



(11) Publication number : **0 522 778 A1**

(12) **EUROPEAN PATENT APPLICATION**

(21) Application number : **92306056.0**

(51) Int. Cl.⁵ : **D04B 1/24**

(22) Date of filing : **30.06.92**

(30) Priority : **05.07.91 JP 192652/91**

(43) Date of publication of application :
13.01.93 Bulletin 93/02

(84) Designated Contracting States :
DE ES FR GB IT

(71) Applicant : **SHIMA SEIKI MFG., LTD.**
85, Sakata
Wakayama-shi, Wakayama-ken (JP)

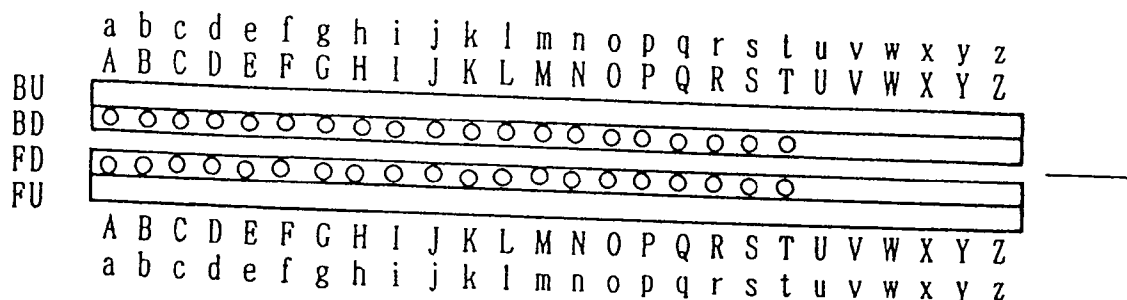
(72) Inventor : **Takahashi Nobuyasu**
39-2, Higashi-sakamoto, Iwade-cho
Naga-gun, Wakayama-ken (JP)
Inventor : **Okuno, Masao**
2-4-5, Higashi-takamatsu
Wakayama-shi, Wakayama-ken (JP)

(74) Representative : **Hillier, Peter**
Reginald W. Barker & Co., 13, Charterhouse
Square
London, EC1M 6BA (GB)

(54) **Tubular knitted fabric having a three-dimensional silhouette shape and method of knitting the same.**

(57) A method of knitting a tubular knitted fabric of three-dimensional silhouette shape includes knitting a tubular fabric, which consists of a front half and a back half joined at side ends to each other, with the use of a flat knitting machine having four, upper front, lower front, upper rear, and lower rear, needle beds (BU,BD,FD,FU). The number of wales at one of the two, front and back, halves of the tubular fabric is increased or decreased so that a difference in the wale number is given between the two halves. During the transfer of loops of yarn from one needle bed which carries a more number of wales to another needle bed which carries a less number of wales, the yarn is tucked on an unoccupied knitting needle of the needle bed disposed opposite to the needle bed to which the loops are transferred. During the knitting of a portion containing the loops to be transferred, the yarn is threaded through knitting needles of the needle bed which carry no loops. The loops are transferred by knocking over across the tucked loop on the unoccupied knitting needle.

Fig. 1



BACKGROUND OF THE INVENTION

The present invention relates to a tubular knitted fabric in which the circumferential length is varied to form a three-dimensional silhouette shape and a method of knitting the same.

Using a common flat knitting machine provided with two, front and rear, needle beds, a tubular knitted fabric is produced by knitting a front half of the tubular fabric from yarn threaded onto knitting needles of the front needle bed and a back half, which is joined at both side ends to the front half, from the yarn threaded onto the rear needle bed, in which the procedure is repeated a predetermined number of times for forming a tubular shape.

In common, such tubular knitted fabrics are finished as garments, e.g. sweaters, tights, or pants.

The tubular knitted fabric can be adjusted in the size or circumferential length by increasing and/or decreasing the number of the knitting needles to be used or more specifically, by varying the number of wales.

When the circumferential length is lengthened by increasing in steps the number of the knitting needles to be used, the tubular shape can be turned to e.g. a sleeve having a wide cuff.

An example for shortening the circumferential length by decreasing the number of the knitting needles to be used is disclosed in Japanese Patent Laid-open Publication 229248(1990) in which a body portion and two sleeve portions are gradually reduced in the width from the armpits as being knitted separately.

The prior art method is successfully applicable to knitting of a front-to-back asymmetrical shape, e.g. a gourd shape. However, if a tubular fabric is designed for producing a sweater or one-piece garment, it should have a front half raised at the breast for corresponding to a human body while a back half needs no raise. In fact, the tubular fabric is not symmetrical from the front to the back.

When a raise on the front half of the tubular knitted fabric is produced by increasing and then, decreasing the number of wales, a difference in the number of wales is created between the two, front and back, halves. As the result, both side edges of the front half where the wales are increased tend to be stretched towards the back half so that the seams between the two halves become longer.

When a garment, e.g. a sweater, tights, or pants, produced from the tubular knitted fabric in which the seams between two, front and back, halves are elongated is in use, loops of yarn along the seams between the two halves are stressed to loose thus appearing unfavorable.

Also, if the difference in the number of wales between the two, front and back, halves of the tubular knitted fabric is too great, the yarn itself will be broken. Hence, as the difference in the number of wales between the two halves is determined within a specific

range, the shape of a raise and variations in the circumferential length will be limited more or less.

The present invention has been introduced for overcoming the foregoing drawbacks and its object is to provide an improved tubular knitted fabric of three-dimensional silhouette shape which ensures a natural fit in use as a garment without impairing an appearance and a method of knitting the same.

SUMMARY OF THE INVENTION

A method of knitting a tubular knitted fabric of three-dimensional silhouette shape, according to the present invention, is provided for achievement of the object, comprising the steps of: knitting a tubular fabric, which consists of a front half and a back half joined at side ends to each other, with the use of a flat knitting machine having four, upper front, lower front, upper rear, and lower rear, needle beds; increasing or decreasing the number of wales at one of the two, front and back, halves of the tubular fabric so that a difference in the wale number is given between the two halves; during the transfer of loops of yarn from one needle bed which carries a more number of wales to another needle bed which carries a less number of wales, tucking the yarn on an unoccupied knitting needle of the needle bed disposed opposite to the needle bed to which the loops are transferred; during the knitting of a portion containing the loops to be transferred, threading the yarn through knitting needles of the needle bed which carry no loops; and transferring the loops by knocking over across the tucked loop on the unoccupied knitting needle.

Another method of knitting a tubular knitted fabric of three-dimensional silhouette shape, according to the present invention, comprises the steps of: knitting a tubular fabric, which consists of a front half and a back half joined at side ends to each other, with the use of a flat knitting machine having four, upper front, lower front, upper rear, and lower rear, needle beds; increasing or decreasing the number of wales at one of the two, front and back, halves of the tubular fabric so that a difference in the wale number is given between the two halves; and for averting the twisting of any loop during the transfer of loops of yarn from one needle bed which carries a more number of wales to another needle bed which carries a less number of wales, feeding the yarn in such a direction that a twist is eliminated.

A tubular knitted fabric according to the present invention comprises a front half and a back half coupled at the side ends to each other, in which the circumferential length is varied by increasing and/or decreasing the number of wales of one of the two, front and back, halves for forming a three-dimensional silhouette shape.

The action of the present invention will now be described.

Using a known "4-bed" knitting machine provided with four, upper-front, lower-front, upper-rear, and lower-rear, needle beds, the front half of e.g. a sweater is knitted on one of the front or rear needle beds while the back half is knitted on the opposite needle bed as being joined to the front half so that a tubular shape can be produced.

For forming a raised breast region of the front half of the tubular shape, the number of wales in the front half is increased in steps by a degree corresponding to the size of a raise while the wales in the back half remain unchanged.

For the purpose of minimizing a difference in the number of wales between the two, front and back, halves, loops at both side edges of the front half are transferred to the back half.

A row of loops is added to the transferred loops to the back half. For averting the twisting of any loop during transfer of the row of loops back to the front half, it is prepared that one loop is intentionally twisted in advance so that it can be returned back to the normal during transfer from the back half to the front half.

Accordingly, no twist on the loops will appear after transferred from the back half to the front half.

The same procedure will be applied in knitting a specific tubular shape by increasing and then, decreasing the number of wales in the front half.

The specifically shaped three-dimensional knitted fabric can thus be produced through increasing and/or decreasing the number of wales in either of the two, front and back, halves.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig.1 illustrates a course of knitting a straight portion of a tubular knitted fabric according to the present invention;

Figs.2 and 3 show courses of preparation for starting a constricted portion in succession to the straight portion;

Figs.4 to 32 show courses of decreasing the number of wales to shorten the circumferential length for knitting a first half of the constricted portion of the tubular knitted fabric;

Figs.33 to 73 show courses of increasing the number of wales to lengthen the circumferential length for knitting a second half of the constricted portion;

Fig.74 is a schematic view of a knitted fabric produced by a method other than the method of the present invention;

Fig.75 is a front view of the constricted portion of the tubular knitted fabric produced by the method of the present invention;

Fig.76 is a front view showing a modification of the constricted portion of the tubular knitted fabric produced by the method of the present invention; Fig.77 is a front view showing another modifica-

tion of the constricted portion of the tubular knitted fabric produced by the method of the present invention;

Fig.78 is a front view showing a further modification of the constricted portion of the tubular knitted fabric produced by the method of the present invention; and

Fig.79 is a front view showing a still further modification of the constricted portion of the tubular knitted fabric produced by the method of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Tubular knitted fabrics of a three-dimensional silhouette form and a method of knitting the same according to the present invention will be described referring to the accompanying drawings.

As not particularly shown, a knitting machine employed for implementation of the embodiments is a so-called "fourbed flat knitting machine" which comprises two pairs of front and rear needle beds arranged upper and lower and a carriage of single lock type having both knitting lock and transfer lock in the same phase.

Figs.1 to 73 illustrate a series of courses for knitting procedure, in which the lower front needle bed is denoted by FD, the upper front needle bed by FU, the lower rear needle bed by BD, and the upper rear needle bed by BU. Also, the alphabetic capital letters A to Z represent knitting needles on the lower needle beds and the small letters a to z represent knitting needles on the upper needle beds.

