Claims

1. A method for producing a shaped profile section in a continuous line process, the method comprising steps of:

providing an outer facing web;

providing an inner facing web;

laying down liquid foam reactants in the outer facing web;

wherein the method comprises the further steps of: pre-forming the outer facing web into a desired outer profile shape prior to laying down the reactants, and shaping the inner facing web with foam formed by the liquid foam reactants within the pre-formed outer facing web to provide a desired inner profile shape for the shaped profile section.

2. A method for producing a shaped profile section in a continuous line process, the method comprising steps of:

providing an outer facing web;

laying down liquid foam reactants in the outer facing web;

engaging an inner facing web with the outer facing web;

wherein the method comprises the further steps of: pre-forming the outer facing web into a desired outer profile shape prior to laying down the reactants, and pre-forming the inner facing web into a desired inner profile shape for the shaped profile section prior to engagement with the outer facing web.

3. A method for producing a shaped profile section as claimed in claim 1 or claim 2, in which the outer facing web is provided as an elongate web, and the step of pre-forming comprises deforming the outer facing web to provide a pair of connected elongate sections, each section having a substantially C-shaped cross-section.

4. A method for producing a shaped profile section as claimed in any of claims 1 to 3, in which the step of deforming the outer facing web further comprises forming a wing at a free end of each C-shaped section.

5. A method for producing a shaped profile section as claimed in any preceding claim, in which the step of pre-forming the outer facing web comprises passing the outer facing web between engaging surfaces of a complementary roller couple in which the rollers in each roller couple have inter-fitting convex and concave engaging surfaces.

6. A method for producing a shaped profile section as claimed in any preceding claim, in which the step of pre-forming the outer facing web comprises passing the outer facing web between surfaces of a series of spaced apart complementary roller couples positioned so that serially consecutive portions of the outer facing web are sequentially engaged by the roller couples.

7. A method for producing a shaped profile section as claimed in claim 5 or claim 6, comprising a step of, in the direction of movement of the outer facing web through the roller couples, configuring the engaging surfaces of the series of spaced apart complementary roller couples with rollers of gradually increasing size, such that a last roller couple in the series thereof is provided with engaging surfaces corresponding to the shape of the pair of connected substantially C-shaped sections.

8. A method for producing a shaped profile section as claimed in any of claims 2 to 7, wherein the step of pre-forming the inner facing web comprises deforming the

inner facing web to provide a pair of spaced-apart sections, each section having a substantially C-shaped cross-section.

9. A method for producing a shaped profile section as claimed in claim 8, wherein the step of deforming the inner facing web further comprises forming a wing at a free end of each C-shaped section, and a connecting portion between adjacent ends of each C-shaped section.

10. A method for producing a shaped profile section as claimed in any of claims 2, 8 or 9, wherein the step of pre-forming the inner facing web comprises passing the inner facing web between engaging surfaces of a complementary roller couple in which the rollers in each roller couple have inter-fitting convex and concave engaging surfaces.

11. A method for producing a shaped profile section as claimed in any of claims 2, 8, 9 or 10, wherein the step of pre-forming the inner facing web comprises passing the inner facing web between surfaces of a series of spaced apart complementary roller couples positioned so that serially consecutive portions of the inner facing web are sequentially engaged by the roller couples.

12. A method for producing a shaped profile section as claimed in claim 10 or claim 11, comprising a step of, in the direction of movement of the inner facing web through the roller couples, configuring the engaging surfaces of the series of spaced apart complementary roller couples with rollers of gradually increasing size, such that a last roller couple in the series thereof is provided with engaging surfaces corresponding to the shape of the pair of connected substantially C-shaped sections.

13. A method for producing a shaped profile section as claimed in any of claims 10 to 12, wherein the step of pre-forming the inner facing web further comprises a step of micro-ribbing the inner facing web.

14. A method for producing a shaped profile section as claimed in claim 13, wherein the step of micro-ribbing the inner facing web is performed prior to passing the inner facing web between engaging surfaces of a complementary roller couple.

15. A method for producing a shaped profile section as claimed in claim 13 or claim 14, wherein the step of micro-ribbing comprises passing the inner facing web between two spaced-apart pairs of micro-ribbing rollers to provide a pair of elongate ribs or indentations along the length of the inner facing web, each rib corresponding to one of the C-shaped sections of the pre-formed inner facing web.

16. A method for producing a shaped profile section as claimed in any of claims 10 to 15, wherein the step of pre-forming the inner facing web further comprises one or more heating steps.

17. A method for producing a shaped profile section as claimed in claim 16, wherein the one or more heating steps are performed prior to passing the inner facing web.

18. A method for producing a shaped profile section as claimed in claim 17, wherein the one or more heating steps comprise an initial heating step comprising passing the inner facing web between a series of heaters to heat the inner facing web to a pre-determined temperature.

19. A method for producing a shaped profile section as claimed in claim 18, wherein the one or more heating steps further comprise a final heating step comprising passing the inner facing web along a heater to return the inner facing web to the pre-determined temperature.

