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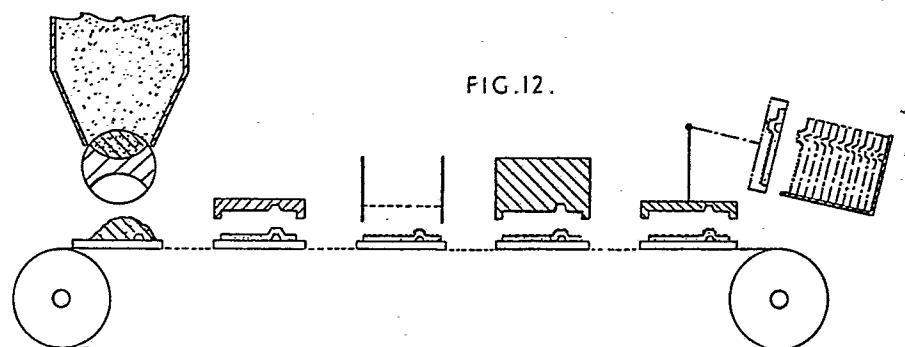
Manufacturing process for concrete roof tiles.

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The need for curing moulds in the manufacture of concrete roof tiles becomes possible in a process which overcomes the problem of handling thin, non-planar, uncured (and necessarily wet) tiles and which comprises the steps of metering concrete mix into a tile mould, applying pressure to the mix in the mould both to form an uncured tile having a thin, non-planar shape which nevertheless permits packing of the tiles to form a substantially solid block of tiles, and also to dewater and deaerate the mix and give an uncured tile containing the water required for hydraulic curing, removing the uncured tile from the mould, and loading the tile into a support frame – the steps being repeated, and the loading being carried out with the repetition of the steps, so as to form a virtually solid block of uncured tiles on the support frame; and curing the tiles or allowing the tiles to cure, while in the form of the solid block.

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1.

Folio: 41895

"Manufacturing Process for Concrete Roof Tiles".

The present invention relates to a process for manufacturing concrete roof tiles.

According to the present invention there is provided a process for manufacturing concrete roof tiles without the use of curing moulds, the process comprising the steps of metering concrete
5 mix into a tile mould, applying pressure to the mix in the mould both to form an uncured tile having a thin, non-planar shape which nevertheless permits packing of the tiles to form a substantially solid block of tiles, and also to dewater and deaerate the mix and
10 give an uncured tile containing the water required for hydraulic curing, removing the uncured tile from the mould, and loading the tile into a support frame; the steps being repeated, and the loading being carried out with the repetition of the steps, so as to form a virtually solid block of uncured tiles on the support frame; and
15 curing the tiles, or allowing the tiles to cure, while in the form of the solid block.

2.

It is by the formation of the solid block of uncured tiles that it becomes possible to dispense with curing moulds and yet process the thin, non-planar, uncured (and necessarily wet) tiles.

5 This invention is particularly directed to improvement upon the processes, already in existence, for manufacturing thin concrete roof tiles. It can totally eliminate the need for curing pallets in the curing or hardening processes.

10 This is achieved by a process of pressure and extraction of air and water, which leaves the fresh tiles already with a minimum of mechanical resistance. The tiles usually have exactly complementary upper and lower surfaces, thus permitting their being stacked face-to-face whilst still fresh, optionally separated by a fine film of paper or other products, to form a solid block of concrete without gaps, which, once enclosed in a support-case or frame of the same shape
15 as the outside part of the concrete blocks, permit that this can withstand the following transportation and curing processes without the tiles within suffering any damage. Once the protecting support-case has been removed, the tiles remain in a block during all the following stages of stacking in the yard and transportation to the
20 building site.

Thus, the principle objective of this invention is the improvement in the existing systems of mass-production of concrete tiles.

25 At the present, concrete roof tiles are manufactured by tile making machines using pressure or extrusion and the fresh concrete mass is left on individual moulds or pallets, usually of aluminium, where it remains until after hardening, to be later

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de-palleted and packed. Given the great speed and the great volume of production, it is necessary to store the fresh tiles during the curing process in racks, which are usually mobile, and to transport these racks to curing chambers in which they remain a minimum of eight hours. Later the racks are taken from the curing chamber to an unloading station, the moulds and tiles passing finally through a de-palletting station and through a packing station. A diagram illustrates this conventional tile making process:-

Figure 1 is a diagram of a conventional tile making process.