It is assumed that each knitted fabric is fabricated by plain knitting with the use of a minimum number of the knitting needles for ease of description.

According to the present invention, a tubular fabric shaped symmetrical front to rear is knitted using a thread of yarn fed in the counter-clockwise direction. In action, the number of wales of a front half of the fabric is first reduced in steps to shorten the circumferential length and then, increased thus forming a constricted part of the tubular fabric along a waistline, as shown in Fig.75.

A straight portion of the tubular fabric is produced by coupling both side ends to each other which are hanged on the knitting needles (A and T) of their respective lower needle beds FD and BD, as shown in Fig.2.

In Fig.2, as the carriage runs to the right, the yarn is fed to make a row of loops on the knitting needles A to T of the lower front needle bed FD. Then, as the carriage runs back to the left, another row of loops are produced on the knitting needles T to A of the lower rear needle bed BD, as shown in Fig.3.

After repeating once again the two courses shown in Figs.2 and 3, the loops of yarn on the knitting

needles A to G and N to T of the lower front needle bed FD are transferred onto the knitting needles a to g and n to t of the upper rear needle bed BU, as shown in Fig.4.

The repeating of the courses of Figs.2 and 3 is for decrease in at least every two courses in order to avert twisting of loops during transfer from needles to other needles.

As shown in Fig.5, the two rear needle beds BD, BU are moved one knitting needle distance to the right by racking and the loops on the knitting needles a to g of the upper rear needle bed BU are transferred onto the knitting needles B to H of the lower front needle bed FD so that two loops of the yarn overlap with each other on the knitting needle H of the lower front needle bed FD.

Then, the two rear needle beds BD, BU are moved back one knitting needle distance to the left by racking and the loops on the knitting needles n to t of the lower rear needle bed BD are transferred onto the knitting needles M to S of the lower front needle bed FD so that the loop from the knitting needle n of the lower rear needle bed BD can be placed over the loop hanged on the knitting needle M of the lower front needle bed FD, as shown in Fig.6.

In succession, as shown in Fig.7, the yarn is fed to form loops on the knitting needles B to S of the lower front needle bed FD. Accordingly, the loops hanged on the knitting needles A to T of the lower front needle bed FD shown in Fig.1 are reduced by two to hang on the knitting needles B to S.

After the yarn is fed to form loops on the knitting needles T to B of the lower rear needle bed BD as shown in Fig.8, it is threaded back from left to right thus forming a loop on the knitting needle A of the same, as shown in Fig. 9.

As shown in Fig.10, the feeder which forms a loop on the knitting needle A of the lower rear needle bed BD is displaced out from the knitting area of the machine and then, the yarn is fed to form a row of loops on the knitting needles B to S of the lower front needle bed FD, as shown in Fig.11, while the knitting needle T remains unoccupied where the yarn is tucked.

Then, the loops on the knitting needles B to G of the lower front needle bed FD are transferred onto the knitting needles b to g of the upper rear needle bed BU, as shown in Fig.12. The two rear needle beds BD, BU are moved one knitting needle distance to the right, as shown in Fig.13, and the loops on the knitting needles b to g of the upper rear needle bed BU are transferred onto the knitting needles C to H of the lower front needle bed FD so that two loops of the yarn overlap with each other on the knitting needle H of the lower front needle bed FD. Simultaneously, the loop on the knitting needle A of the lower rear needle bed BD is transferred onto the knitting needle B of the lower front needle bed FD.

It should be noted that if the yarn is threaded from

the knitting needle T to B of the lower rear needle bed BD, as shown in Fig.8, and the knitting procedure shown in Fig.9 is not carried out, the loop on the knitting needles B of the lower front needle bed FD, as shown in Fig.13, becomes twisted as denoted by the arrow x in Fig.74.

As shown in Fig.14, the two rear needle beds BD, BU are then returned one knitting needle distance to the left and the yarn is fed to form a further row of loops on the knitting needles S to B of the lower rear needle bed BD.

The loops on the knitting needles N to S of the lower front needle bed FD are transferred onto the knitting needles n to s of the upper rear needle bed BU, as shown in Fig.15, and also, the tucked yarn shown in Fig.11 is transferred onto the knitting needle T of the lower rear needle bed BD.

The loops are transferred as knocked over across the loop transferred from the knitting needle T of the lower front needle bed FD to the knitting needle T of the lower rear needle bed BD.

More particularly, if latch needles are used for knitting, the knitting needles for receiving the loops should be arranged to move upward to a height where the loops to be transferred can clear over the distal end of the opening latch of each knitting needle.

If compound needles are used, the loops to be transferred shall be arranged to ride over the slider during the upward movement of the knitting needles for receiving the loops and when the knitting needles move backward, slide on the slider to be knocked over across the tucked yarn.

As shown in Fig.16, the two rear needle bed BD, BU are moved one knitting needle distance to the left by racking and the loops on the knitting needles n to s of the upper rear needle bed BU are transferred onto the knitting needles M to R of the lower front needle bed FD so that two loops overlap with each other on the knitting needle M of the lower front needle bed FD. Simultaneously, the loop on the knitting needle T of the lower rear needle bed is transferred onto the knitting needle S of the lower front needle bed FD.

More particularly, the tucked yarn on the knitting needle T of the lower rear needle bed BD which was not looped at the step of Fig.14 is threaded through the loop carried on the knitting needle T of the lower front needle bed FD for transfer to the knitting needle S of the lower front needle bed FD.

As apparent from Figs.11 to 16, the tucked yarn on the knitting needle T of the lower front needle bed FD becomes a loop of the tubular knitted fabric in the end, as shown in Fig.11, like as the other loops. Hence, the feeding length of the tucked yarn is preferably equal to the yarn length which forms a unit loop or stitch.

The yarn is fed to form a row of loops on the knitting needles B to S of the lower front needle bed FD, as shown in Fig.17, and in turn, another row of loops

on the knitting needles S to B of the lower rear needle bed BD, as shown in Fig.18. This action shown in Figs.17 and 18 is repeated once more.

As shown in Fig.19, the loops on the knitting needles B to G and N to S of the lower front needle bed FD are then transferred onto the corresponding knitting needles b to g and n to s of the upper rear needle bed BU. The two rear needle beds BD,BU are moved one knitting needle distance to the right by racking and the loops on the knitting needles b to g of the upper rear needle bed BU are transferred onto the knitting needles C to H of the lower front needle bed FD so that two loops overlap with each other on the knitting needle H of the lower front needle bed FD, as shown in Fig.20.

Then, the two rear needle beds BD,BU are moved back one knitting needle distance to the left by racking and the loops on the knitting needles n to s of the lower rear needle bed BD are transferred onto the knitting needles M to R of the lower front needle bed FD so that the loop from the Knitting needle n of the lower rear needle bed BD is placed over the loop on the knitting needle M of the lower front needle bed FD, as shown in Fig.21.

As illustrated in Fig.22, the yarn is fed to from a row of loops on the knitting needles C to R of the lower front needle bed FD. Accordingly, the row of loops on the knitting needles C to R is two loops less than the preceding row of the loops on the knitting needles B to S of the lower front needle bed FD shown in Fig.18.

The yarn is fed from right to left to form a row of loops on the knitting needles S to C of the lower rear needle bed BD, as shown in Fig.23, and then threaded in a reverse direction to form another row of loops starting from the knitting needle B of the lower rear needle bed BD, as shown in Fig.24.

The feeder after threading through the knitting needle A of the lower rear needle bed BD is removed out to the left from the knitting area, as shown in Fig.25, and the yarn is fed to from a row of loops on the knitting needles C to R of the lower front needle bed FD, as shown in Fig.26, while the knitting needle S remains unoccupied where the yarn is tucked.

As shown in Fig.27, the loops on the knitting needles C to G of the lower front needle bed FD are transferred onto the knitting needles c to g of the upper rear needle bed BU. Then, the two rear needle beds BD,BU are displaced one knitting needle distance to the right by racking and the loops on the knitting needles c to g of the upper rear needle bed BU are transferred onto the knitting needles D to H of the lower front needle bed FD so that two loops overlap with each other on the knitting needle H, as shown in Fig.28. Simultaneously, the loop on the knitting needle B of the lower rear needle bed BD is transferred onto the knitting needle B of the lower front needle bed FD.

The two rear needle beds BD,BU are moved back

to the left by one knitting needle distance and the yarn is fed to from a row of loops on the knitting needles R to C of the lower rear needle bed BD, as shown in Fig.29.

As shown in Fig.30, the loops on the knitting needles N to R of the lower front needle bed FD are transferred onto the knitting needles n to r of the upper rear needle bed BU. Also, the tucked yarn shown in Fig.26 is transferred onto the knitting needle S of the lower rear needle bed BD.

For transfer, the loops to the knitting needles of the lower rear needle bed BU are knocked over across the tucked loop transferred from the needle bed FD to the needle bed BD in the same manner as described previously.

The two rear needle beds BD,BU are moved one knitting needle distance to the left by racking and the loops on the knitting needles n to r of the upper rear needle bed BU are transferred onto the knitting needles M to Q of the lower front needle bed FD so that two loops overlap with each other on the knitting needle M of the lower front needle bed FD, as shown in Fig.31.

The procedure shown in Figs.1 to 31 is repeated a given number of times to reduce the circumferential length of the tubular knitted fabric. Then, the yarn is fed to from a row of loops on the knitting needles C to R of the lower front needle bed FD, as shown in Fig.32. In succession, the number of wales is increased in the procedure from Fig.33. More specifically, the two loops are transferred by split stitch from the knitting needles H and M of the lower front needle bed FD to the knitting needles h and m of the upper rear needle bed BU respectively, as shown in Fig.33. Then, the loops on the knitting needles C to G of the lower front needle bed FD are transferred onto the knitting needles c to g of the upper rear needle bed BU, as shown in Fig.34.

As shown in Fig.35, the two rear needle bed BD,BU are moved one knitting needle distance to the left by racking and the loops on the knitting needles c to h of the upper rear needle bed BU are transferred onto the knitting needles B to G of the lower front needle bed FD. Simultaneously, the loops on the knitting needles M to R of the lower front needle bed FD are transferred onto the knitting needles n to s of the upper rear needle bed BU.