20. A method for producing a shaped profile section as claimed in claim 18 or claim 19, wherein the step of deforming the inner facing web is performed while the inner facing web is at or near the pre-determined temperature.

21. A method for producing a shaped profile section as claimed in any one of the preceding claims, in which the step of laying down liquid foam reactants comprises operating a delivery head to dispense the liquid foam reactants into the pre-formed outer facing web.

22. A method for producing a shaped profile section as claimed in claim 21, in which the delivery head is a spray head or a pouring head.

23. A method for producing a shaped profile section as claimed in any one of the preceding claims, comprising steps of providing an outer facing web mould having a supporting surface shaped to support the pre-formed outer facing web thereon, providing an inner facing web mould configured with a moulding surface, arranging the moulding surface of the inner facing web mould to face and engage at least a portion of the supporting surface of the outer facing web mould, and conveying the preformed outer facing web with liquid foam reactants and the inner facing web in between the mould surfaces to provide, from the outer facing web mould to the inner facing web mould, sequential layers comprising the outer web facing web, the liquid foam reactants and the inner facing web.

24. A method for producing a shaped profile section as claimed in claim 23, wherein the method further comprises steps of: operating a mould conveyor arrangement comprising a first rotary conveyor and a second rotary conveyor, in which a plurality of distinct inner facing web moulds are arranged along a perimeter of the first rotary conveyor and a plurality of distinct outer facing web moulds are arranged along a perimeter of the second rotary conveyor, whereby first rotary conveyor and second rotary conveyor are arranged such that the moulds move along a conveyor path and each inner facing web mould engages with an outer facing web mould for at least a portion of the conveyor path.

25. A method for producing a shaped profile section as claimed in claim 24, in which the moulding surface of each inner facing web mould comprises a pair of spaced apart substantially C-shaped mould plates.

26. A method for producing a shaped profile section as claimed in claim 25, in which the substantially C-shaped mould plates are placed in substantial radial alignment within the C-shaped sections of the outer facing web when the moulds are engaged along the conveyor path.

27. A method for producing a shaped profile section as claimed in any one of claims 23 to 26, in which foam formed by the liquid foam reactants is shaped and cured between the inner and outer facing webs while an inner facing web mould is engaged with an outer facing web mould.

28. A method for producing a shaped profile section as claimed in any one of claims 23 to 27, comprising a step of applying pressure to one or both of the inner facing web mould and the outer facing web mould for a predetermined period of time to maintain the moulds in engagement.

29. A method for producing a shaped profile section as claimed in any one of claims 23 to 28, comprising a step of separating the moulds along the conveyor path to release the shaped profile section from between the moulds.

30. A method for producing a shaped profile section as claimed in any one of the preceding claims, comprising a step of cutting the shaped profile section to a desired length.

31. A method for producing a shaped profile section as claimed in any one of the preceding claims, in which the outer facing web is one of metal foil such as aluminium foil, paper, glass, thermoplastic film or combinations of two or more thereof.

32. A method for producing a shaped profile section as claimed in any one of the preceding claims, in which inner facing web is made of a thin porous material.

33. A method for producing a shaped profile section as claimed in any of clams 2 to 32, in which the inner facing web may comprise fibres bound by a PVA binder.

34. A method for producing a shaped profile section as claimed in claim 33, wherein the fibres comprise a blend of glass fibres and polyester fibres.

35. A method for producing a shaped profile section as claimed in claim 34 wherein the at least 50% of the fibres are polyester fibres.

36. A method for producing a shaped profile section as claimed in any one of the preceding claims, in which the liquid foam reactants are suitable for forming phenolic foam, poly-ester foam, poly-ether foam and/or poly-isocyanuarate foam.

37. A continuous line apparatus for producing a shaped profile section, the apparatus comprising:

means for providing an outer facing web;

means for providing an inner facing web;

means for laying down liquid foam reactants in the outer facing web;

wherein the apparatus further comprises means for pre-forming the outer facing web into a desired outer profile shape prior to laying down the reactants, and means for shaping the inner facing web with foam formed by the liquid foam reactants within the pre-formed outer facing web to provide a desired inner profile shape for the shaped profile section.

38. A continuous line apparatus for producing a shaped profile section, the apparatus comprising:

means for providing an outer facing web;

means for laying down liquid foam reactants in the outer facing web;

means for engaging an inner facing web with the outer facing web;

wherein the apparatus further comprises means for pre-forming the outer facing web into a desired outer profile shape prior to laying down the reactants, and means for pre-forming the inner facing web into a desired inner profile shape for the shaped profile section prior to engagement with the outer facing web.

39. A continuous line apparatus as claimed in claim 37 or 38, in which the outer facing web is provided as an elongate web, and the apparatus further comprises means for deforming the outer facing web to provide a pair of connected sections, each section having a substantially C-shaped cross-section.

40. A continuous line apparatus as claimed in claim 39, in which a wing is formed at a free end of each C-shaped section.

41. A continuous line apparatus as claimed in any one of claims 39 or 40, in which the means for pre-forming the outer facing web comprises a complementary roller couple in which rollers in each roller couple have inter-fitting convex and concave engaging surfaces, whereby the outer facing web is passed between the engaging surfaces.

