mutually parallel
20 and the second portions joining the first portions diverge with a sharp angle.

 17. Mould according to claim 16, characterized in that the mould parts consist of a relatively flexible material, wherein longitudinally extending rigid elements are included
25 with mutual spacings in the material of mould parts, while longitudinally extending slots are formed between the rigid elements in the sides of the mould parts facing away from each other, wherein the rigid elements and the slots are disposed at predetermined positions with respect to the stone strips
30 form.

 18. Mould according to claim 17, characterized in that the rigid elements in each mould part are laterally interconnected by a plurality of strips of inextensible, flexible material.

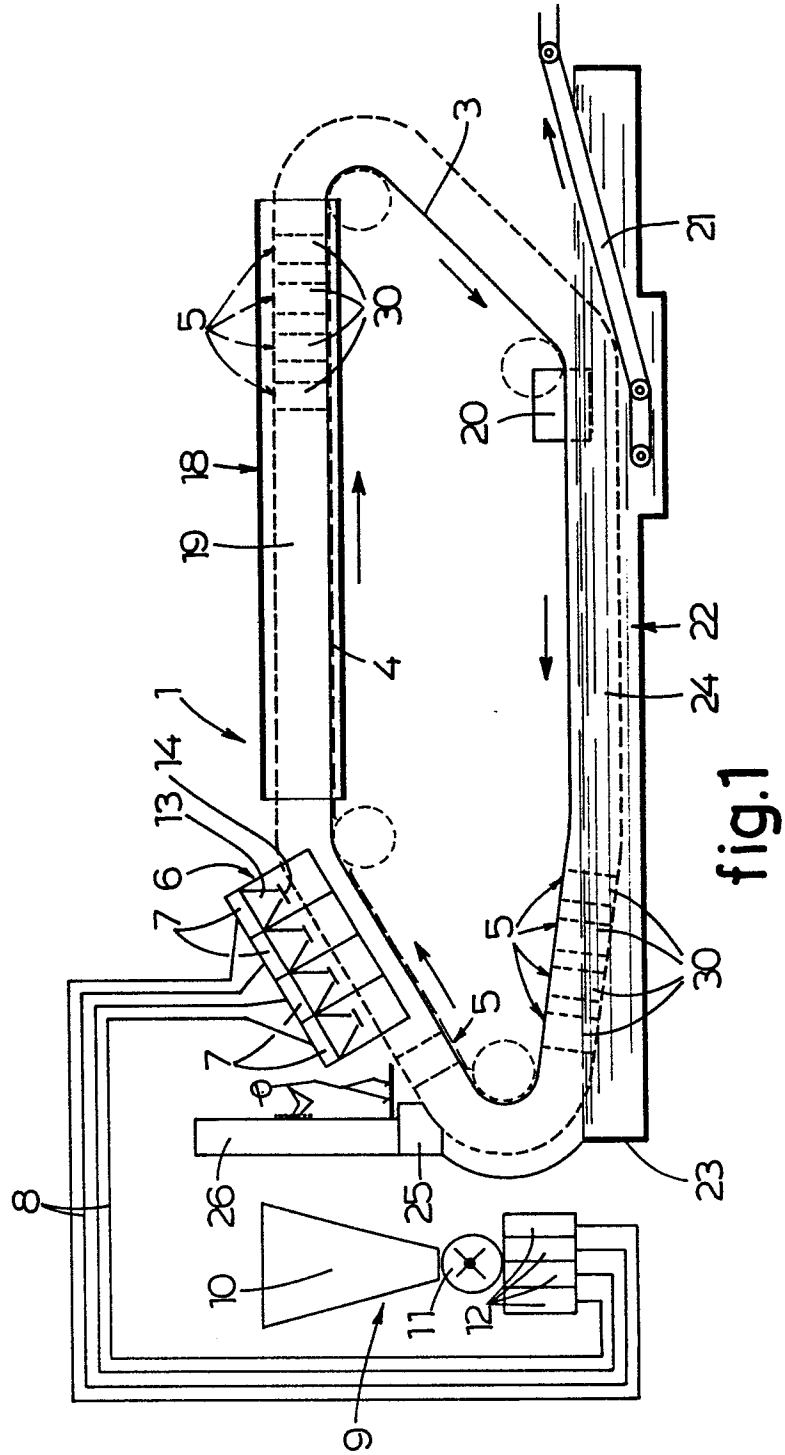
35 19. Mould according to claim 17 or 18, characterized in that each rigid element carries at least one guiding pin on both sides.