The two rear needle beds BD,BU are moved back to the right by the same distance and the loops on the knitting needles m to s of the upper rear needle bed BU are transferred onto the knitting needles M to S of the lower front needle bed FD, as shown in Fig.36.

The yarn is fed to form a row of loops on the knitting needles R to C of the lower rear needle bed BD and its end is tucked on the knitting needle B which remains unoccupied, as shown in Fig.37. Then, the yarn is fed to form a row of loops on the knitting needles C to R of the lower front needle bed FD, as shown

in Fig.38.

As shown in Fig.39, the tucked yarn on the knitting needle B of the lower rear needle bed BD is transferred onto the knitting needle B of the lower front needle bed FD. It is then transferred back to the knitting needle B of the lower rear needle bed BD, as shown in Fig.40.

The yarn from the feeder is threaded from right to left to form a loop on the knitting needle S of the lower front needle bed FD, as shown in Fig.41. The feeder is removed out from the knitting area, as shown in Fig.42, and the yarn is fed to form a row of loops on the knitting needles R to B of the lower rear needle bed BD, as shown in Fig.43.

The loop on the knitting needle S of the lower front needle bed FD is transferred onto the knitting needle S of the lower rear needle bed BD, as shown in Fig.44, and the yarn is fed to form another row of loops on the knitting needles C to R of the lower front needle bed FD, as shown in Fig.45.

As the result of action through the courses illustrated in Figs.33 to 45, the number of the wales is increased by two as the loops on the knitting needles C to R of the needle bed BD turn to those on the knitting needles B to S.

The two loops on the knitting needles H and M of the lower front needle bed FD are transferred by split stitch onto the knitting needle h and m of the upper rear needle bed BU respectively, as shown in Fig.46. Then, the loops on the knitting needles C to G of the lower front needle bed FD are transferred onto the knitting needles c to g of the upper rear needle bed BU, as shown in Fig.47.

The two rear needle beds BD, BU are moved one knitting needle distance to the left by racking and the loops on the knitting needles c to h of the upper rear needle bed BU are transferred onto the knitting needles B to G of the lower front needle bed FD, as shown in Fig.48. Simultaneously, the loops on the knitting needles M to R of the lower front needle bed FD are transferred onto the knitting needles n to s of the upper rear needle bed BU. In succession, the two rear needle beds BD, BU are moved back by one knitting needle distance to the right and the loops on the knitting needles m to s of the upper rear needle bed BU are transferred onto the knitting needles M to S of the lower front needle bed FD, as shown in Fig.49.

As shown in Fig.50, the yarn is fed to form a row of loops on the knitting needles S to B of the lower rear needle bed BD. Then, the yarn is further fed to form another row of loops on the knitting needles B to S of the lower front needle bed FD, as shown in Fig.51, and also, threaded to form a further row of loops on the knitting needles S to B of the lower rear needle bed BD, as shown in Fig.52. Finally, the yarn is fed to form a row of loops on the knitting needles B to S of the lower front needle bed FD, as shown in Fig.53.

As the result, the loops on the knitting needles C

to R of the lower front needle bed FD shown in Fig.45 are turned to the loops on the knitting needles B to S, thus increasing the wales by two.

A series of the courses shown in Figs.33 to 52 are repeated from Fig.54 to Fig.73 so that the wales are increased in number.

More particularly, the two loops on the knitting needles H and M of the lower front needle bed FD are transferred by split stitch onto the knitting needle h and m of the upper rear needle bed BU respectively, as shown in Fig.54. Then, the loops on the knitting needles B to G of the lower front needle bed FD are transferred onto the knitting needles b to g of the upper rear needle bed BU, as shown in Fig.55.

The two rear needle beds BD, BU are moved one knitting needle distance to the left by racking and the loops on the knitting needles b to h of the upper rear needle bed BU are transferred onto the knitting needles A to G of the lower front needle bed FD, as shown in Fig.56. Simultaneously, the loops on the knitting needles M to S of the lower front needle bed FD are transferred onto the knitting needles n to t of the upper rear needle bed BU. In succession, the two rear needle beds BD, BU are moved back by one knitting needle distance to the right and the loops on the knitting needles m to t of the upper rear needle bed BU are transferred onto the knitting needles M to T of the lower front needle bed FD, as shown in Fig.57.

As shown in Fig.58, the yarn is fed to form a row of loops on the knitting needles S to B of the lower rear needle bed BD and its end is tucked on the knitting needle A which remains unoccupied. The yarn is then fed to form a row of loops on the knitting needles B to S of the lower front needle bed FD, as shown in Fig.59.

The tucked yarn on the knitting needle A of the lower rear needle bed BD shown in Fig.58 is transferred onto the knitting needle A of the lower front needle bed FD, as shown in Fig.60. It is then transferred back to the knitting needle A of the lower rear needle bed BD, as shown in Fig.62.

The yarn from the feeder is threaded from right to left to form a loop on the knitting needle T of the lower front needle bed FD, as shown in Fig.62. The feeder is rightwardly removed out from the knitting area, as shown in Fig.63, and the yarn is fed to form a row of loops on the knitting needles S to A of the lower rear needle bed BD, as shown in Fig.64.

The loop on the knitting needle T of the lower front needle bed FD is transferred onto the knitting needle T of the lower rear needle bed BD, as shown in Fig.65, and the yarn is fed to form another row of loops on the knitting needles B to S of the lower front needle bed FD, as shown in Fig.66.

As the result of action through the courses illustrated in Figs.54 to 66, the number of the wales is further increased by two as the loops on the knitting needles B to S of the needle bed BD turn to those on the

knitting needles A to T.

Also, the two loops on the knitting needles H and M of the lower front needle bed FD are transferred by split stitch onto the knitting needle h and m of the upper rear needle bed BU respectively, as shown in Fig.67. Then, the loops on the knitting needles B to G of the lower front needle bed FD are transferred onto the knitting needles b to g of the upper rear needle bed BU, as shown in Fig.68.

The two rear needle beds BD, BU are moved one knitting needle distance to the left by racking and the loops on the knitting needles b to h of the upper rear needle bed BU are transferred onto the knitting needles A to G of the lower front needle bed FD, as shown in Fig.69. Simultaneously, the loops on the knitting needles M to S of the lower front needle bed FD are transferred onto the knitting needles n to t of the upper rear needle bed BU. In succession, the two rear needle beds BD, BU are moved back by one knitting needle distance to the right and the loops on the knitting needles m to t of the upper rear needle bed BU are transferred onto the knitting needles M to T of the lower front needle bed FD, as shown in Fig.70.

As illustrated in Fig.71, the yarn is fed to form a row of loops on the knitting needles T to A of the lower rear needle bed BD. Then, the yarn is further fed to form another row of loops on the knitting needles A to T of the lower front needle bed FD, as shown in Fig.72, and also, threaded to form a further row of loops on the knitting needles T to A of the lower rear needle bed BD, as shown in Fig.73.

As the result, the loops on the knitting needles B to S of the lower front needle bed FD shown in Fig.66 are turned to the loops on the knitting needles A to T, thus increasing the wales by two.

The resultant tubular knitted fabric has a front-to-back asymmetrical shape in which the front half is composed of a less number of wales, as best shown in Fig.75. The back half has both side ends extending to the front for joining to the front half.

It would be understood that the two front needle beds FD, FU may be moved by racking although the racking movement of the two rear needle beds BD, BU only is implemented in the embodiment.

Although the waist constricted part of the tubular fabric is knitted by decreasing the number of wales at both the side ends of the front half, it may be produced by decreasing the number of wales at one side end of the front half, as shown in Fig.76, by increasing the number of wales at the side end of the same, as shown in Fig.77, or by increasing the number of wales at the two side ends and then, decreasing the same for forming extensions, as shown in Fig.77. Also, a three-dimensional silhouette form of the tubular fabric may be produced using any combination of the foregoing techniques.

Claims

1. A method of knitting a tubular knitted fabric of three-dimensional silhouette shape comprising the steps of:

knitting a tubular fabric, which consists of a front half and a back half joined at side ends to each other, with the use of a flat knitting machine having four, upper front, lower front, upper rear, and lower rear, needle beds;

increasing or decreasing the number of wales at one of the two, front and back, halves of the tubular fabric so that a difference in the wale number is given between the two halves;

during the transfer of loops of yarn from one needle bed which carries a more number of wales to another needle bed which carries a less number of wales, tucking the yarn on an unoccupied knitting needle of the needle bed disposed opposite to the needle bed to which the loops are transferred;

during the knitting of a portion containing the loops to be transferred, threading the yarn through knitting needles of the needle bed which carry no loops; and

transferring the loops by knocking over across the tucked loop on the unoccupied knitting needle.

2. A method of knitting a tubular knitted fabric of three-dimensional silhouette shape comprising the steps of:

knitting a tubular fabric, which consists of a front half and a back half joined at side ends to each other, with the use of a flat knitting machine having four, upper front, lower front, upper rear, and lower rear, needle beds;

increasing or decreasing the number of wales at one of the two, front and back, halves of the tubular fabric so that a difference in the wale number is given between the two halves; and

for averting the twisting of any loop during the transfer of loops of yarn from one needle bed which carries a more number of wales to another needle bed which carries a less number of wales, feeding the yarn in an opposite direction so as to eliminate a twist.

3. A tubular knitted fabric comprising a front half and a back half coupled at the side ends to each other, in which the circumferential length is varied by increasing and/or decreasing the number of wales of one of the two, front and back, halves for forming a three-dimensional silhouette shape.

