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(54) Compound forming fabric with additional bottom yarns

(57) A compound forming fabric (100) having a top weave (101) and a bottom weave (102). The fabric includes binder warp/weft yarns (B1,B2,B4,...), where the binder yarns are arranged in groups of at least two inter-changing binder yarns. Each group of the binder yarns

forms an integral part at least of the top weave (101). Per group of binder yarns the number of bottom warp/weft yarns (W3,W6,...) only weaving the bottom weave (102) is higher than the number of top warp/weft yarns only weaving the top weave (101).

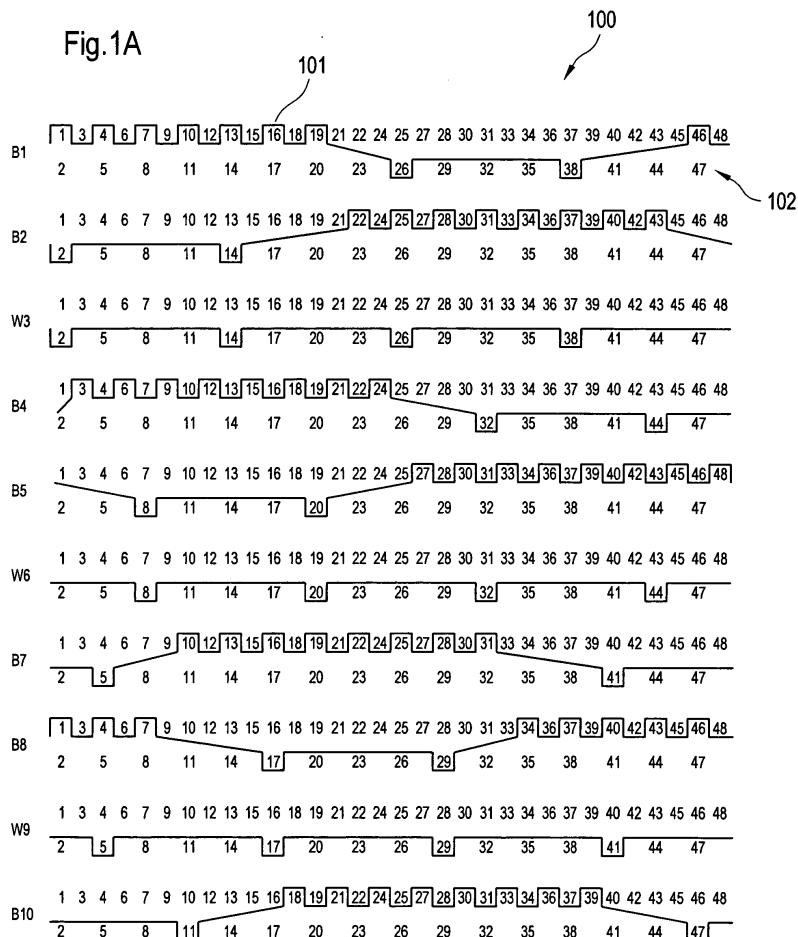


Fig.1B

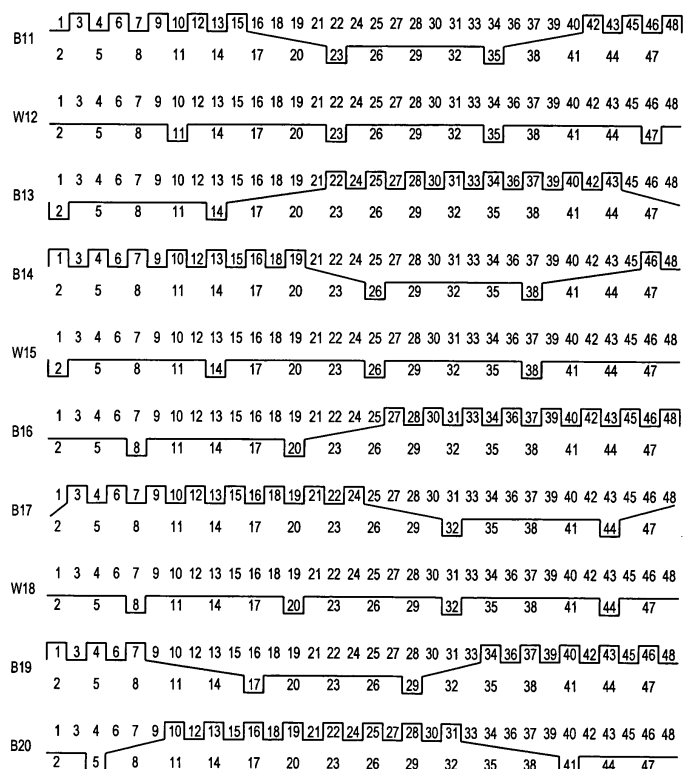
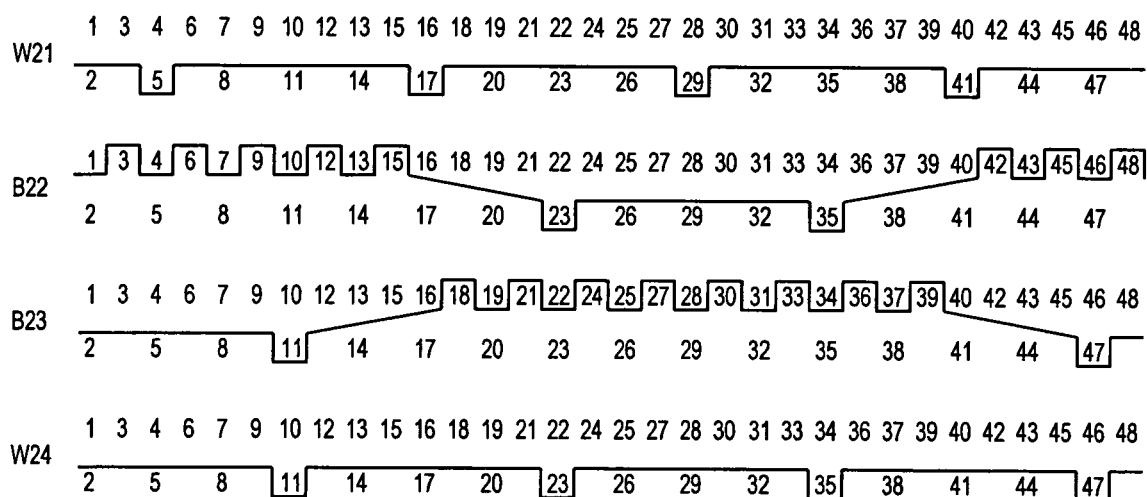


Fig.1C



## Description

### BACKGROUND OF THE INVENTION

#### 1. Field of the invention.

[0001] The present invention relates to compound forming fabrics for use in the forming section of a paper-machine to manufacture graphical paper, board and packaging paper, or tissue paper.

#### 2. Description of the related art.

[0002] Compound forming fabrics are known in the art. Compound forming fabrics include a top or paper side weave and a bottom or machine side weave. The top and the bottom weave are bound together by binder yarns which alone or in combination can be binder warp or binder weft yarns and therefore weave with the top and bottom weft yarns of the top and bottom weave or with the top and the bottom warp yarns of the top and the bottom weave.

[0003] The binder yarns further can be integral or so called fabric born binder yarns thereby forming at least an integral part of the top weave. U.S. Patent No. 5,152,326 describes a compound forming fabric having integral binder yarns arranged in pairs. Alternatively, the binder yarns can be additional binder yarns thereby forming no integral part of the top weave.

[0004] A compound forming fabric having integral binder warp yarns which is made with a high warp density to provide adequate stability often has a top or paper side surface which is too closed to provide sufficient drainage. On the other hand, if the paper side surface is made less dense to provide sufficient drainage the fabric stability is not sufficient.