In Figure 1,

T - tile making machine from which the fresh tiles come out on their moulds/pallets.

A - fresh tiles are loaded on the racks

B - racks are conveyed to the curing chambers/tunnels (C)

C - curing chambers

D - racks are removed from curing chambers

E - tiles on their moulds are taken off the racks

F - cured tiles are removed from moulds/de-palletted (moulds are returned to 1)

G - cured tiles are packed

P - packed tiles are conveyed to storage yard

This process requires moulds and racks which with the auxiliary equipment, namely automatic systems of rack loading, conveyance systems for the racks, curing chambers, systems for transporting racks of already hardened tiles, de-palletting systems, and systems for packing the tiles, represents a large investment. It also implies large personnel, maintenance and amortization costs.

4.

The proposed invention, object of this patent, seeks essentially to reduce radically these costs, basing itself on the substitution for the above described stages of the previous manufacturing process, of a system of solid block formation and continuous
5 curing chamber; the only auxiliary equipment being the support-cases, as illustrated in Figure 2.

Figure 2 is a diagram of tile making process of the invention.

In Figure 2,

- T - tile machine, out of which comes the fresh tiles
- 10 A - solid blocks are formed in the support-cases
- B - these undergo a short curing process in a continuous curing chamber
- P - cured blocks pass to the storage yard, the empty support-cases returning to phase A to be filled again.

15 To be able to understand better this manufacturing process, an example is illustrated in Figure 3.

Figure 3 is an example of the process of the invention.

In Figure 3,

- 1 and 1' - concrete mixer
- 20 T - conveyor belts of already mixed concrete
- 2 - lineal press of various stages
- 3 - vacuum extractor
- 4 - formation of solid block
- 5 - continuous curing tunnel
- 25 6 - hardened solid blocks ready to go to the storage yard (P)

5.

If the support-cases are non-disposable they return to stage 4.

Figure 4 is an example of a press employed in the present invention.

5 In Figure 4 can be seen a rotating press of 5 stages, in which four tiles are produced in parallel simultaneously.

1 - extraction by vacuum of freshly pressed tile

2 - loading of concrete

3 - pre-pressing process

10 4 - pressure and extraction of water and air

5 - de-framing/de-palletting process by elevation

The results of the formation of the blocks can be seen in the following diagrams, where

15 Figures 5 to 8 illustrate solid blocks formed during the process of the invention.

Figure 5

----- block of concrete roof tiles with small spaces between tiles,
a five-sided support-case in horizontal position.

Figure 6

20 ----- support-case made of sheets of rubber which are compressing laterally, encasing a solid block of ridge tiles, in a three-sided support-case which is vertical.

6.

Figure 7

----- seen from above, a block of concrete roof tiles with lower horizontal support, side ends closed.

Figure 8

5 ----- horizontal block of tiles with three sides closed.

This invention offers very important advantages over the conventional systems of concrete roof tile production already in existence. These are listed below.

- 10 a Drastic reductions in the cost of auxiliary elements and automatic systems - so much so that the costs of a factory's investment can be reduced to approx. one third.
- b The running of a factory is possible by four people per shift; for the concrete mixer, the tile machine, the block formation and the transportation of the blocks to the storage yard.
- 15 c Reduction of maintenance costs
- d Great versatility in patterns of tiles, curing moulds not being necessary.
- e Possibility of producing coloured tiles in which the colour-through concrete is a superficial layer, or the possibility of
20 producing multi-layer tiles having one or more coloured layers.
- f Possibility of reinforcing the tiles with steel wire netting between various layers of pressed concrete, and thus of

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making tiles of greater length or width.

We believe that this new method has great possibilities and can revolutionize the concrete roof tile industry - an industry established more than fifty years ago, and of which hundreds of
5 factories exist all over the world, with annual productions of approximately 10 million tiles per factory, ie. 300 million pesetas per annum, per factory.

The process has been described here in its purest form. Nevertheless, variations are possible.