Fig. 1

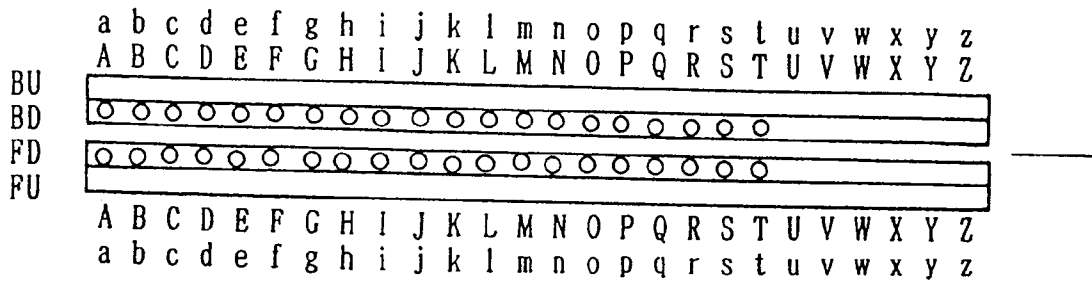


Fig. 2

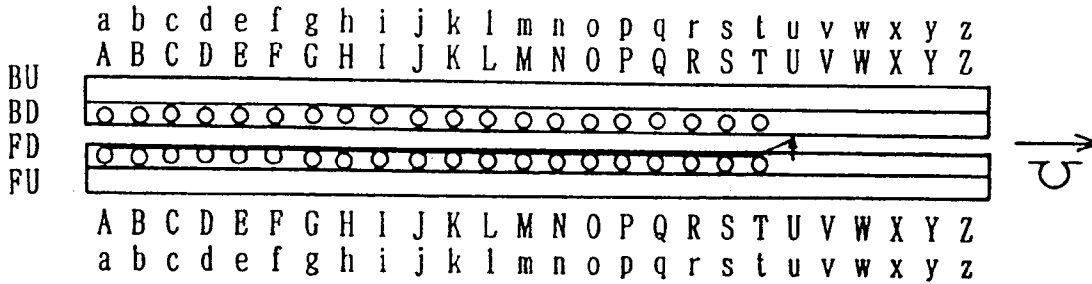


Fig. 3

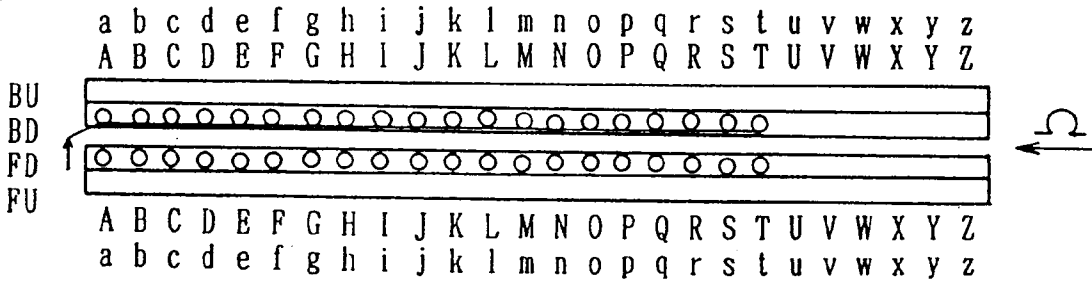


Fig. 4

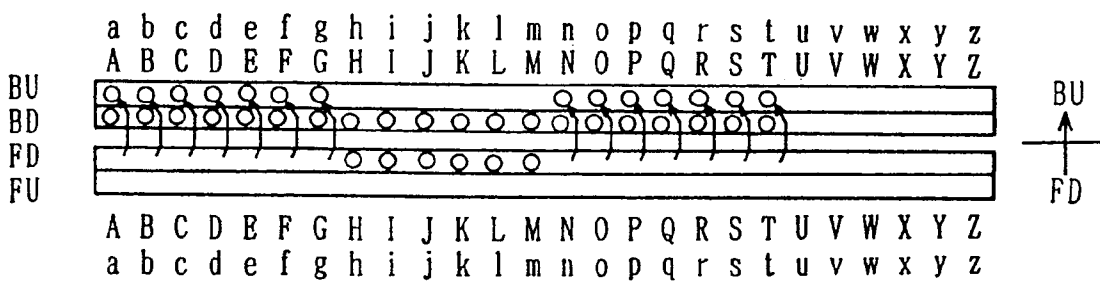


Fig. 5

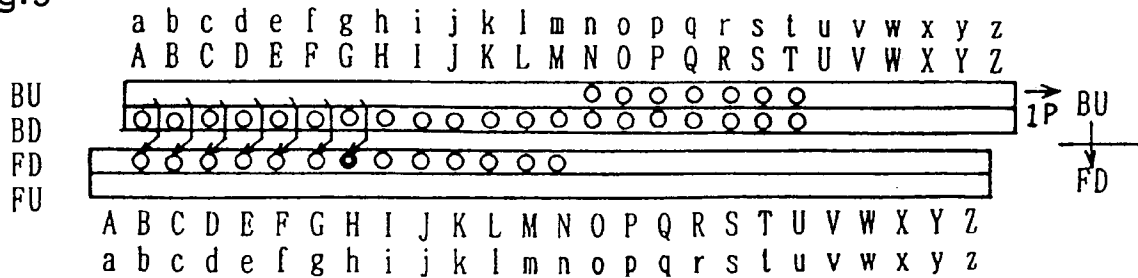


Fig.6

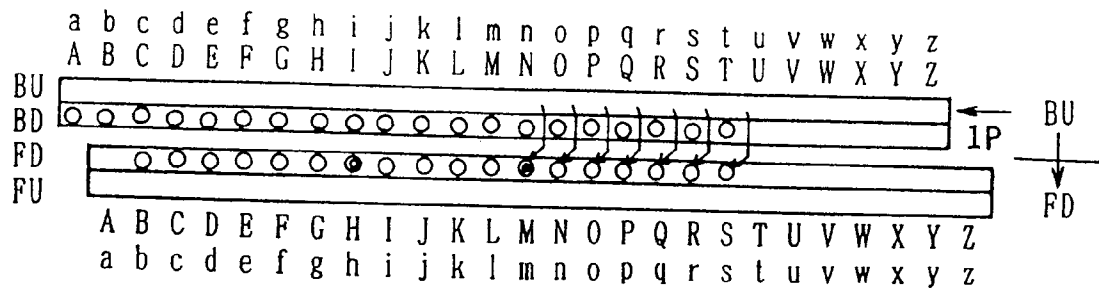


Fig.7

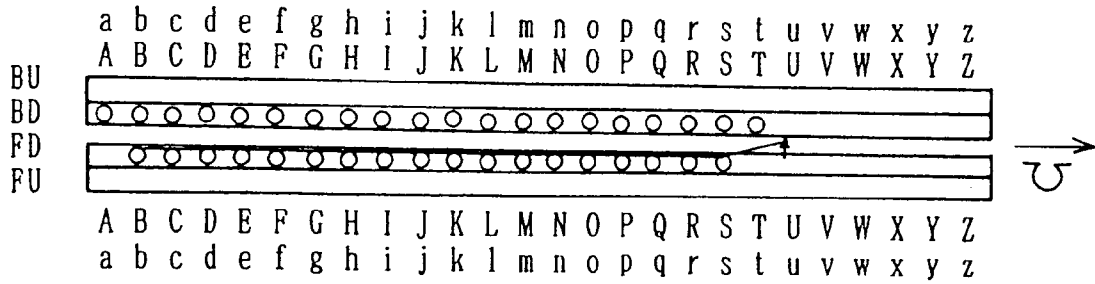


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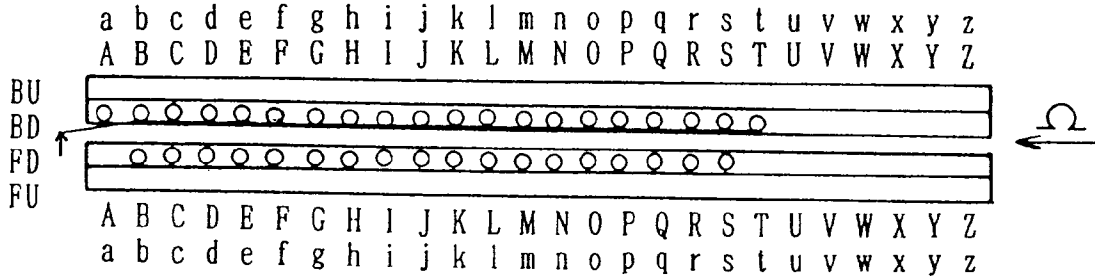


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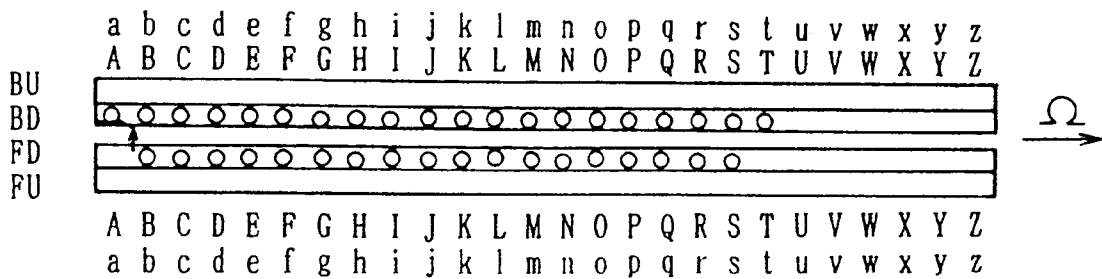


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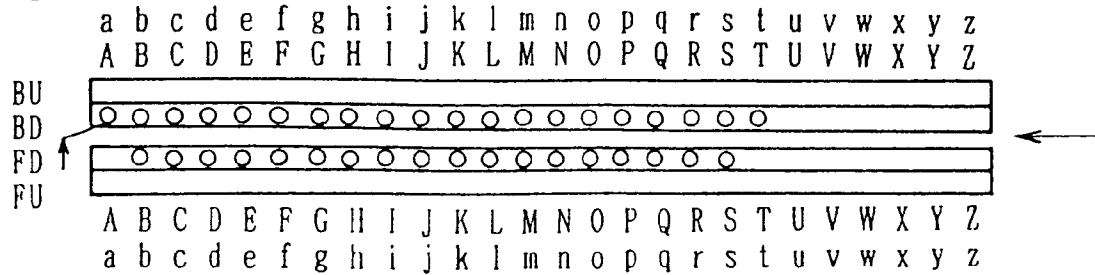