[0005] Also a compound forming fabric with integral binder weft yarns which is made with a high weft density to provide adequate stability often has a top or paper side surface which is too closed to provide sufficient drainage. On the other hand if the paper side surface is made less dense to provide sufficient drainage the fabric stability is not sufficient.

[0006] What is needed in the art is a compound forming fabric with good water drainage performance combined with sufficient stability.

### SUMMARY OF THE INVENTION

[0007] The present invention provides a compound forming fabric with good water drainage performance combined with sufficient stability.

[0008] According to a first aspect of the present invention there is provided a compound forming fabric with a top weave and a bottom weave, the fabric includes binder warp yarns, the binder yarns are arranged in groups of at least two interchanging binder yarns, wherein each group of said binder yarns forms an integral part at least

of said top weave, wherein per group of binder yarns the number of bottom warp yarns only weaving the bottom weave is higher than the number of top warp yarns only weaving the top weave.

5 [0009] The expression "interchanging" has to be understood in the sense that for each group at the same time only one of the binder yarns weaves the top weave and only one of the other binder yarns weaves the bottom weave. If a group comprises for example only two binder  
10 warp yarns this means that when the first of the binder warp yarns weaves the top weave the second of the binder warp yarns weaves the bottom weave.

[0010] According to the invention the bottom weave comprises one or more bottom warp yarns only weaving the bottom weave. Further according to the invention the top weave comprises no or one or more than one top warp yarn only weaving the top weave.

[0011] By providing a compound forming fabric which has per group of binder yarns a greater number of bottom warp yarns only weaving the bottom weave than a number of top warp yarns only weaving the top weave, a sufficient stability in general, especially a good dimensional stability and a good wear resistance is achieved and at the same time an open structure is maintained.

25 [0012] According to a preferred embodiment of the present invention, the number of bottom warp yarns only weaving the bottom weave is one more than the number of top warp yarns only weaving the top weave. It was found by the Applicant that by providing per group of binder warp yarns one more bottom warp yarn in the bottom  
30 weave than top warp yarn in the top weave, for many applications sufficient stability can be achieved by maintaining a fabric having a good open structure.

[0013] According to a further preferred embodiment of the present invention there is foreseen that per group of binder warp yarns at least one of said bottom warp yarns only weaving the bottom weave weaves over and under the same bottom weft yarns like said group of interchanging binder warp yarns. Therefore at least one of said bottom warp yarns forms the same knuckles and floats with the bottom weft yarns like the group of binder warp yarns, thereby creating pairs of knuckles and floats allowing to use bottom weft yarns with larger diameter and thereby increasing the wear resistance of the compound fabric.

45 [0014] The above mentioned principles are also applicable for compound forming fabrics having weft binders.

[0015] Therefore according to a second aspect of the present invention there is provided a compound forming fabric having a top weave and a bottom weave, the fabric has binder weft yarns, the binder yarns are arranged in groups of at least two interchanging binder yarns, wherein each group of binder yarns forms an integral part at least of the top weave, wherein per group of binder yarns the number of bottom weft yarns only weaving the bottom  
50 weave is higher than the number of top weft yarns only weaving the top weave.

[0016] Further, according to a preferred embodiment of the second aspect of the present invention the number

of bottom weft yarns only weaving the bottom weave is one more than the number of top weft yarns only weaving the top weave.

**[0017]** In addition, the present invention can include a compound forming fabric having weft binder yarns, wherein per group of binder yarns at least one of the bottom weft yarns only weaving the bottom weave weaves over and under the same bottom warp yarns like the group of binder yarns.

**[0018]** The above mentioned advantages of the present invention are also applicable for compound forming fabric having binder warp yarns and binder weft yarns.