10 For instance, the following possibilities exist

- i of there being small spaces between the tiles, as for example in the lateral assemblies of roof tiles, without invalidating the "solid block" concept.
- ii of not placing a separating film between each tile when
15 working with certain concretes
- iii of the separating film having a certain consistency and thickness so as to absorb small differences between one tile and the next.
- iv of the support-case, or of some of its sides, being of paper,
20 plastic, or some other disposable material
- v of not having to use even the curing chamber, stacking the fresh blocks directly in the storage yard.

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The present invention is further illustrated by the following non-limiting example.

In the example reference is made to Figures 9 to 12. Figures 9 to 11 show a tile made by the process of the invention, and Figure 12 illustrates the steps in the process of the invention.

Example

A wet concrete mix was prepared using 1 part by weight of cement, 2 parts by weight of sand (mesh size: on 2 mm, pass 3 mm) and sufficient water to give a plastic consistency. The mix was then metered into 4 lower moulds arranged in side-by-side relationship across a conveyor belt. The 4 moulds formed part of a continuous array of moulds extending the length of the belt. This metering and the subsequent stages are shown illustratively in Figure 12, with each part of Figure 12 showing a stage through which each mould passes on the belt.

With advancement of the conveyor belt, the 4 moulds under consideration left the metering station and reached a pre-forming station, where an upper forming mould was applied to each lower mould to shape the wet concrete mix to give a preformed tile having the shape shown in Figures 9 to 11. In order to allow for subsequent expansion, the preformed tile was slightly undersize.

The moulds were then advanced to a surface treatment station, where a pigmented coating of a semi-dry concrete mix containing fine sand, cement and other additives was applied to the tiles through an overhead sieving device. Thereafter with advancement to a pressing and dewatering station a high pressure of between 50 and 120 kg/cm², usually 80 kg/cm², was applied to

9.

the preformed tiles in the moulds. In this manner air and excess water was expressed from the tiles, and drained off through filter openings provided for this purpose.

5 The belt was then advanced to a demoulding station, where
a vacuum-assisted lifting head with a shape complementary to the
top of the tile served to remove the tiles from the four moulds
and transfer them to a support frame. The support frame
comprised a base and a rear wall at right angles, with the
base being supported such that the top of the rear wall was
10 inclined rearwardly at an angle of about 10° to the vertical.

The process of making the 4 preformed, uncured concrete
tiles took about 6 seconds, and was repeated continuously. As the
tiles were produced they were loaded onto the support frame to
give 4 virtually solid blocks of tiles, each tile resting with a lower
15 edge on the base and leaning at 10° to the vertical against previously
loaded tiles.

When the support frame was full, it was transferred to a
curing chamber and the tiles cured for 2 to 6 h, say 4 h, at about
 50°C and at about saturation humidity. Thereafter the tiles were
20 unloaded from the support frame, moved to the factory yard, left
about a month for curing to complete and were then ready for
transportation as the block. Each cured tile was about 42 cm long,
about 33 cm in breadth, and about 1.2 cm in depth.

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CLAIMS:

