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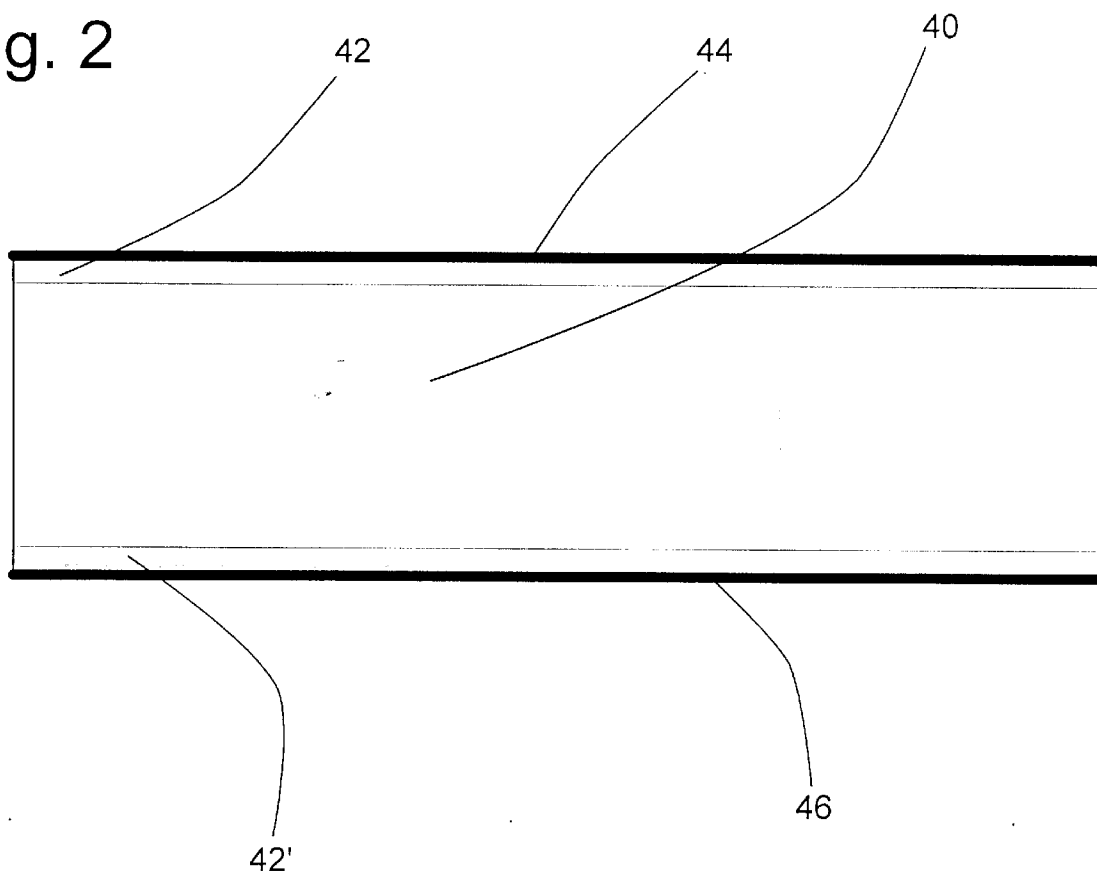
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(54) **Plasterboard**

(57) A plasterboard comprising a layer 40 of phosphogypsum between layers 42, 42' of desulphogypsum is disclosed. A method of making such a plasterboard

comprises forming a slurry of phosphogypsum, forming a slurry of desulphogypsum, and forming the slurries into a multi layer board.

Fig. 2



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Description

[0001] This invention relates to a multi layer plasterboard and finds particular application in plasterboards lined on one or both principal faces with paper or other liner.