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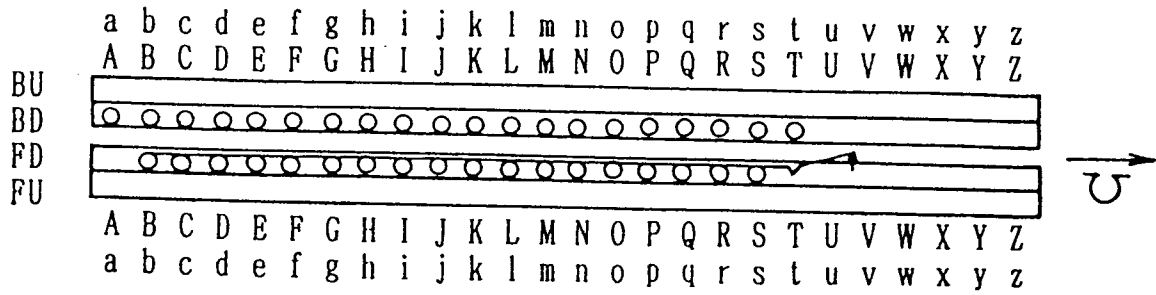


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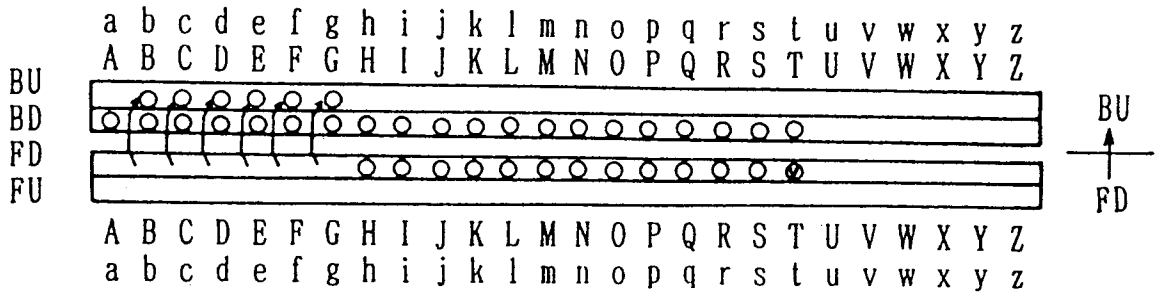


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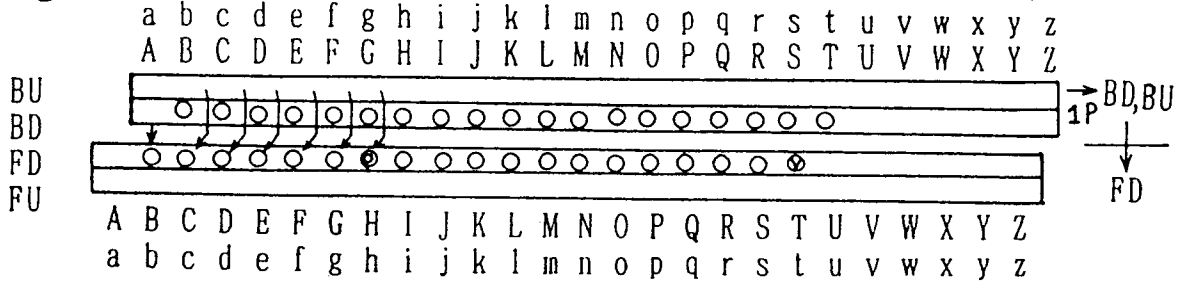


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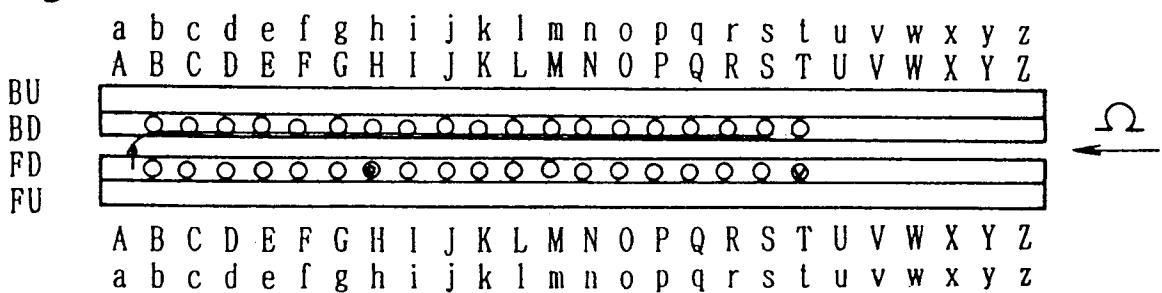


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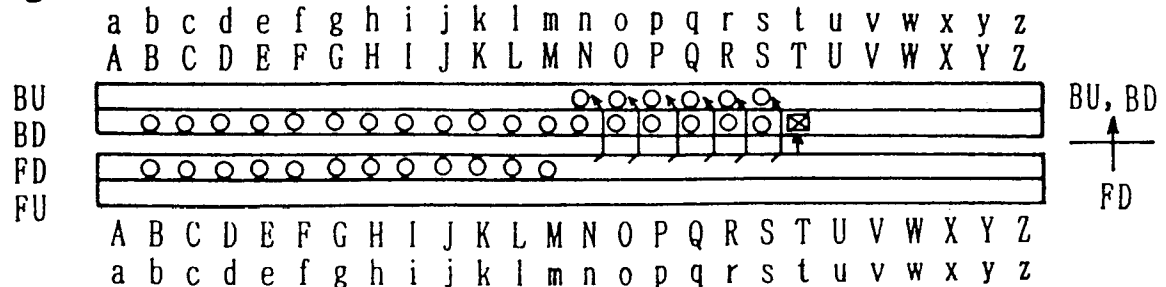


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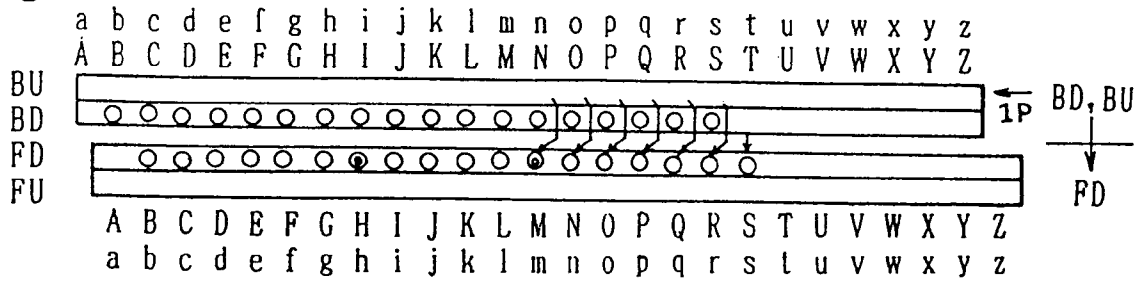


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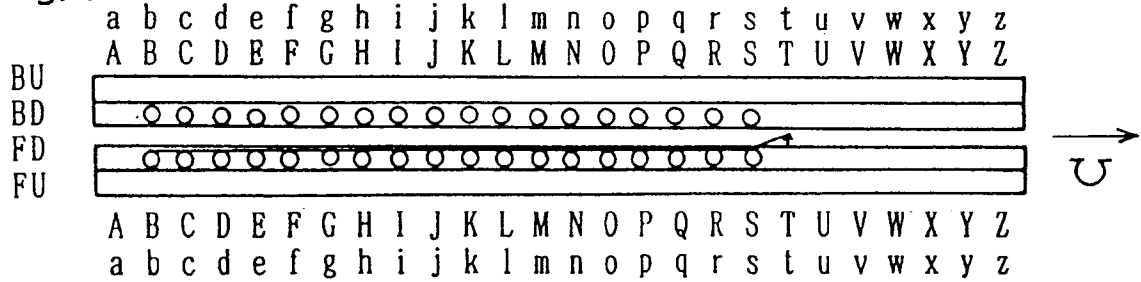


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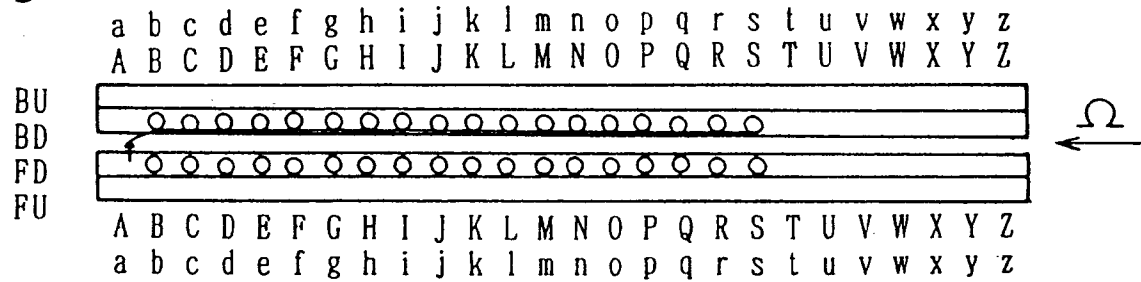


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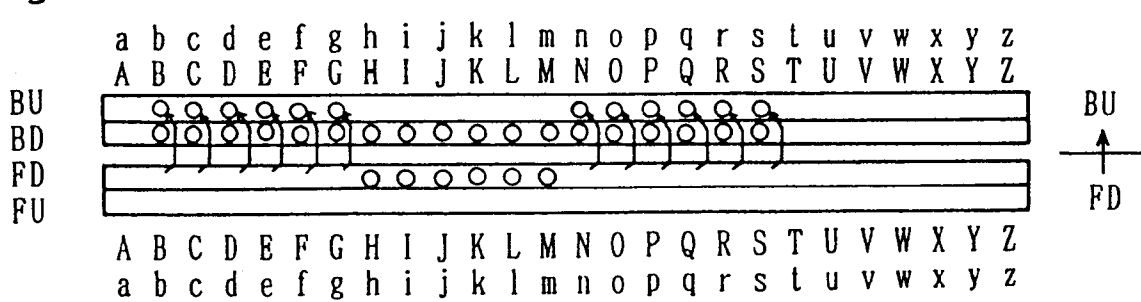