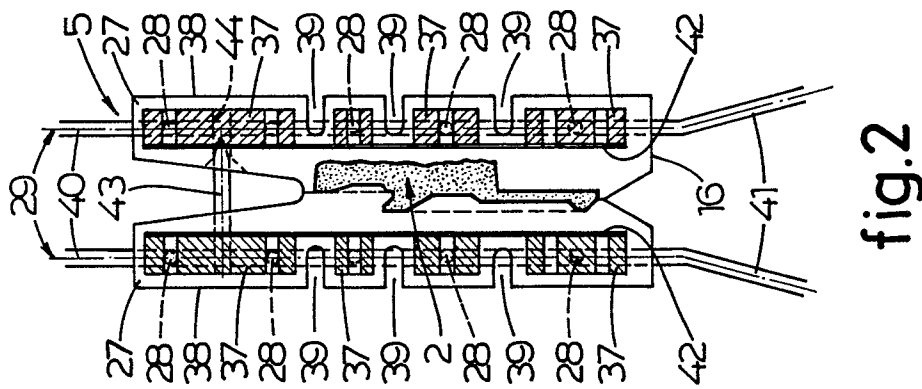
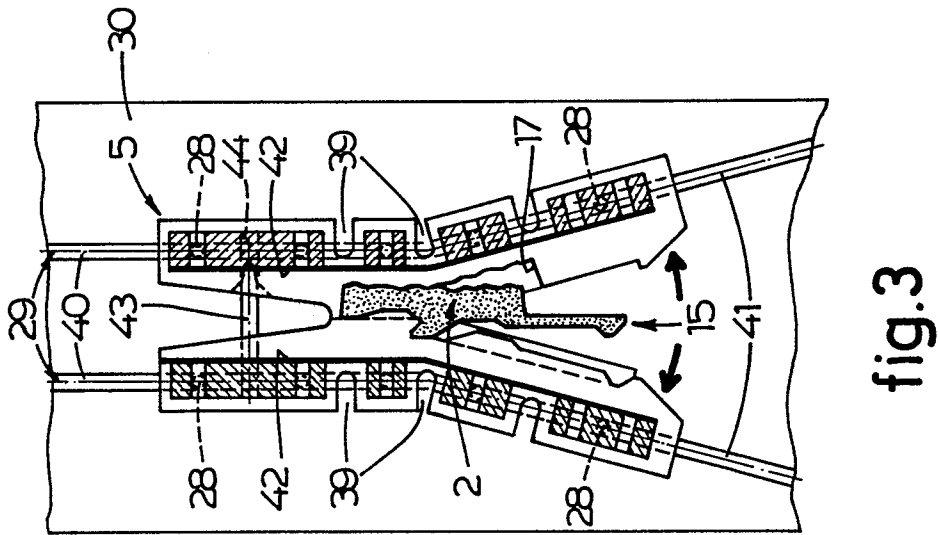
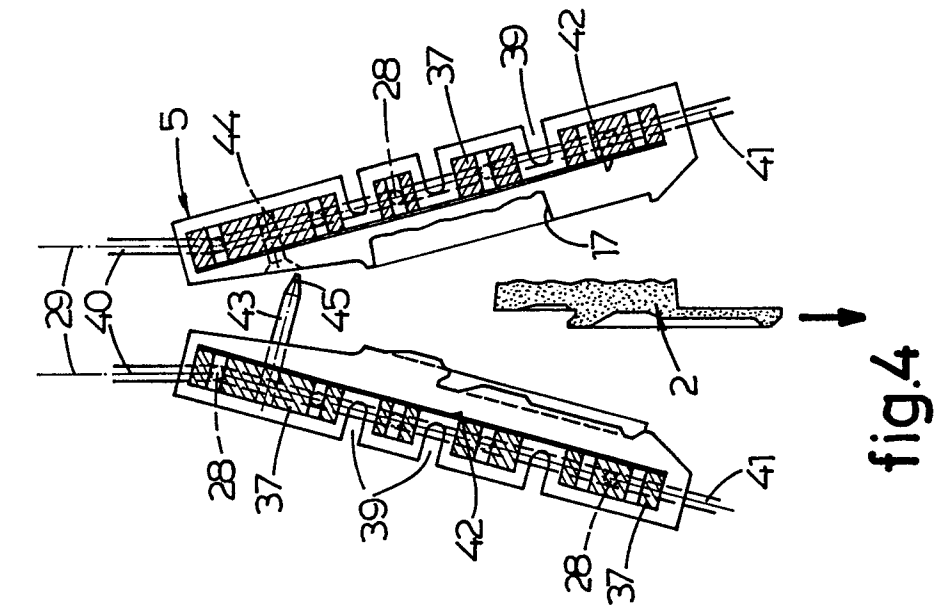
 20. Mould according to claim 17, 18 or 19, characterized in that the rigid elements at the side of the mould parts
40 opposite of the diverging slot portions are coupled with each other by a plurality of mainly cylindrical pins distributed

along the longitudinal direction of the mould parts, which pins are fixed to the respective element in one of the mould parts, while cylindrical bores are formed in the respective element in the other mould part, the pins being partially fit-
5 tingly received in said bores when the mould is in the closed position.