**[0019]** According to a preferred embodiment of the present invention the binder yarns are arranged in pairs.

**[0020]** According to a further preferred embodiment of the present invention there is provided a compound forming fabric having a top weave that include no top yarns weaving only the top weave and extending in the direction of the binder yarns. In the case of a warp binder system the top weave is formed by the weaving of the binder warp yarns with the top weft yarns and the bottom weave is formed by the weaving of the binder warp yarns and the bottom warp yarns with the bottom weft yarns. In the case of a weft binder system the top weave is formed by the weaving of the binder weft yarns with the top warp yarns and the bottom weave is formed by the weaving of the binder weft yarns and the bottom weft yarns with the bottom warp yarns.

**[0021]** To increase the wear resistance of the compound forming fabric on the one hand and to provide an open top weave structure on the other hand it is desirable, if the diameter of the binder yarns is less than the diameter of the bottom yarns extending in the direction of the binder yarns.

**[0022]** According to a preferred embodiment of the present invention the weave repeat of the compound forming fabric has 24 warp yarns or more. According to a further preferred embodiment of the present invention the weave repeat of the compound forming fabric includes 48 weft yarns or more.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

**[0023]** The above-mentioned and other features and advantages of this invention, and the manner of attaining them, will become more apparent and the invention will be better understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawing, split among Figs. 1A, 1B and 1C, wherein the sole drawing is a series of weft cross-sectional diagrams showing consecutive warp paths of all of the warp yarns in a compound forming fabric in accordance with the present invention.

**[0024]** Corresponding reference characters indicate corresponding parts throughout the several views. The exemplification set out herein illustrates one preferred embodiment of the invention, in one form, and such exemplification is not to be construed as limiting the scope

of the invention in any manner.

#### **DETAILED DESCRIPTION OF THE INVENTION**

**[0025]** Referring now to the sole drawing, Figs. 1A, 1B and 1C, there is shown a compound forming fabric 100 having a weave repeat of 24 warp yarns and 48 weft yarns. Fabric 100 includes binder warp yarns B1, B2, B4, B5, B7, B8, B10, B11, B13, B14, B16, B17, B19, B20, B22 and B24 which are arranged in pairs B1, B2 and B4, B5 and B7, B8 and so on.

**[0026]** Fabric 100 includes top weft yarns 1, 3, 4, 6, 7, 9, 10, 12, 13, 15, 16, 18, 19, 21, 22, 24, 25, 27, 28, 30, 31, 33, 34, 36, 37, 39, 40, 42, 43, 45, 46 and 48 and bottom weft yarns 2, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 41, 44 and 47.

**[0027]** Further, fabric 100 includes bottom warp yarns W3, W6, W9, W12, W15, W18, W21 and W24.

**[0028]** Fabric 100 has a top weave 101 and a bottom weave 102. Top weave 101 is a plain weave. Top weave 101 of fabric 100 is formed by the weaving of the interchanging binder yarns B1, B2, B4, B5, etc. with the top weft yarns 1, 3, 4, 6, 7, 9, 10, 12, 13, 15, 16, 18, 19, 21, 22, 24, 25, 27, 28, 30, 31, 33, 34, 36, 37, 39, 40, 42, 43, 45, 46 and 48, wherein the binder yarns of each pair together form a full weave path like a top warp yarn only interweaving with top weft yarns would do. Each of the binder yarns of each binder pair forms part of the top weave 101. Binders B1, B2, B4, B5, B7, B8, B10, B11, B13, B14, B16, B17, B19, B20, B22 and B24 therefore are integral binders.

**[0029]** By way of example, binder yarn B1 consecutively weaves in an over under manner with top weft yarns 1, 3, 4, 6, 7, 9, 10, 12, 13, 15, 16, 18, 19 before passing between top wefts 21, 22, 24 and bottom weft 23 to the bottom weave 102 forming knuckles under bottom weft yarns 26 and 38 to form part of bottom weave 102. When binder B1 weaves with top wefts 1, 3, 4, 6, 7, 9, 10, 12, 13, 15, 16, 18, 19 binder warp B2 weaves the bottom weave 102 by forming knuckles under bottom weft yarns 2 and 14. When binder B1 passes to weave the bottom weave 102 binder B2 passes to weave the top weave 101. Binders B1 and B2 cross each other at the interchange top weft yarn 21.

