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(54) Apparatus for making fibre-reinforced cement sheet material.

(57) Apparatus for making fibre-reinforced cement sheet material, particularly such material reinforced with glass fibres, comprises a vessel (10) for holding an aqueous fibre-containing cement slurry and having an outlet defined between a water-pervious belt (12) passing around a guide roller (13) and a superposed roller (17), so that a layer of the cement slurry is deposited on the belt and subsequently de-watered by drainage apparatus (24), the de-watered fibrous cement web being wound on to a roller from which sheets are cut when a sufficient thickness has been built up. An agitator in the vessel (10) comprises parallel strips (30) disposed in vertical planes at right angles to the roller axes and spaced across the width of the outlet immediately upstream thereof, the strips being mounted on a common horizontally reciprocable carriage (33,34). The lower ends (47) of the strips (30) project right into the nip between the belt (12) and superposed roller (17) so as to produce turbulence immediately upstream of the outlet.

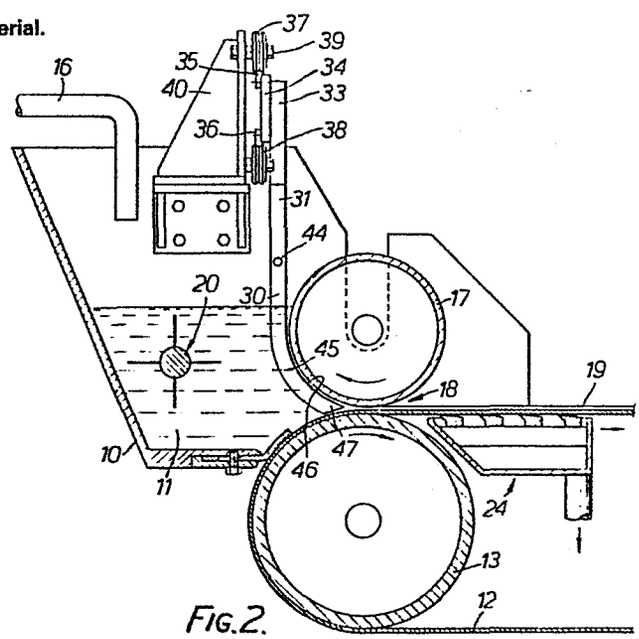

FIG.2.

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APPARATUS FOR MAKING FIBRE-REINFORCED CEMENT SHEET MATERIAL

This invention relates to apparatus for making fibre-reinforced cement sheet material, particularly but not exclusively such material reinforced with glass fibres.

Various types of machines have been developed for making cement sheet materials reinforced with asbestos fibres. The present invention is more particularly concerned with apparatus of the kind comprising a vessel for holding an aqueous fibre-containing cement slurry and an endless water-pervious belt for receiving and de-watering a layer of the slurry and arranged to move around a series of guide rollers, one of said guide rollers cooperating with a superposed parallel roller to define the outlet for the slurry from the vessel on to the belt. Apparatus of this kind is described, for example, in U.K. Patent Application No. 2059867A of Bell Maschinenfabrik AG.

A problem which arises in such machines, particularly when using glass fibres, is the tendency for the fibres to become unevenly distributed and to be aligned predominantly in one direction, the direction of movement of the belt, with the result that the strength of the sheet material produced is lower than it could be with uniform random distribution of the fibres, and in particular is substantially lower in the direction transverse to the direction of movement of the belt than it is in the direction of movement. Various measures, including agitators in the vessel, have been proposed to improve the mixing of the fibres into the cement and to ensure random distribution of the fibres, but none have been wholly successful.

According to the present invention, in apparatus of the kind comprising a vessel for holding an aqueous fibre-containing cement slurry and an endless water-pervious belt for receiving and de-watering a layer of the slurry and arranged to move around a series of guide rollers, one of said guide rollers cooperating with a superposed parallel roller to define the outlet for the slurry from the vessel on to the belt, an

agitator is provided in the vessel, extending into the nip between the superposed roller and the belt where it passes around the guide roller and extending across the width of the nip, so as to cause turbulence in the slurry immediately upstream of the outlet.

The agitator is preferably formed by a series of similar parallel blades disposed in vertical planes and spaced from one another across the width of the nip. Advantageously the blades are disposed in planes parallel to the direction of movement of the belt and are mounted for reciprocating movement parallel to the width of the nip.