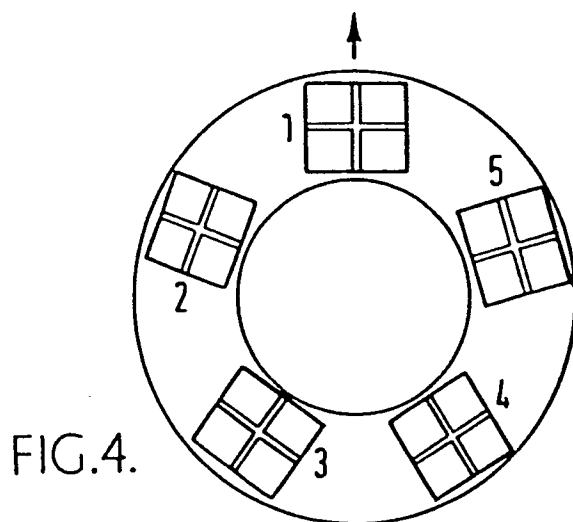
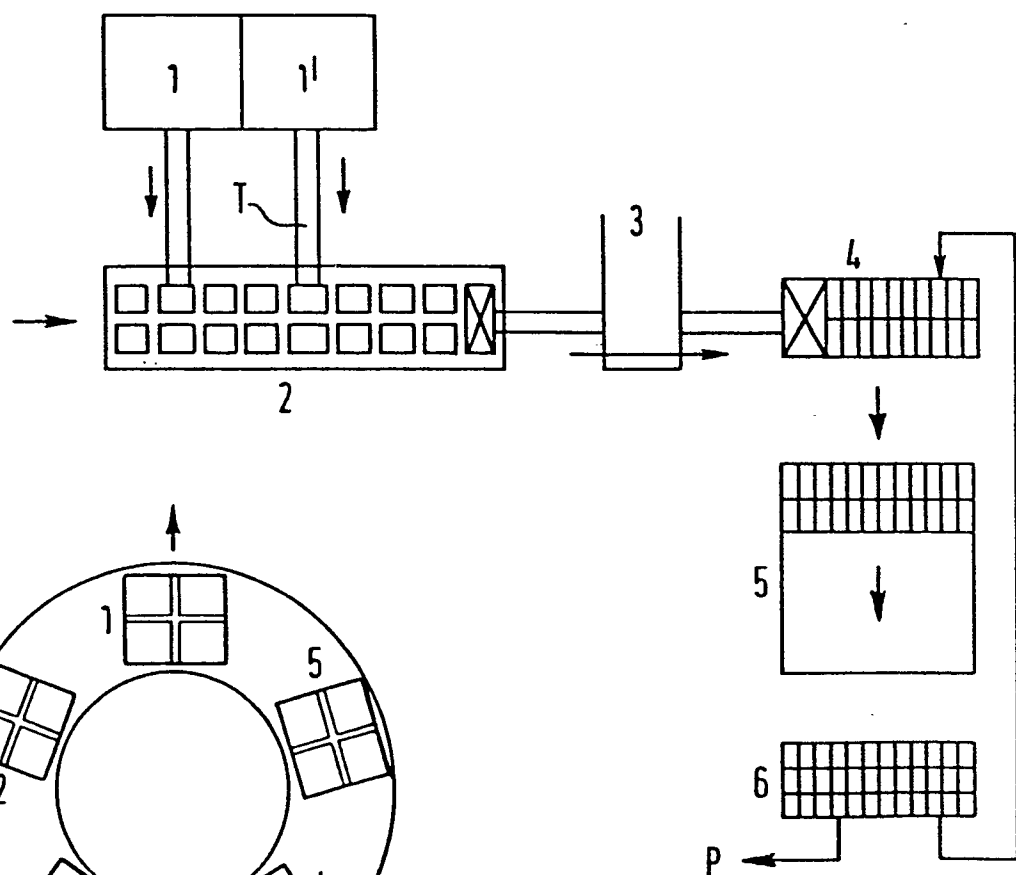
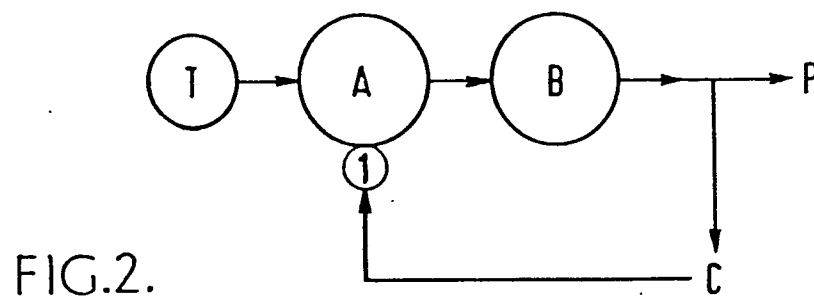
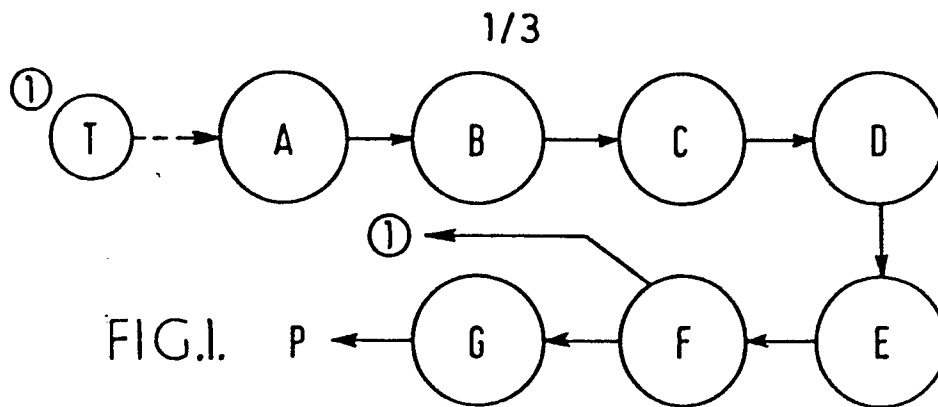
1. A process for manufacturing concrete roof tiles without the use of curing moulds, the process comprising the steps of metering concrete mix into a tile mould, applying pressure to the mix in the mould both to form an uncured tile having a thin, non-planar shape which nevertheless permits packing of the tiles to form a substantially solid block of tiles, and also to dewater and deaerate the mix and give an uncured tile containing the water required for hydraulic curing, removing the uncured tile from the mould, and loading the tile into a support frame; the steps being repeated, and the loading being carried out with the repetition of the steps, so as to form a virtually solid block of uncured tiles on the support frame; and curing the tiles or allowing the tiles to cure, while in the form of the solid block.
2. A process according to claim 1, wherein the tiles have projections on one face which complement recesses on the opposite face to allow formation of the blocks.
3. A process according to claim 1 or 2, wherein the concrete roof tiles have a length and/or breadth which is 20 to 50 times the depth.
4. A process according to any preceding claim, wherein a dewatering pressure of 50 to 120 kg/cm² is applied to the mix.
5. A process according to any preceding claim, wherein a release sheet or release surface is applied to the uncured tiles before or during the loading to give the block.