**[0030]** After that binder B2 consecutively weaves in an over under manner with top wefts 22, 24, 25, 27, 28, 30, 31, 33, 34, 36, 37, 39, 40, 42, 43 to form part of the top weave 101. Next interchange point is top weft yarn 45 where binder B1 and B2 cross each other so that again binder B1 weaves the top weave 101 by weaving with top weft yarns 46 and 47.

**[0031]** As can be seen bottom weave 102 is formed by the weaving of the binder yarns B1, B2, B4, B5, B7, B8, B10, B11, B13, B14, B16, B17, B19, B20, B22, B24 and the bottom warp yarns W3, W6, W9, W12, W15, W18, W21, W24 with the bottom weft yarns 2, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 41, 44 and 47.

**[0032]** Per binder pair B1, B2 and B4, B5 etc. the

number of top warp yarns only weaving with top weft yarns 1, 3, 4, 6, ... is in the current embodiment zero. Per binder pairs B1, B2 and B4, B5, etc. the number of bottom warp yarns W3, W6 etc. is one. Therefore per binder pair the number of bottom warp yarns W3, W6, etc. only weaving the bottom weave 102 is one more than the number of top warp yarns only weaving the top weave 101. Further, for each binder warp yarn pair e.g. B1, B2 and B4, B5, etc. the bottom warp yarns W3 and W6, etc., only weaving the bottom weave 102 weaves over and under the same bottom weft yarns like the pair of binder yarns.

**[0033]** This can be illustrated by way of example. Binder B1 forms knuckles under bottom weft yarns 26 and 38 and weaves over bottom weft yarns 23, 29, 32, 35, 41, 44. Binder B2 forms knuckles under bottom weft yarns 2 and 14 and weaves over bottom weft yarns 5, 8, 11, 17, 20, 47. Bottom warp yarn W3 forms knuckles under bottom weft yarns 2, 14, 26 and 38 and weaves over bottom weft yarns 5, 8, 11, 17, 20, 23, 29, 32, 35, 41, 44, 47.

**[0034]** Alternatively, the present invention can be configured so that yarns B1, B2, B4, B5, B7, B8, B10, B11, B13, B14, B16, B17, B19, B20, B22 and B24 are binder weft yarns, with top warp yarns 1, 3, 4, 6, 7, 9, 10, 12, 13, 15, 16, 18, 19, 21, 22, 24, 25, 27, 28, 30, 31, 33, 34, 36, 37, 39, 40, 42, 43, 45, 46 and 48, bottom warp yarns 2, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 41, 44 and 47, and bottom weft yarns W3, W6, W9, W12, W15, W18, W21 and W24.

**[0035]** While this invention has been described as having a preferred design, the present invention can be further modified within the spirit and scope of this disclosure. This application is therefore intended to cover any variations, uses, or adaptations of the invention using its general principles. Further, this application is intended to cover such departures from the present disclosure as come within known or customary practice in the art to which this invention pertains and which fall within the limits of the appended claims.

## Claims

1. A compound forming fabric having a top weave and a bottom weave, said compound forming fabric comprising: a plurality of binder warp yarns being arranged in a plurality of groups of at least two interchanging binder yarns, wherein each of said group of interchanging binder yarns forms an integral part at least of said top weave, and wherein per group of binder yarns the number of bottom warp yarns only weaving the bottom weave is greater than the number of top warp yarns only weaving the top weave.
2. The compound forming fabric of claim 1, wherein said number of bottom warp yarns only weaving the bottom weave is one more than said number of top

warp yarns only weaving the top weave.