The reciprocating movement of the blades produces turbulence in the cement slurry immediately upstream of the outlet and thereby produces improved uniformity of distribution of the fibres in the cement while reducing their tendency to be oriented in one direction.

Conveniently the blades may each have a vertically extending upper portion connected to a common horizontally reciprocable carriage and a curved lower portion which has one edge lying closely adjacent to the superposed roller and which has its lower end extending into the nip between the superposed roller and the belt passing around the guide roller. The carriage may be mounted on rollers above the vessel for its horizontal reciprocating movement, and may be arranged to be driven by a crank and connecting rod from a motor. With such an arrangement, the means for reciprocating the blades are disposed conveniently above the level of the cement slurry in the vessel but the lower ends of the blades provide the necessary turbulence just where it is required, as the cement slurry enters the outlet and is deposited on the belt.

Fibre-reinforced cement sheet material made on apparatus in accordance with the invention has been found to have considerably improved strength properties, particularly as regards the ratio of strength in the longitudinal direction to that in the transverse direction, due to

the more uniform distribution of the fibres and the reduced orientation of the fibres in the cement. This is particularly noted in sheet materials using glass fibres as reinforcement.

A specific embodiment of the invention will now be described in more detail by way of example and with reference to the accompanying drawings, in which:

FIGURE 1 is a schematic side elevational view of an apparatus in accordance with the invention,

FIGURE 2 is a longitudinal sectional view to a larger scale of the left hand end of Figure 1, and

FIGURE 3 is an end elevation, to a larger scale again, showing the mounting of the parallel blades in the apparatus of Figures 1 and 2.

As shown in Figures 1 and 2, the apparatus comprises a vessel 10 for holding an aqueous fibre-containing cement slurry 11, and an endless water-pervious belt 12, e.g. of felt, which is arranged to be driven around a series of guide rollers 13, 14, 15. Slurry is delivered to the vessel 10 continuously during operation through a supply pipe 16. The right hand end of the vessel 10 is defined partly by the upper surface of the belt 12 as it passes around the guide roller 13 and partly by a superposed roller 17, which is driven in the opposite sense to the sense of rotation of the guide roller 13. A small gap 18 between the upper surface of the belt 12 and the lowermost part of the periphery of the roller 17 constitutes the outlet from the vessel 10 and permits a thin layer 19 of the cement slurry to be deposited on the belt. In accordance with normal practice, a rotary agitator 20 is disposed in the vessel 10 to cause turbulence in the slurry 11.

The layer 19 of fibre-containing cement slurry on the belt 12 is de-watered in known manner through the belt using a first gravity

drainage chamber 24 and a second suction drainage chamber 25. After de-watering, the layer 19 becomes a cohesive web 26 of fibre-reinforced cement which is picked up from the belt 12 and wound on to a rotatable pivotally mounted receiving roller 27. When a sufficient thickness of fibre-reinforced cement has been built up on the surface of the roller 27, it is cut axially of the roller and taken off for pressure de-watering and curing.

The novel features of the present invention lie in the additional agitator provided in the vessel 10, extending into the nip between the roller 17 and the belt 12. This agitator is formed by a series of similar parallel blades 30 which are disposed in vertical planes parallel to the direction of movement of the belt 12 (i.e. at right angles to the axes of the rollers 13, 17) and spaced from one another across the width of the vessel 10 and the outlet 18 immediately upstream of the latter. The blades 30 each have a vertically extending upper portion 31 secured to a respective web 32 of a vertical channel section member 33 secured to a horizontal beam 34 extending across the width of the vessel 10. The beam 34 is provided with upper and lower rails 35, 36 engaging grooved upper and lower rollers 37, 38 mounted on fixed pivots 39 on upstanding brackets 40 bolted to respective sides of the vessel 10. The beam 34 with the channel section members 33 thus constitutes a carriage which is horizontally reciprocable between the rollers 37, 38. For producing such horizontal reciprocating movement of the carriage 33, 34, it is connected via a pivotally mounted connecting rod 41 to a crank pin 42 on a disc 48 which is driven by a belt 43 from a motor (not shown). The carriage speed can be varied independently of the speed of the belt 12, though their drives may be electrically linked so that increase in the speed of the belt 12 results in an increase in the speed of the carriage 33, 34.