2.

6. A process according to any preceding claim, wherein the uncured tiles are loaded with each standing generally vertically to form the block.

7. A process according to any preceding claim, wherein the support frame supports two faces of the block.

8. A process according to any preceding claim, wherein after curing the tiles are left as the solid block, ready for transportation from the manufacturing plant.



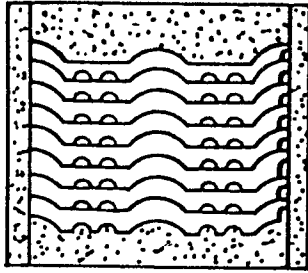


FIG. 5.

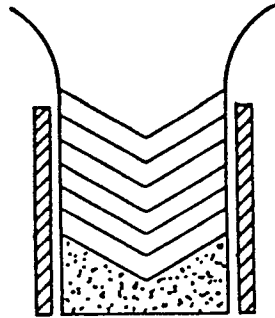


FIG. 6.

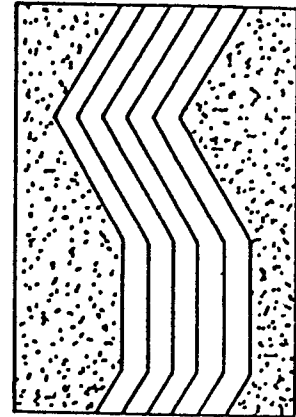


FIG. 7.