[0002] Plasterboard is conventionally formed by preparing a slurry of gypsum plaster (calcium sulphate hemi-hydrate) in water. The slurry is flowable, and may contain foam, aggregates and setting and other additives. The slurry is poured onto a lower continuous belt and formed by an upper continuous belt into a continuous length of board. The set board is cut and dried. To produce lined plasterboard, the slurry is poured onto a sheet of paper or other liner on the lower belt, and a further sheet of paper or other liner is brought onto the top of the slurry with the upper belt. As the slurry, in contact with the liner sheets, moves down the board line it hydrates and sets. The wet set core develops a bond with the paper liner. This wet bond is important in the board manufacturing process and it is particularly important that a good wet bond is formed by the time the board reaches the cutter. If an adequate wet bond has not developed by the cutter, the cut ends of the paper may be lifted off the wet set core during cutting. If the wet bond is inadequate when the board is in the dryer, after cutting, the paper may be blown off the board by the high velocity hot air stream, or it may start to roll around the transport rollers. This results in an unusable product and can lead to jams in the dryer.

[0003] Plasterboard may be made from gypsum from a number of sources, each of which has different chemical and physical properties. These types of gypsum include natural gypsum, desulphogypsum which is a by-product of the desulphurisation of flue gases from power stations or other burners and phosphogypsum which is a by-product of the manufacture of phosphoric acid by the sulphuric acid process. Natural gypsum and desulphogypsum readily form a good wet bond with paper liner, typically in about one minute. Many phosphogypsums have been found to take longer to develop an adequate wet bond, typically around five minutes, and some may not develop an adequate wet bond at all. Since the cutter on a board line may be only three minutes from the wet end of the board line, it has been necessary to slow production speeds or lengthen board lines in order to utilise phosphogypsum in plasterboards. Both of these measures reduce the efficiency of the board lines. Accordingly, it has been desired to provide a means whereby phosphogypsum can be efficiently utilised in the manufacture of lined plasterboard. It has also been desired to utilise effectively the particular properties of different types of gypsum.

[0004] According to the invention there is provided a plasterboard comprising a layer of a first type of gypsum and a layer of a second type of gypsum. Preferably the plasterboard is lined and the first type of gypsum forms a more rapid wet bond with the liner than the second

type and is in contact with the liner. More preferably, the board is lined on both faces and layers of the first type of gypsum are either side of a layer of the second type of gypsum.

[0005] Also according to the invention there is provided a method of making a gypsum plasterboard comprising forming a slurry of a first type of gypsum plaster; forming a slurry of a second type of gypsum plaster; and forming the slurries into a multi layer board. Preferably, a liner is applied to a surface formed by the slurry of the first type of gypsum plaster and the first type of gypsum forms a more rapid wet bond with the liner than does the second type of gypsum. More preferably, both surfaces of the board are provided by the slurry of the first type of gypsum plaster and a respective liner is applied to the surface of both slurries of the first type of gypsum plaster.

[0006] It is particularly preferred that the first type of gypsum is natural gypsum or desulphogypsum and that the second type of gypsum is phosphogypsum or a mixture of phosphogypsum and at least one other gypsum. The types of gypsum are not limited to these gypsums and may be mixtures of more than one gypsum.

[0007] In order to ensure that the layers in the set product are adequately adhered, the chemistry of the slurries is adjusted appropriately. In particular, it is desirable that the setting times of the slurries are similar and the degree of shrinkage exhibited by the slurries during setting is similar. This latter parameter can be controlled by addition of known additives, for example a crystal modifier such as tartrate, to one or both slurries.

[0008] In addition to their ability to form a good wet bond with a liner, the types of gypsum may be chosen for other properties.

[0009] The different slurries may contain different additives or different proportions of the same additives. Examples of such additives include: microsilica to enhance the fire resistance of the board; starch to further improve adhesion between the gypsum and a liner; fibres such as glass fibres to strengthen the board; and water reducing agents. The slurries may be treated differently; for example, the energy input during mixing can be varied between the slurries. In one embodiment of this feature, the slurries which will form the surface layers in the board are subjected to relatively high shear mixing compared to the or each other slurry, for example, to increase the strength of the surface layers and thus the strength and stiffness of the board.