The blades 30 are connected to one another near their mid-lengths by a

spacer rod 44. The lower portion 45 of each blade 30 is curved and has one edge 46 lying closely adjacent to the periphery of the upper roller 17. The end 47 of each blade 30 extends into the nip between the upper surface of the belt 12 passing round the guide roller 13 and the superposed roller 17. Horizontal reciprocating movement of the carriage 33, 34 thus causes the blades 30 to reciprocate horizontally, at right angles to their width, and to cause turbulence just where it is required for mixing the fibres more uniformly in the slurry and reducing their tendency to lie parallel to one another. Measurements of the modulus of rupture of glass-fibre reinforced cement sheet material were made on the apparatus described above, in directions parallel and transverse to the length of the sheet, i.e. to the direction of movement of the belt 12, firstly with agitation by reciprocation of the blades 30 and secondly without such reciprocation, for comparison. The ratio of modulus of rupture in the longitudinal direction to that in the transverse direction was approximately 1.3 for the sheet made with such agitation and approximately 1.6 for the sheet made without agitation, showing the improvement resulting from the present invention.

Other forms of agitator extending into the nip between the roller 17 and belt 12 may be employed in place of or in addition to the blades 30. For example, air may be bubbled into the fibre-containing cement slurry from a tube or tubes having outlets in the nip. For this purpose, small-bore tubes may be attached to the sides of the blades 30, the open outlet ends of the tubes being located close to the ends 47 of the blades. Means may alternatively be provided for oscillating each blade 30 about a respective vertical axis lying along its upper portion 31, either in place of or in addition to the reciprocating movement of all the blades parallel to the width of the nip.

CLAIMS

1. Apparatus for making fibre-reinforced cement sheet material, comprising a vessel for holding an aqueous fibre-containing cement slurry and an endless water-pervious belt for receiving and de-watering a layer of the slurry and arranged to move around a series of guide rollers, one of said guide rollers cooperating with a superposed parallel roller to define the outlet for the slurry from the vessel on to the belt, and an agitator being provided in the vessel, characterised in that the agitator extends into the nip between the superposed roller and the belt where the belt passes around the guide roller, and extends across the width of the nip, so as to cause turbulence in the slurry immediately upstream of the outlet.

2. Apparatus according to Claim 1, characterised in that the agitator is formed by a series of similar parallel blades disposed in vertical planes and spaced from one another across the width of the nip.

3. Apparatus according to Claim 2, characterised in that the blades are disposed in planes parallel to the direction of movement of the belt and are mounted for reciprocating movement parallel to the width of the nip.

4. Apparatus according to Claim 3, characterised in that the blades each have a vertically extending upper portion connected to a common horizontally reciprocable carriage and a curved lower portion which has one edge lying closely adjacent to the superposed roller and which has its lower end extending into the nip between the superposed roller and the belt passing around the guide roller.

5. Apparatus according to Claim 4, characterised in that the carriage is mounted on rollers above the vessel for its horizontal reciprocating movement.

6. Apparatus according to Claim 5, characterised in that the carriage is arranged to be driven by a crank and connecting rod from a motor.

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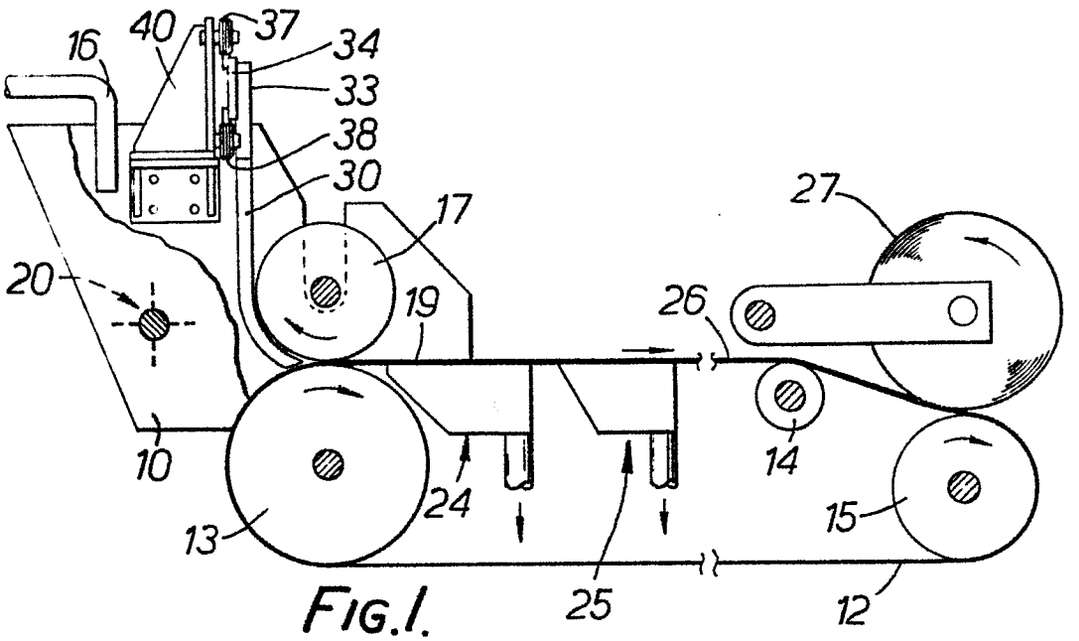
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FIG. 1.