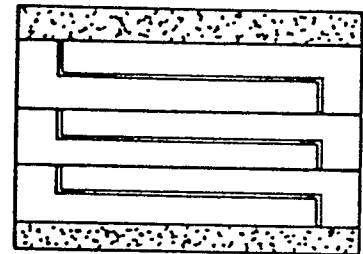
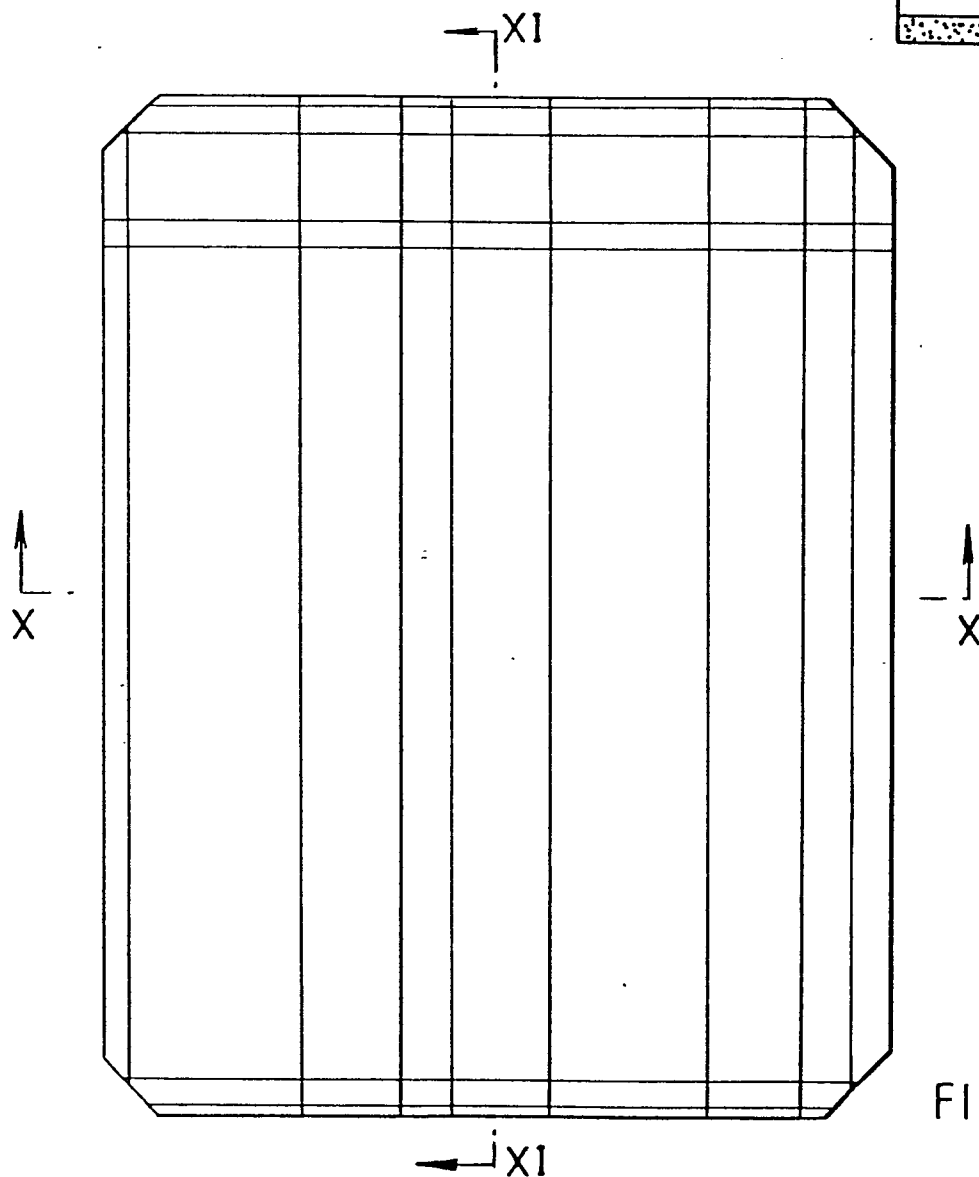


FIG. 8.



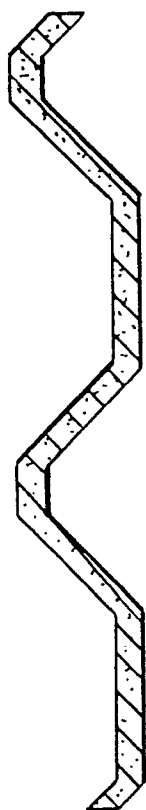


FIG. 10

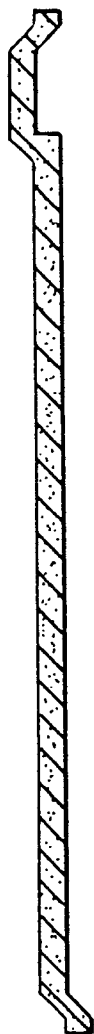


FIG. 11.