[0010] The invention will be further described with reference to the drawings in which:

Figure 1 shows diagrammatically the wet end of a board line for forming a plasterboard according to a preferred embodiment of the preferred invention; and

Figure 2 shows diagrammatically a partial section through a plasterboard according to that preferred

embodiment of the invention.

[0011] The wet end of a board line shown in Figure 1; it makes a plasterboard lined on the top and the bottom principal surfaces with paper liners. The wet end of the board line shown in Figure 1 is of generally conventional construction and operation. It comprises a first mixer 10 to which phosphogypsum plaster, water and any other additives to be employed in the middle layer of the plasterboard, such as foam. A second, smaller, mixer 12 receives desulphogypsum plaster, water and any additives to be employed in the surface layers of the plasterboard. The first mixer is disposed immediately above a continuous belt 14. Which runs around a roller 16. The bottom liner paper 18 is supplied to the upstream end of the belt 14 from a reel (not shown). Between the reel and the outlet 20 of the first mixer 10, a bottom coating roll 22 is disposed across the run of the bottom liner paper 18. The desulphogypsum plaster slurry is supplied to the bottom coating roller 22 from the second mixer 12 through a pipe 24. A gauging roller 26 is disposed downstream of the first mixer; this roller defines the thickness of the plasterboard. The top paper liner 28 runs around the gauging roller 26 from a reel (not shown). An upper coating roller 30 is disposed across the run of the top liner paper 28, and is supplied with the desulphogypsum plaster slurry from the second mixer 12 through a pipe 32.

[0012] In operation, plaster, water and other additives are supplied continuously to the first and second mixers which mix them together to form the slurries for the middle layer and the outer surface layers respectively of the plasterboard. The chemistry of the slurries is adjusted to ensure that a good bond is formed between the middle layer of phosphogypsum and the top and bottom layers of desulphogypsum in the set plasterboard. The slurries can include conventional additives, such as foam, aggregates, setting and retarding agents and water-proofing agents. Advantageously, the slurry which forms the or each outer layer can include a starch or other adhesion aid to further improve the bond between the outer layers and the liner.

[0013] As the bottom paper 18 is drawn past the bottom coating roller 22, a thin film of the desulphogypsum plaster slurry is applied to the upper surface of the paper. The paper then passes onto the continuous belt 14, and the phosphogypsum plaster slurry is deposited on top of the desulphogypsum plaster slurry coating. The top liner paper 28 is similarly coated with a thin layer of the desulphogypsum plaster slurry by the top coating roller 30, and is brought around the gauging roller 26 onto the upper surface of the phosphogypsum plaster slurry 34. The gauging roller 26, together with the continuous belt and appropriate side structures forms the slurries into a continuous board, which sets as it moves down the board line. By the time the set lined board reaches the cutter (not shown), a good bond has formed between the middle phosphogypsum layer and the outer desul-

phogypsum layers, and a good wet bond has formed between the outer desulphogypsum layers and the paper liners. Thus, as the board is cut, transferred to the dryer and passed through the dryer, the liners remain adhered to the board.

[0014] The board made by the board line described above is shown in Figure 2. It comprises a middle layer 40 of phosphogypsum, outer layers 42, 42' of desulphogypsum and top 44 and bottom 46 paper liners. The desulphogypsum outer layers 42, 42' form good wet and dry bonds with the paper liners, and the outer layers 42, 42' of desulphogypsum form a good bond with the middle layer 40 of phosphogypsum.

[0015] The outer layers will normally be up to 1 mm thick in a board of 12.5 mm thickness and in similar proportions in boards of other thicknesses; the weight ratio between the slurry of the first type of gypsum, making up in the preferred embodiment the middle layer of the board and the slurry of the second type of gypsum, making up in the preferred embodiment the outer layers of the board is preferably about 9:1.

[0016] It will be seen that the present invention provides a plasterboard in which different types of gypsum can be exploited for their varying properties in an efficient manner. In particular, it provides a lined plasterboard predominantly of phosphogypsum which exhibits adequate wet bond formation with a liner.