Fig.20

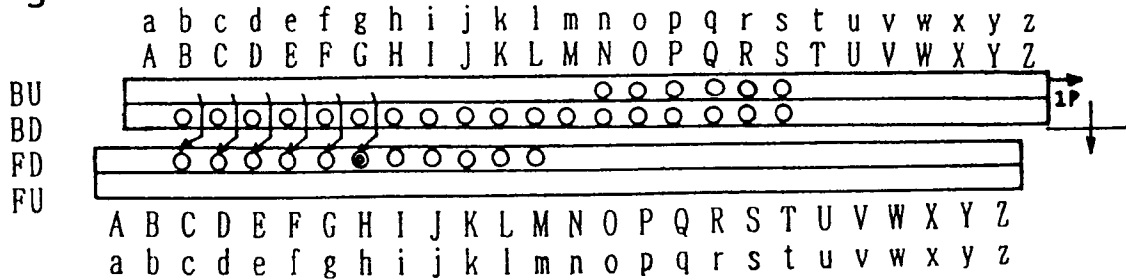


Fig.21

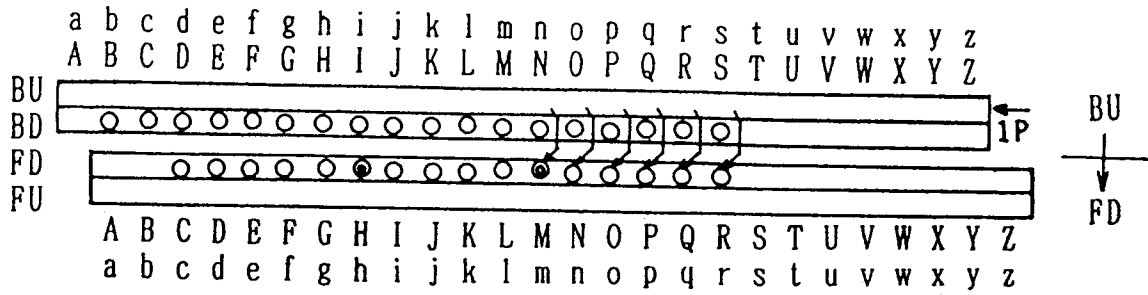


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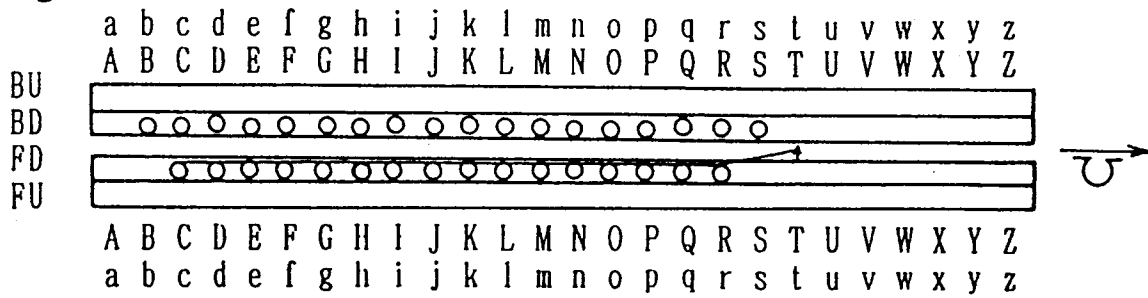


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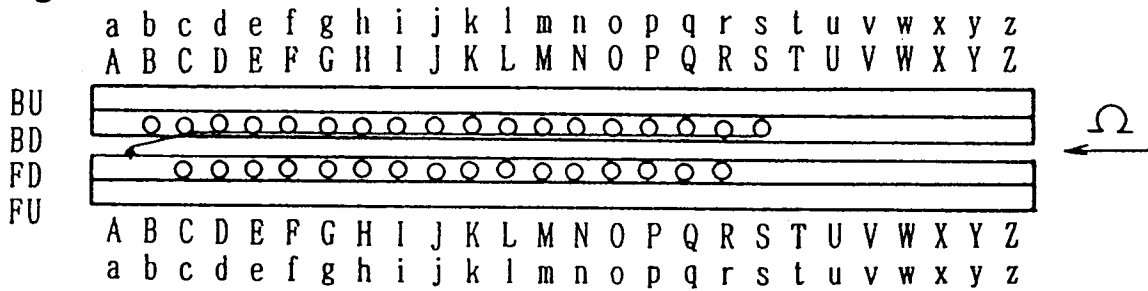


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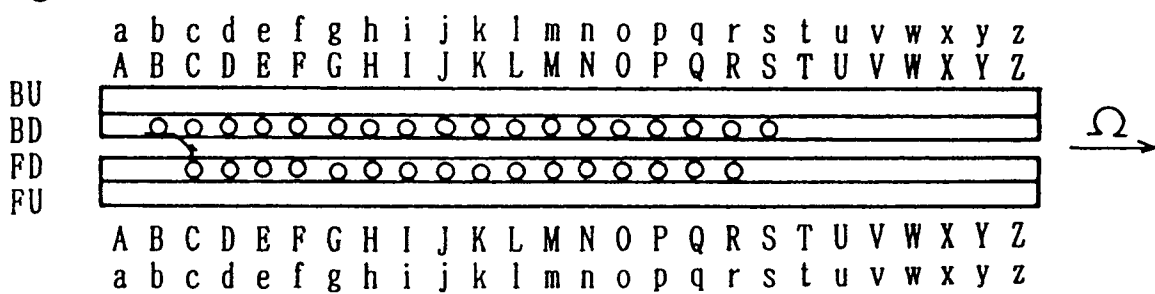


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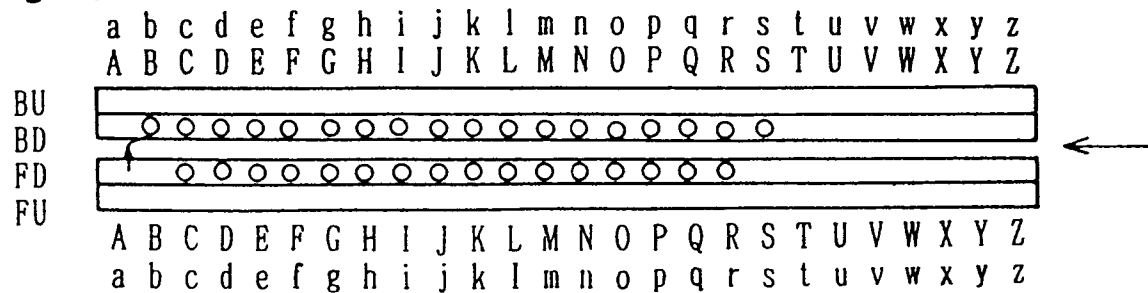


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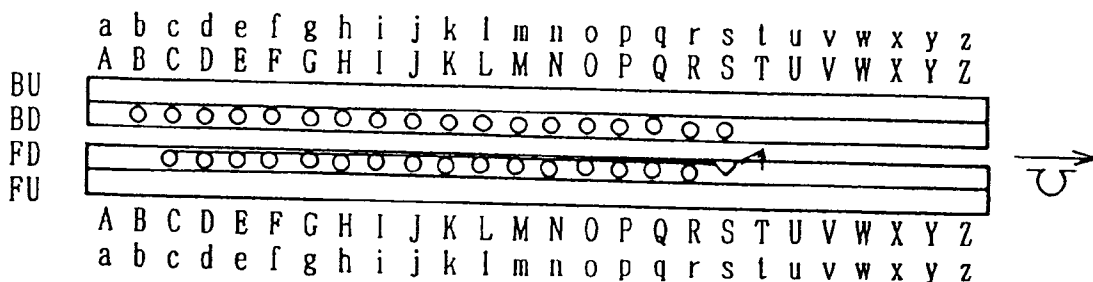


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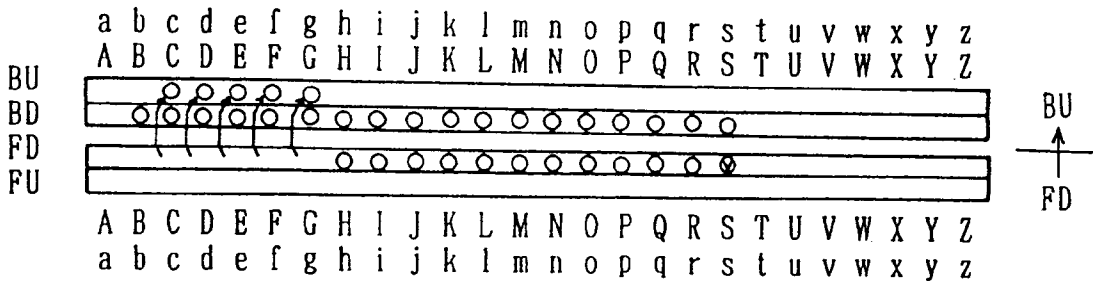


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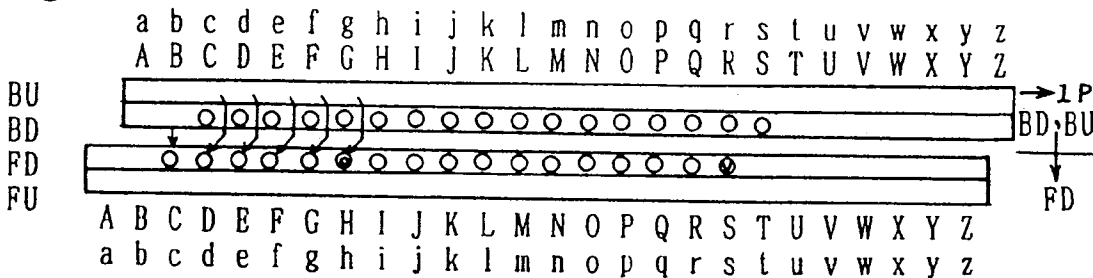


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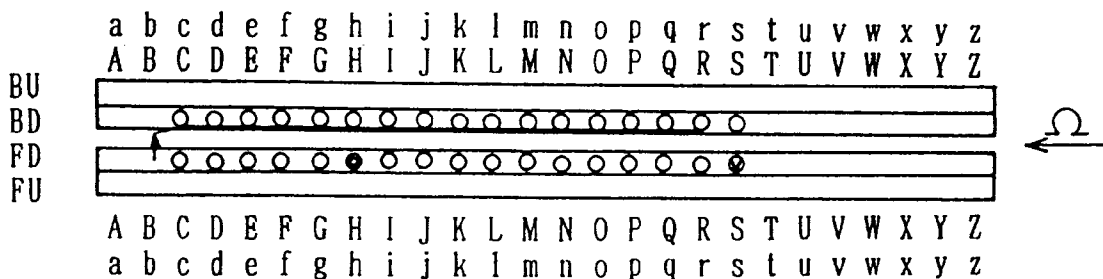