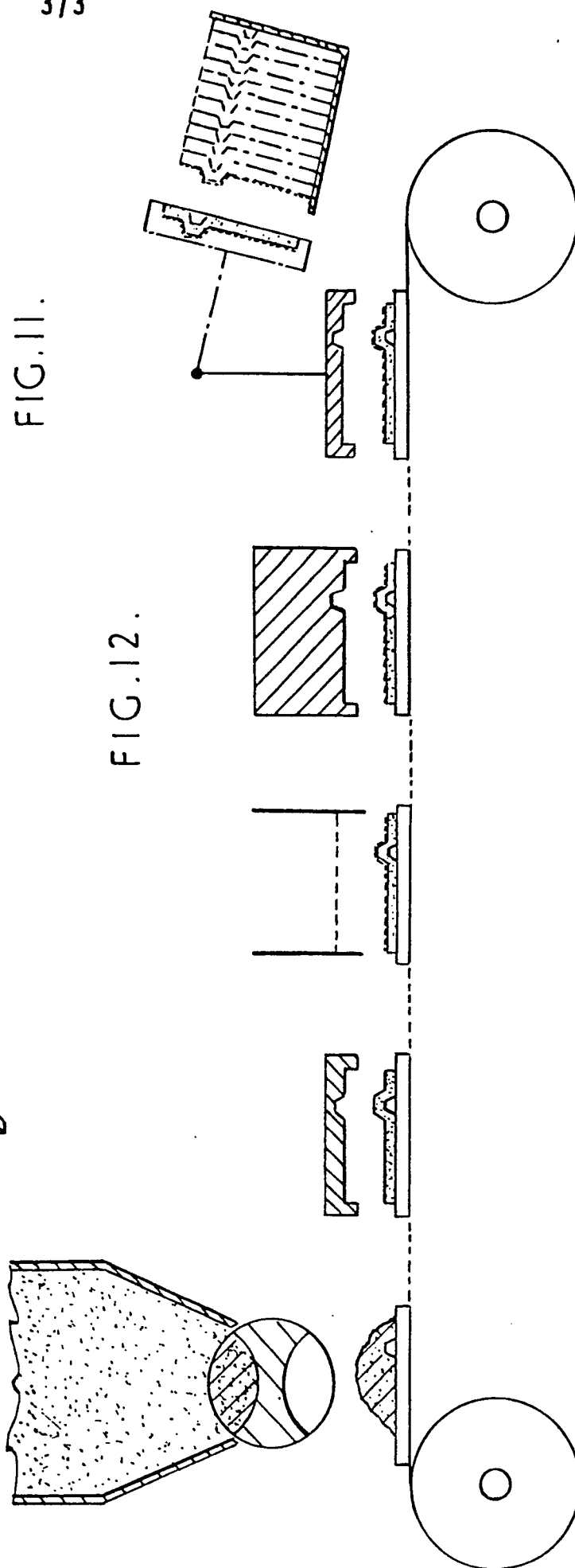


FIG. 12.



European Patent
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EUROPEAN SEARCH REPORT

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Application number
EP 81 30 1068

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. 7)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	<u>DE - C - 806 952</u> (E. BROSS) * the whole document * ---	1,2,5	B 28 B 11/00 B 28 B 13/04
	<u>US - A - 4 158 533</u> (E. LONGINOTTI) * the whole document * ---	1	
A	<u>FR - A - 1 142 846</u> (J. BISCH) * the whole document * ---	1,8	
A	<u>US - A - 2 173 107</u> (R.E. GOULD) * the whole document * ---	1	TECHNICAL FIELDS SEARCHED (Int. Cl. 7)
A	<u>DE - C - 843 466</u> (K. MILDE) * claim 3 * ---	1	B 28 B
A	<u>DE - C - 21 814</u> (F. SCHMIDT) * the whole document * ---	1	
A	<u>US - A - 2 601 105</u> (R.P. DUNMIRE) * the whole document * -----	1	CATEGORY OF CITED DOCUMENTS
			X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
☒ The present search report has been drawn up for all claims			&: member of the same patent family. corresponding document
Place of search The Hague		Date of completion of the search 12-06-1981	Examiner BOLLEN