30 Claims

1. A plasterboard comprising a layer of a first type of gypsum and a layer of a second type of gypsum.
2. A lined gypsum plasterboard according to claim 1 comprising a layer of a first type of gypsum and a layer of a second type of gypsum, the first type of gypsum forming a more rapid wet bond with the liner than the second type, the layer of the first type of gypsum being overlaid with liner.
3. A plasterboard according to claim 2 comprising two layers of the first type of gypsum, one either side of the layer of the second type of gypsum, both layers of the first type of gypsum being overlaid with liner.
4. A plasterboard according to claim 2 or 3 in which the liner is of paper.
5. A plasterboard according to any preceding claim in which the chemical composition of the slurry of the first type of gypsum is different from that of the slurry of the second type of gypsum.
6. A plasterboard according to any preceding claim in which the composition of the slurries is such that on setting a firm bond forms between the layers.

7. A plasterboard according to any preceding claim in which the first and second types of gypsum have similar setting characteristics.
8. A plasterboard according to any preceding claim in which the layers shrink to substantially the same extent during setting.
9. A plasterboard according to any preceding claim in which the layer of the first type of gypsum includes a different additive or additives to the layer of the second type of gypsum.
10. A plasterboard according to any preceding claim in which the layer of the first type of gypsum includes an additive in a first proportion and the layer of the second type of gypsum includes the additive in a second proportion different from the said first proportion.
11. A plasterboard according to any preceding claim including an additive in at least one layer which enhances the fire resistance of the plasterboard.
12. A plasterboard according to any preceding claim including an additive in at least one layer which enhances the moisture resistance of the plasterboard.
13. A plasterboard according to any preceding claim in which a layer of the first type of gypsum includes fibres such as glass fibres.
14. A plasterboard according to any preceding claim in which a layer of the first type of gypsum includes microsilica.
15. A plasterboard according to any preceding claim in which the layer of the first type of gypsum includes a different proportion of starch to the layer of the second type of gypsum.
16. A plasterboard according to any preceding claim in which the first type of gypsum is natural gypsum.
17. A plasterboard according to any of claims 1 to 15 in which the first type of gypsum is desulphogypsum.
18. A plasterboard according to any preceding claim in which the second type of gypsum is phosphogypsum or a mixture of phosphogypsum and one or more other gypsums.
19. A method of making a gypsum plasterboard comprising:
 - forming a slurry of a first type of gypsum plaster;
 - forming a slurry of a second type of gypsum plaster; and
 - forming the slurries into a multi layer board.
20. A method according to claim 19 of making a lined plasterboard further comprising applying a liner to a surface formed by the slurry of the first type of gypsum plaster, in which the first type of gypsum forms a more rapid wet bond with the liner than does the second type of gypsum.
21. A method according to claim 20 in which both external surfaces of the board are provided by the slurry of the first type of gypsum plaster.
22. A method according to claim 19, 20 or 21 in which the slurry of the first type of gypsum plaster is subjected to high shear mixing prior to formation into the board.
23. A method according to any of claims 19 to 22 further comprising modifying at least one of the slurries so that on setting a firm bond is formed between the layers.
24. A method according to any of claims 19 to 23 further comprising adding glass fibres to at least one slurry, preferably that of the first type of gypsum plaster.
25. A method according to any of claims 19 to 24 further comprising adding microsilica to at least one of the slurries so that on setting a firm bond is formed between the layers.
26. A method according to any of claims 19 to 25 further comprising adding starch to the slurry of the first type of gypsum plaster.
27. A method according to any of claims 19 to 26 in which the slurry of the first type of gypsum plaster is formed by forming a slurry of natural gypsum plaster.
28. A method according to any of claims 19 to 26 in which the slurry of the first type of gypsum plaster is formed by forming a slurry of desulphogypsum plaster.
29. A method according to any of claims 19 to 28 in which the slurry of the second type of gypsum plaster is formed by a slurry of phosphogypsum plaster or a mixture of phosphogypsum plaster and at least one other gypsum plaster.
30. A plasterboard made by a method according to any of claims 19 to 29.
31. A gypsum plasterboard substantially as described.
32. A method substantially as described.