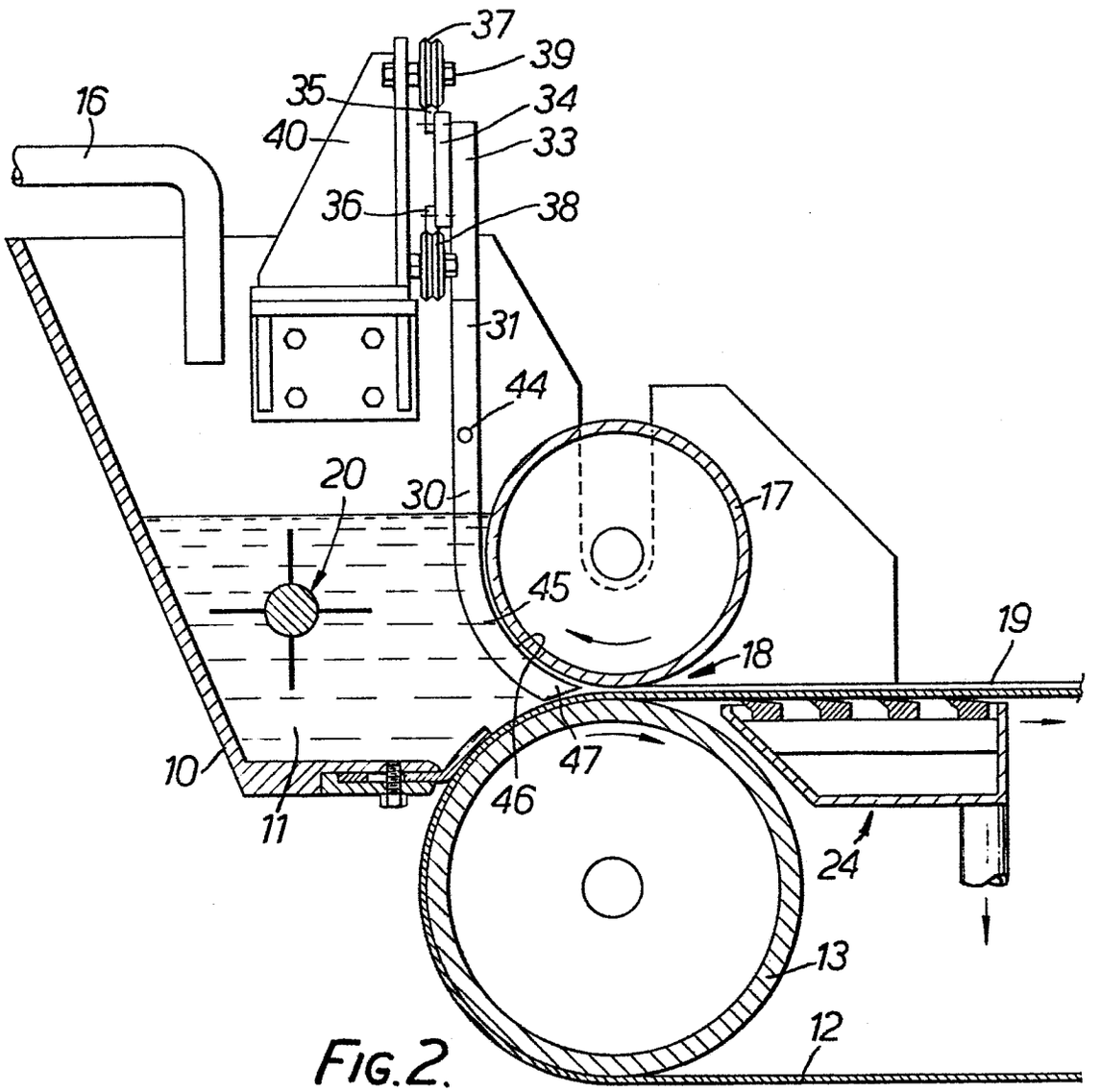
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FIG. 2.