Fig.30

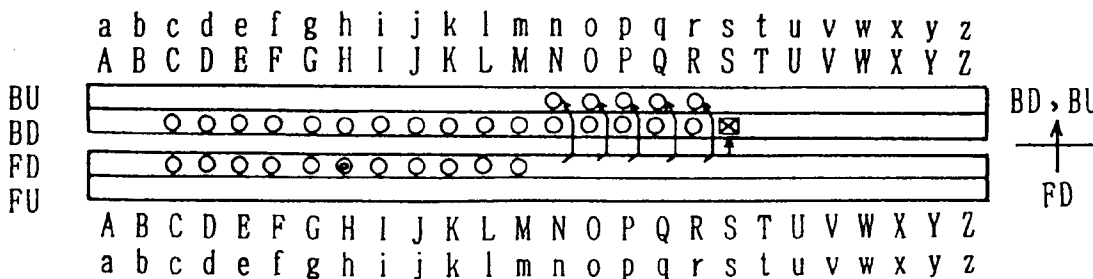


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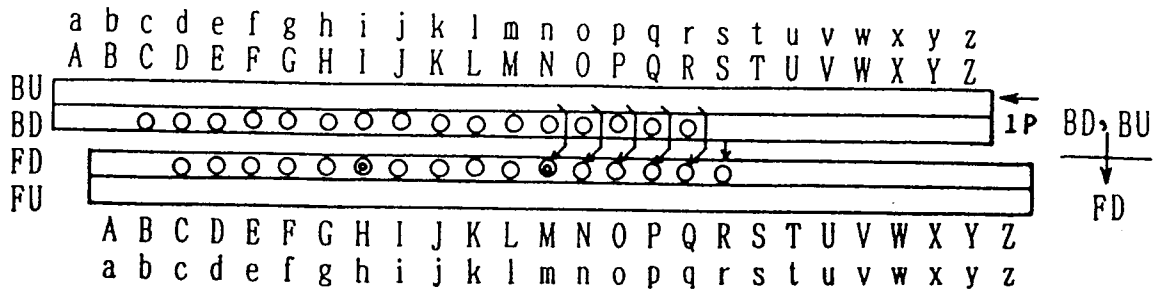


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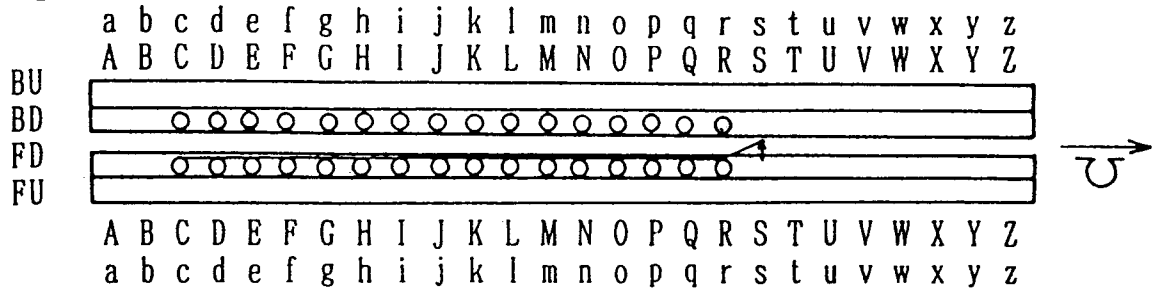


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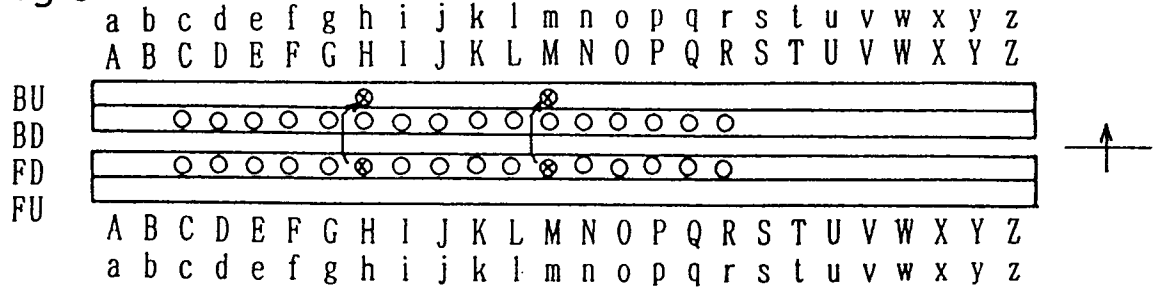


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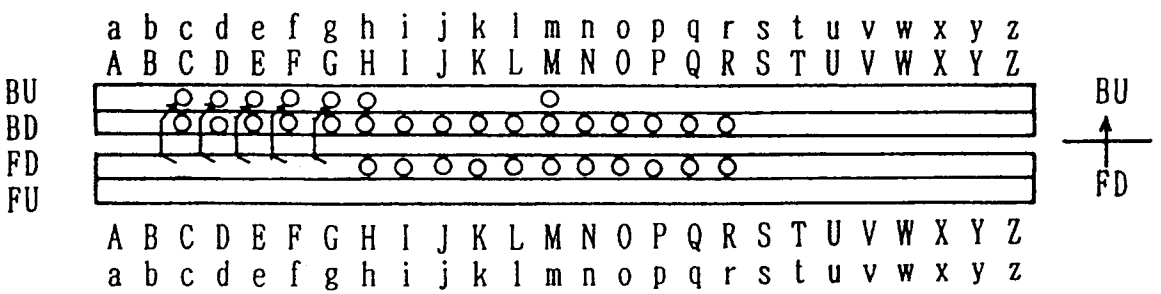


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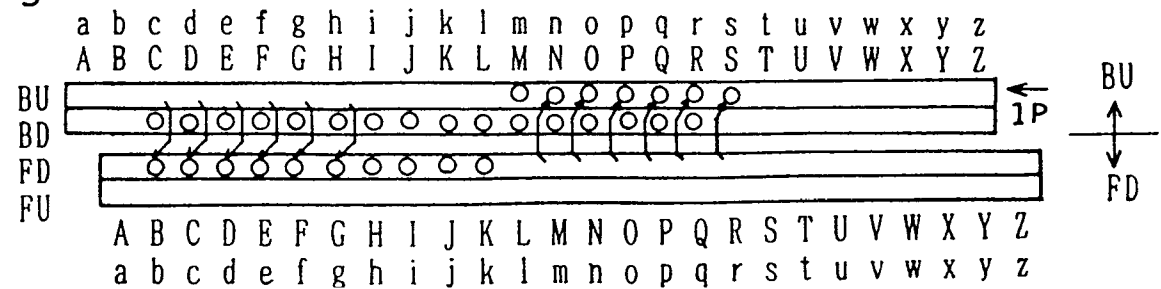


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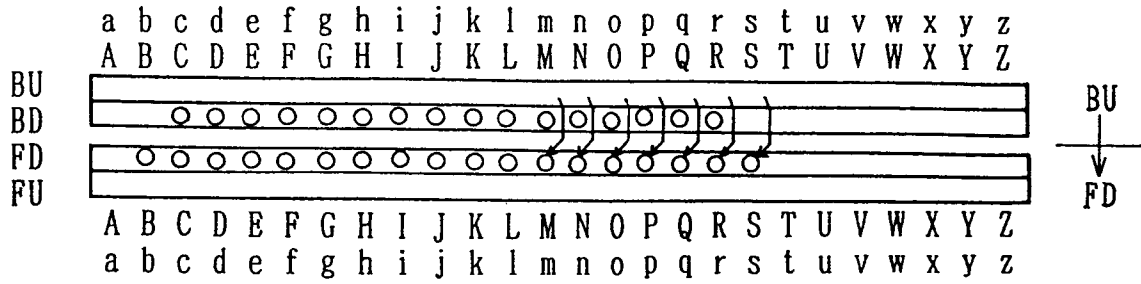


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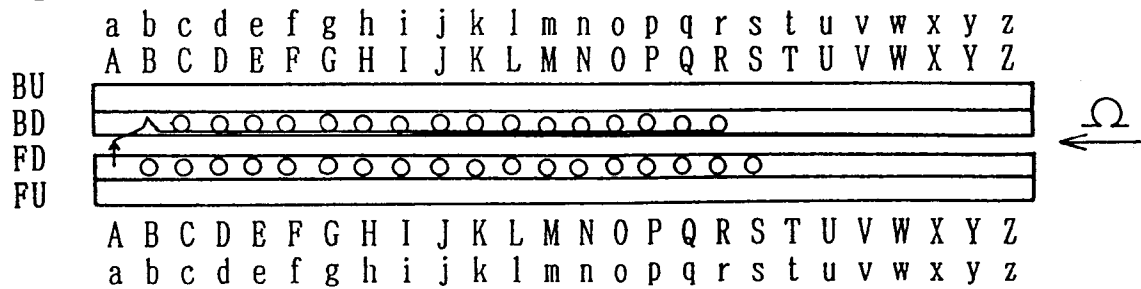


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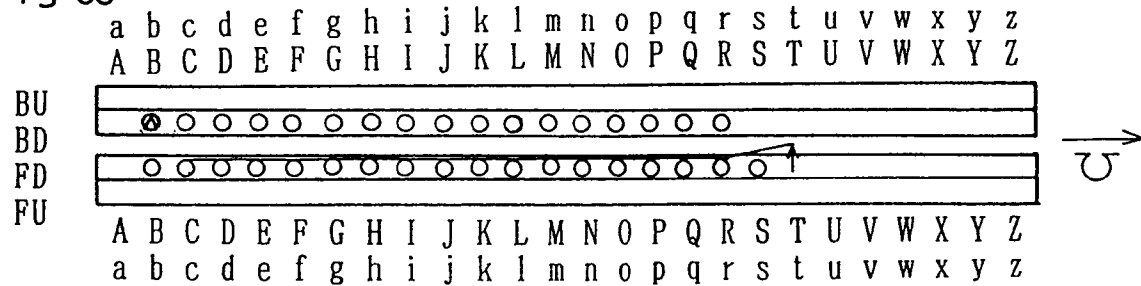