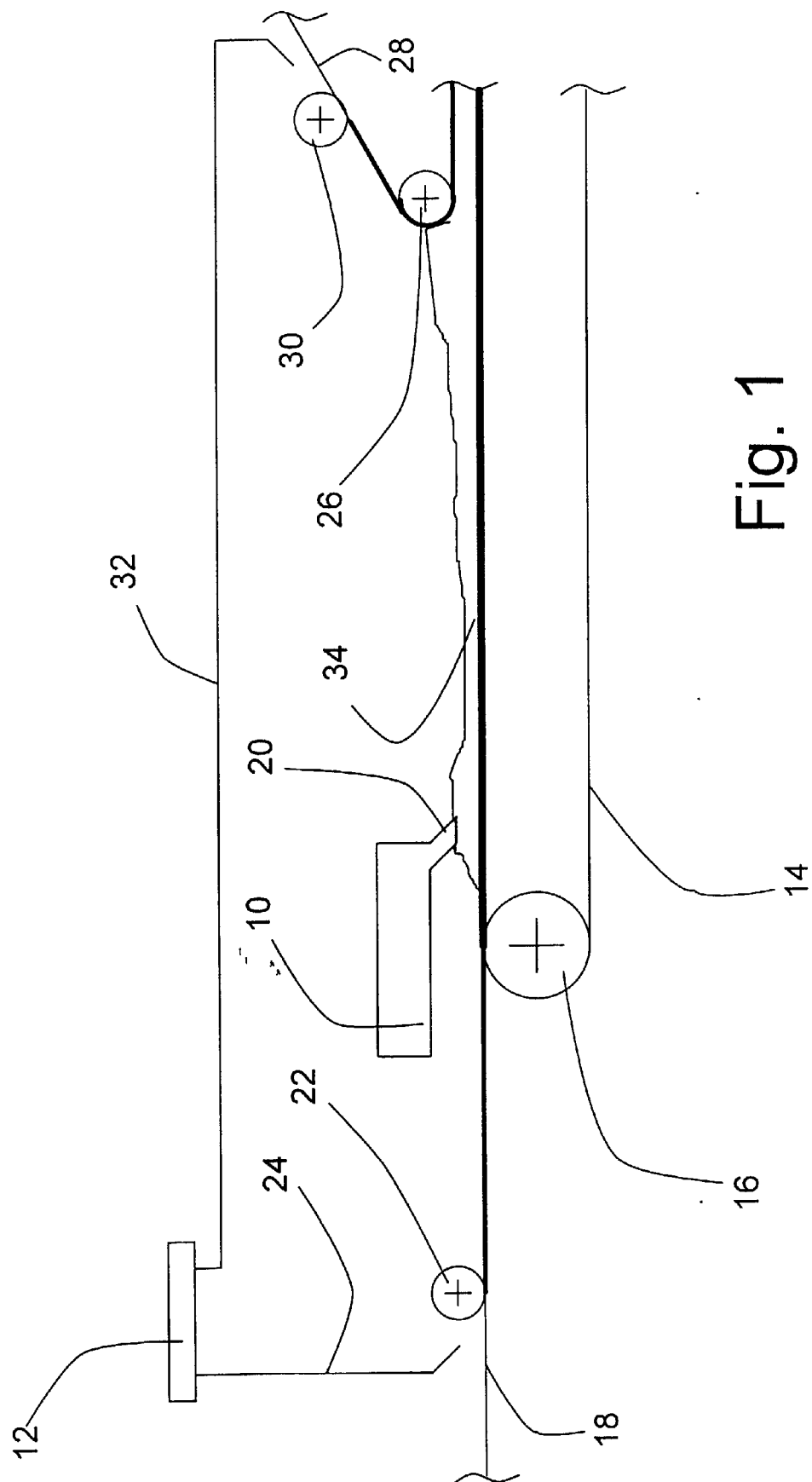


Fig. 1