3. The compound forming fabric of claim 1, wherein for said each group of said plurality of interchanging binder warp yarns at least one of said bottom warp yarns only weaving the bottom weave weaves over and under the same bottom weft yarns like said each group of said plurality of interchanging binder warp yarns.
4. The compound forming fabric of claim 1, further including a plurality of binder weft yarns.
5. The compound forming fabric of claim 1, wherein said each group of said plurality of interchanging binder yarns forms an integral part of the bottom weave.
6. A compound forming fabric having a top weave and a bottom weave, said compound forming fabric comprising: a plurality of binder weft yarns being arranged in a plurality of groups of at least two interchanging binder yarns, wherein each group of said interchanging binder yarns forms an integral part at least of the top weave, and wherein per group of binder yarns the number of bottom weft yarns only weaving the bottom weave is greater than the number of top weft yarns only weaving the top weave.
7. The compound forming fabric of claim 6, wherein said number of bottom weft yarns only weaving the bottom weave is one more than said number of top weft yarns only weaving the top weave.
8. The compound forming fabric of claim 6, wherein for said each group of said plurality of interchanging binder weft yarns at least one of said bottom weft yarns only weaving the bottom weave weaves over and under the same bottom warp yarns like said each group of said plurality of interchanging binder weft yarns.
9. The compound forming fabric of claim 1 or 6, wherein said plurality of interchanging binder yarns are arranged in pairs.
10. The compound forming fabric of claim 1 or 6, wherein the top weave includes no top yarn weaving only the top weave and extending in the direction of said binder yarns.
11. The compound forming fabric of claim 1 or 6, further including a plurality of bottom yarns extending in the direction of said plurality of interchanging binder yarns, wherein the diameter of said plurality of interchanging binder yarns is less than the diameter of said plurality of bottom yarns.

- 12.** The compound forming fabric of claim 1 or 6, further including a repeat having at least 24 warp yarns.
- 13.** The compound forming fabric of claim 1 or 6, further including a repeat having at least 48 weft yarns.