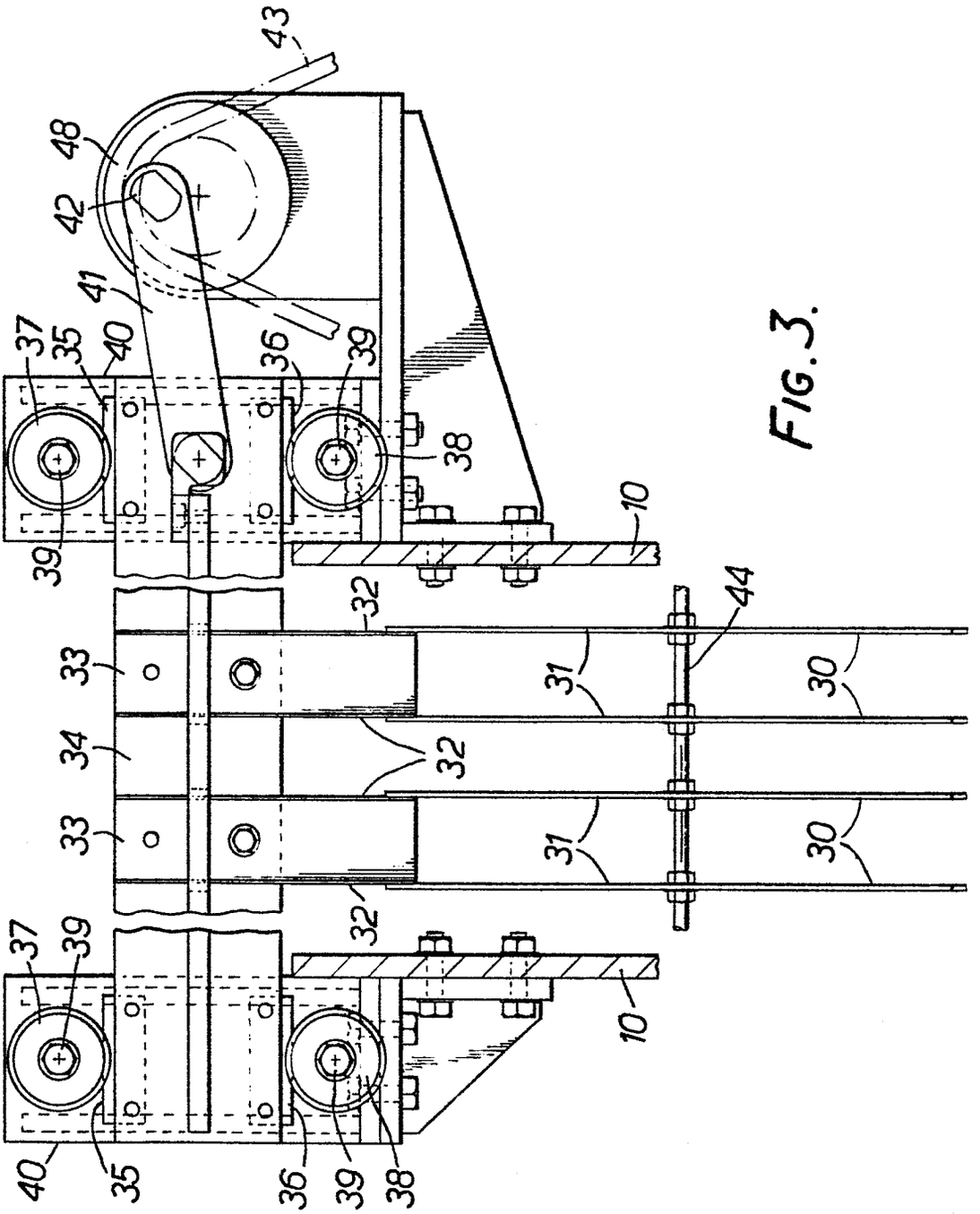
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FIG. 3.