21. Mould according to claim 20, characterized in that the ends of the pins extending in the bores taper.

22. Mould according to anyone of the claims 15-21,
10 characterized in that the guiding pins protrude outwardly with respect of the support plates.





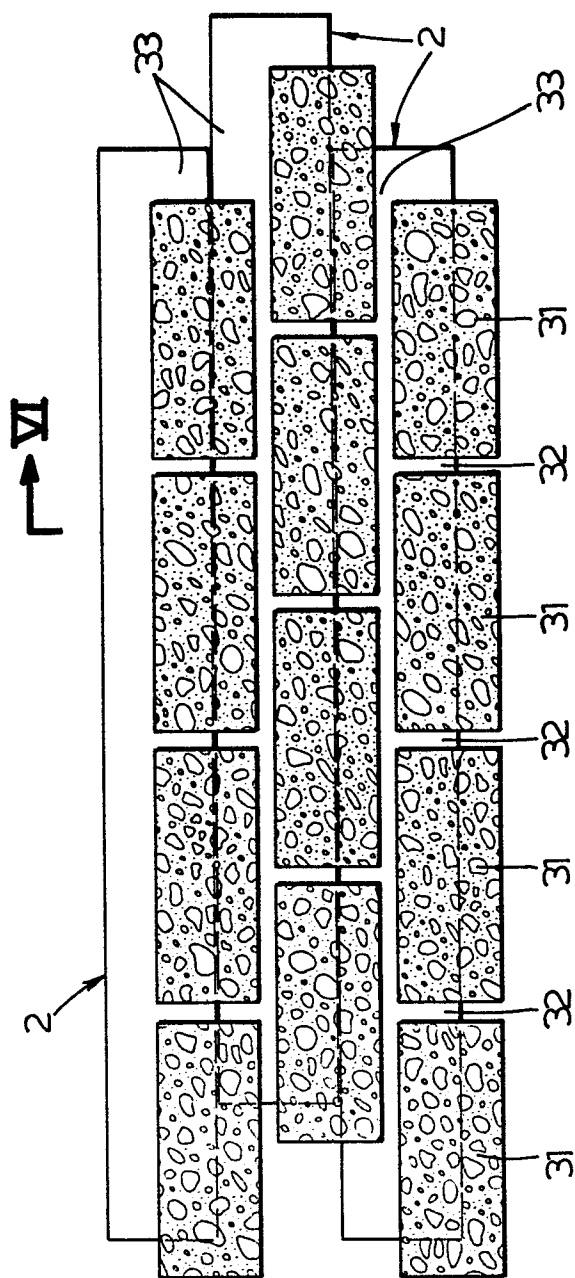


fig. 5

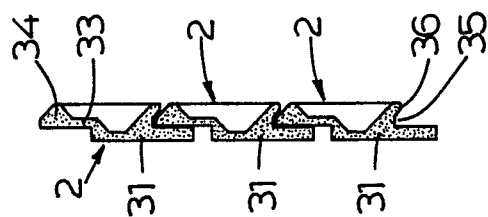


fig. 6

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EUROPEAN SEARCH REPORT

Application number

EP 82 20 1378

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
Y	<p>--- FR-A-1 454 824 (E.HAEUSSLER) *Page 2, right-hand column, line 13 to page 3, left-hand column, line 40; figures 1-5*</p>	1, 7, 15	<p>B 28 B 5/04 B 28 B 7/00 B 28 B 15/00</p>
Y	<p>--- FR-A-2 147 455 (GOUGH AND CY.) *Page 1, line 35 to page 3, line 8; figure 1*</p>	1, 7	
Y	<p>--- US-A-1 453 746 (W.H.CAREY) *The whole document*</p>	1, 7	
Y	<p>--- FR-A-1 428 674 (DURISOL A.G. FÜR LEICHTBAUSTOFFE) *Abstract nr 3*</p> <p>-----</p>	1	
The present search report has been drawn up for all claims			<p>TECHNICAL FIELDS SEARCHED (Int. Cl. 3)</p> <p>B 28 B</p>
Place of search THE HAGUE		Date of completion of the search 08-02-1983	Examiner BOLLEN J.A.G.
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p>		<p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>	