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Fig.1A

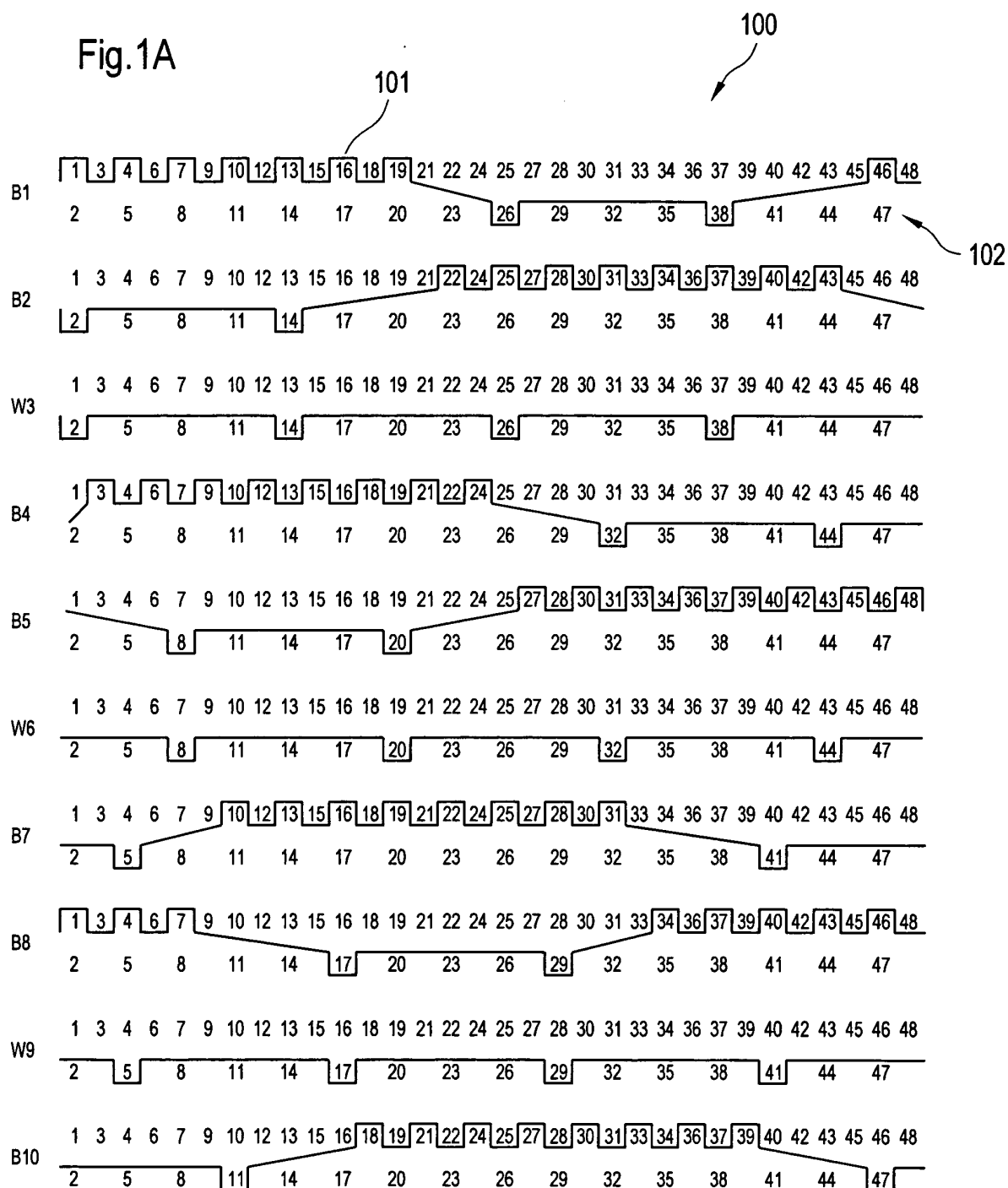


Fig.1B

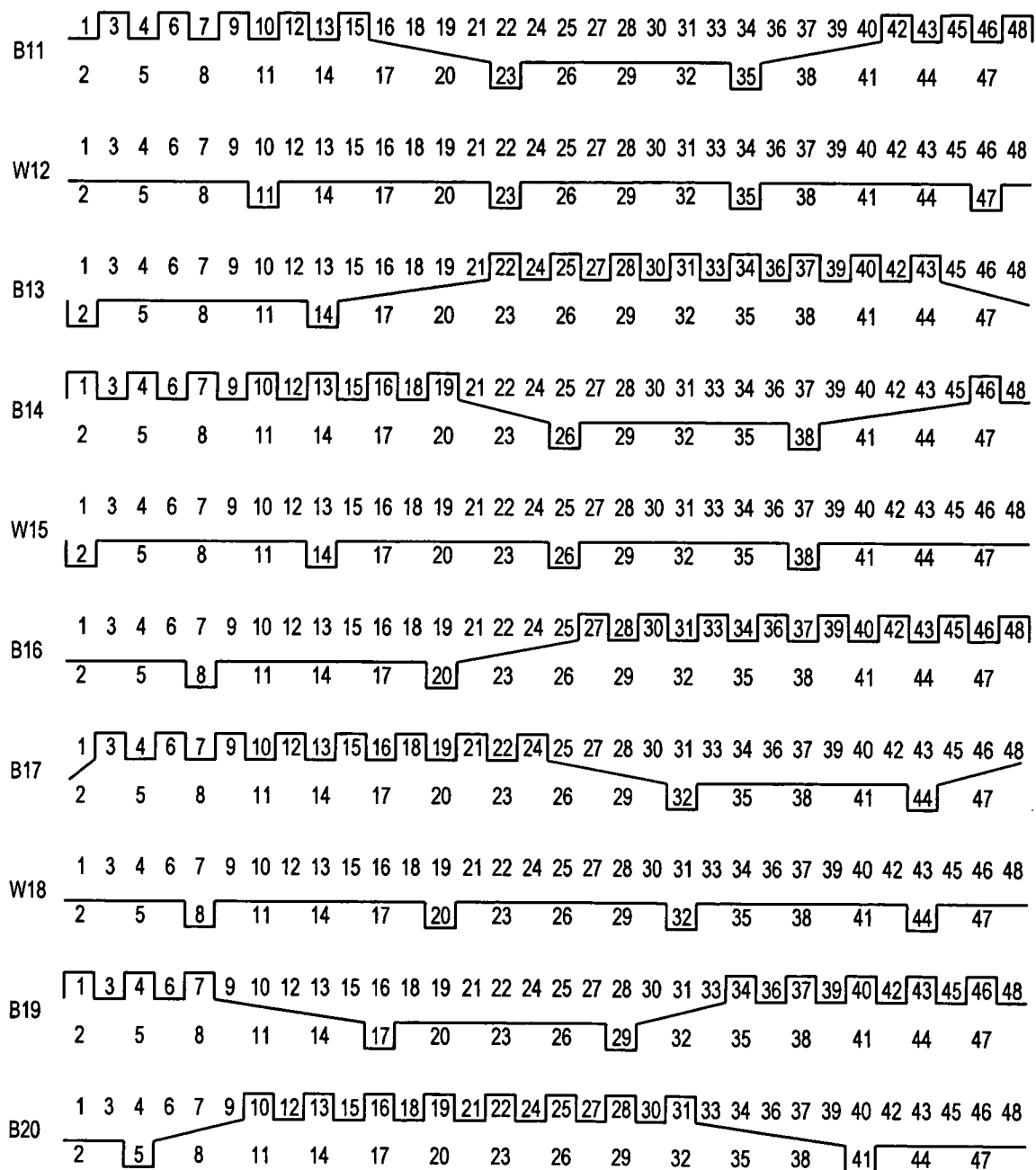
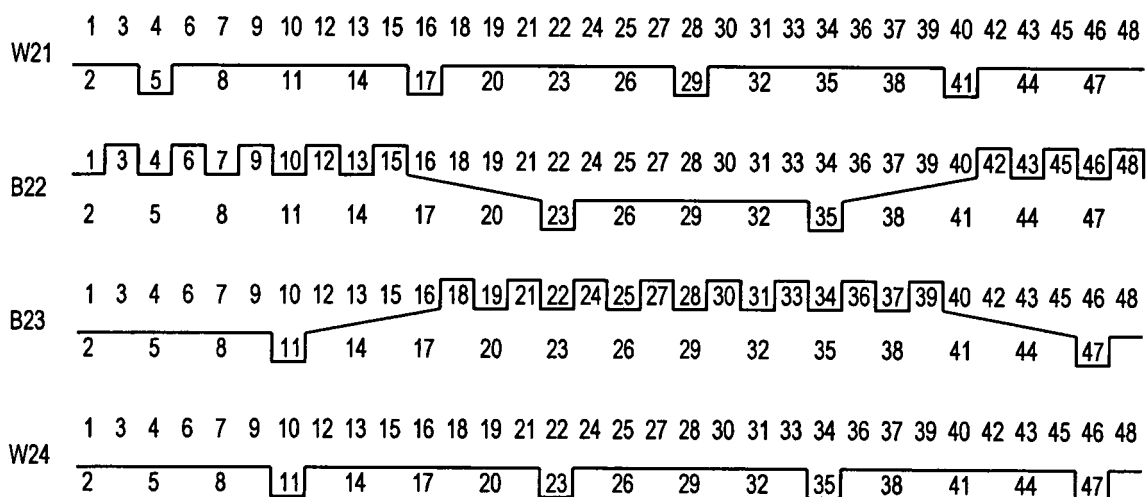


Fig.1C





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Application Number  
EP 05 10 7385

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                     |                                  |                                         |
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| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                                                                       | Relevant to claim                | CLASSIFICATION OF THE APPLICATION (IPC) |
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| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                     |                                  | TECHNICAL FIELDS<br>SEARCHED (IPC)      |
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| Place of search                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                     | Date of completion of the search | Examiner                                |
| Munich                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                     | 14 December 2005                 | Pregetter, M                            |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                                                                                                                                                     |                                  |                                         |

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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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