42. A continuous line apparatus as claimed in claim 41, in which the means for pre-forming the outer facing web comprises a series of spaced apart complementary roller couples positioned so that serially consecutive portions of the outer facing web are sequentially engaged between the engaging surfaces of the roller couples.

43. A continuous line apparatus as claimed in claim 42, in which, in the direction of movement of the outer facing web through the roller couples, engaging surfaces of the series of spaced apart complementary roller couples are configured with rollers of gradually increasing size, such that a last roller couple in the series thereof is provided with engaging surfaces corresponding to the shape of the pair of connected substantially C-shaped sections.

44. A continuous line apparatus as claimed in any one of claims 37 to 43, in which the apparatus comprises operating a delivery head to dispense the liquid foam reactants into the pre-formed outer facing web.

45. A continuous line apparatus as claimed in claim 44, in which the delivery head is a spray head or a pouring head.

46. A continuous line apparatus as claimed in any one of claims 37 to 45, further comprising an outer facing web mould having a supporting surface shaped to support the pre-formed outer facing web thereon, an inner facing web mould configured with a moulding surface, in which the moulding surface of the inner facing web mould is operable to face and engage at least a portion of the supporting surface of the outer facing web mould, and means are provided for conveying the preformed outer facing web with liquid foam reactants and the inner facing web in between the mould surfaces to provide, from the outer facing web mould to the inner facing web mould, sequential layers comprising the outer web facing web, the liquid foam reactants and the inner facing web.

47. A continuous line apparatus as claimed in claim 46, further comprising a mould conveyor arrangement comprising a first rotary conveyor and a second rotary conveyor, in which a plurality of distinct inner facing web moulds are arranged along a perimeter of the first rotary conveyor and a plurality of distinct outer facing web moulds are arranged along a perimeter of the second rotary conveyor, whereby the first rotary conveyor and second rotary conveyor are arranged such that the moulds move along a conveyor path and each inner facing web mould are operable to engage with an outer facing web mould for at least a portion of the conveyor path.

48. A continuous line apparatus as claimed in claim 47, in which the moulding surface of each inner facing web mould comprise a pair of spaced apart substantially C-shaped mould plates.

49. A continuous line apparatus as claimed in any one of claims 37 to 48, further comprising means for cutting the shaped profile section to a desired length.

50. A continuous line apparatus as claimed in any one of claims 37 to 49, in which the outer facing web is one of metal foil such as aluminium foil, paper, glass, thermoplastic film or combinations of two or more thereof.

51. A continuous line apparatus as claimed in any one of claims 37 to 50, in which the inner facing web is made of a thin porous material.

52. A continuous line apparatus as claimed in any one of claims 37 to 51, in which the liquid foam reactants are suitable for forming phenolic foam, poly-ester foam, poly-ether foam and/or poly-isocyanuarate foam.

53. A shaped profile section produced according to the method of claims 1 to 36.

54. A shaped profile section as claimed in claim 53, which is joined around an outer surface of a pipe.

55. A shaped profile section produced by the apparatus of claims 37 to 52.

56. A shaped profile section as claimed in claim 55, and a pipe, whereby the shaped profile section is joined around an outer surface of a pipe.

57. A mould conveyor arrangement for use in producing a shaped profile section, the conveyor comprising a first rotary conveyor and a second rotary conveyor, in which a plurality of inner facing web moulds are arranged along a perimeter of the first rotary conveyor and a plurality of outer facing web moulds are arranged along a perimeter of the second rotary conveyor, whereby the first rotary conveyor and second rotary conveyor are arranged such that the moulds move along a conveyor path and each inner facing web mould is operable to engage with an outer facing web mould for a portion of the conveyor path.

58. A mould conveyor arrangement as claimed in claim 57, in which each inner facing web mould has a moulding surface comprising a pair of spaced apart

substantially C-shaped mould plates, and each outer facing web mould comprises a pair of spaced apart substantially C-shaped supporting surfaces.

59. A mould conveyor arrangement as claimed in claim 58, in which a preformed outer facing web containing liquid foam reactants and an inner facing web is conveyed in between the mould surfaces to provide, from the outer facing web mould to the inner facing web mould, sequential layers comprising the outer web facing web, the liquid foam reactants and the inner facing web for the portion of the conveyor path in which each inner facing web mould engages with an outer facing web mould.

60. A mould conveyor arrangement as claimed in any one of claims 57 to 59, further comprising means for applying pressure to one or both of the inner facing web mould and the outer facing web mould for a predetermined period of time to maintain the moulds in engagement.

61. A mould conveyor arrangement as claimed in any one of claims 57 to 60, further comprising separating the moulds to release the shaped profile section formed between the moulds.

62. A method for producing a shaped profile section in a continuous line process substantially as herein described with reference to the accompanying drawings and/or examples.

63. A continuous line apparatus for producing a shaped profile section substantially as herein described with reference to the accompanying drawings and/or examples.

64. A shaped profile section substantially as herein described with reference to the accompanying drawings and/or examples.

65. A mould conveyor arrangement substantially as herein described with reference to the accompanying drawings and/or examples.