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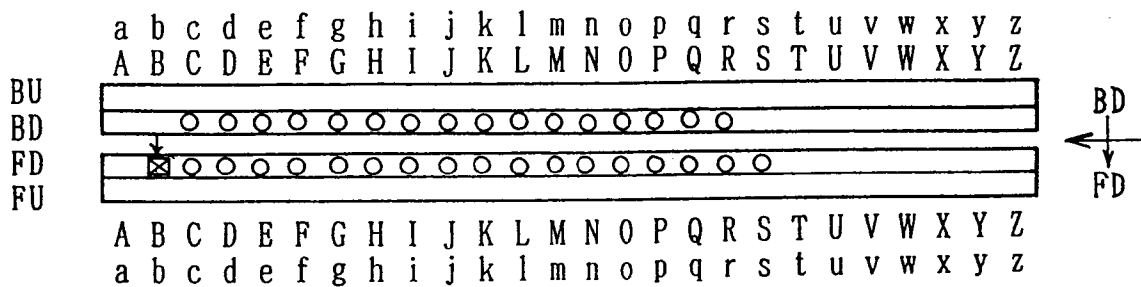


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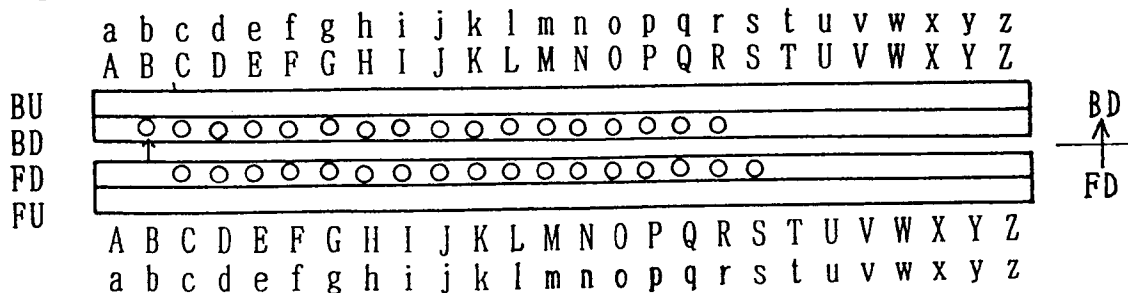


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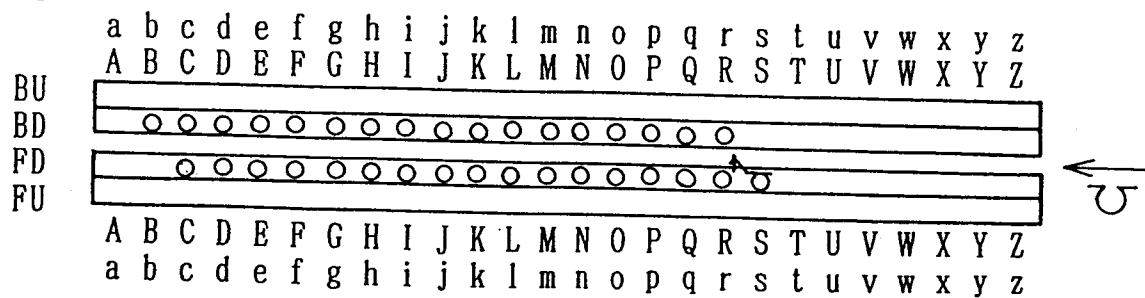


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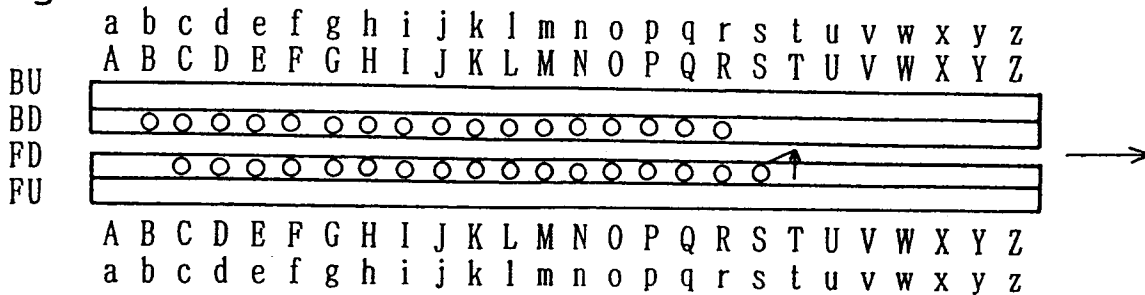


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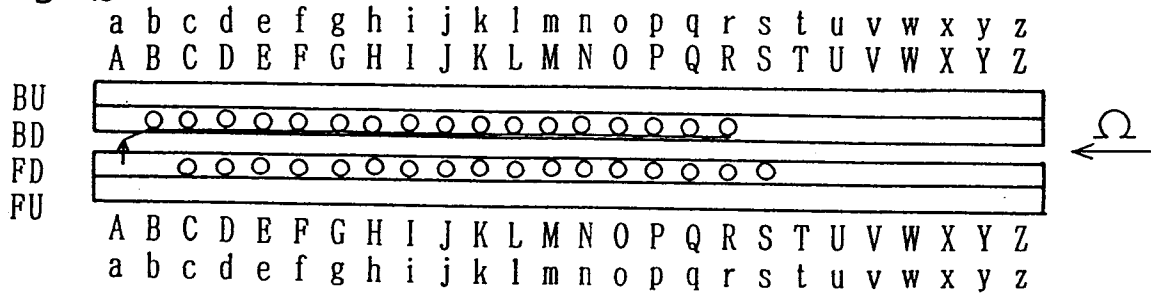


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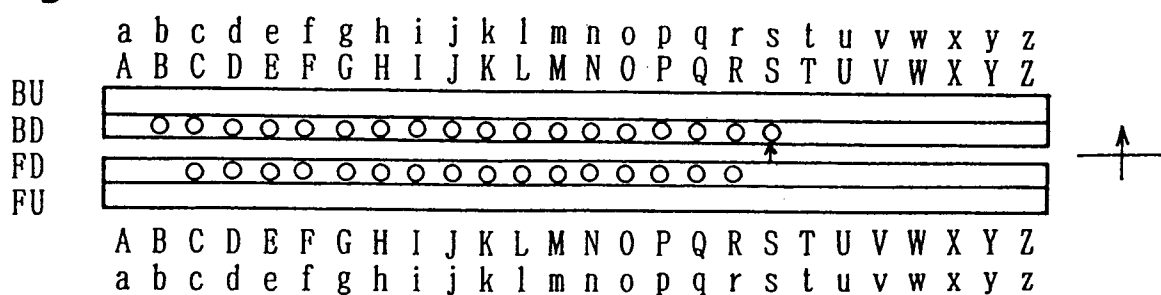


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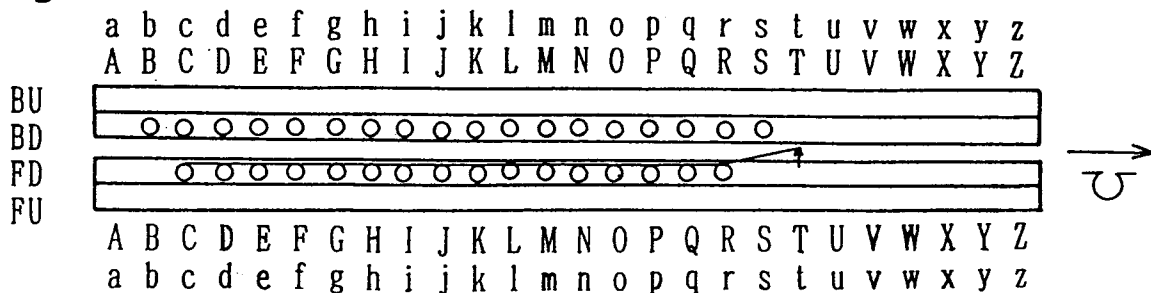


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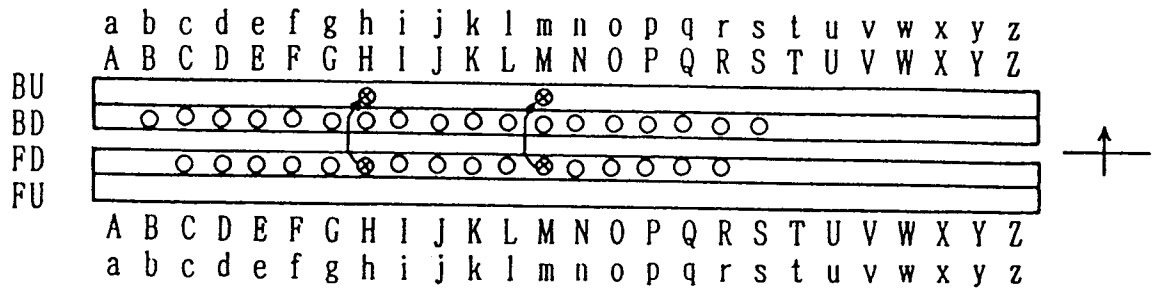


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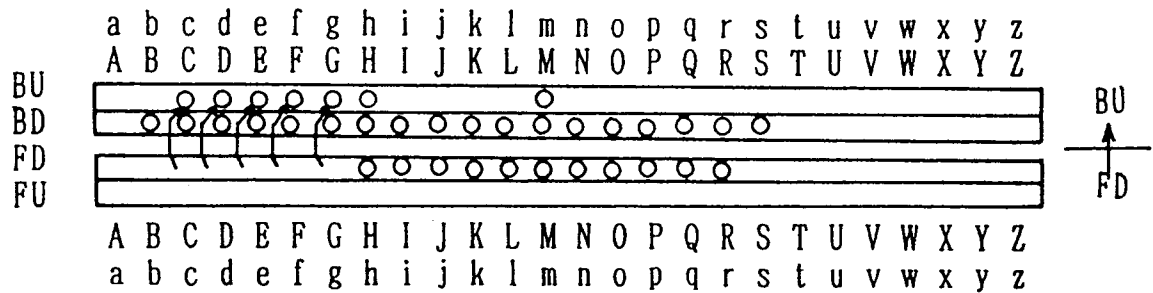


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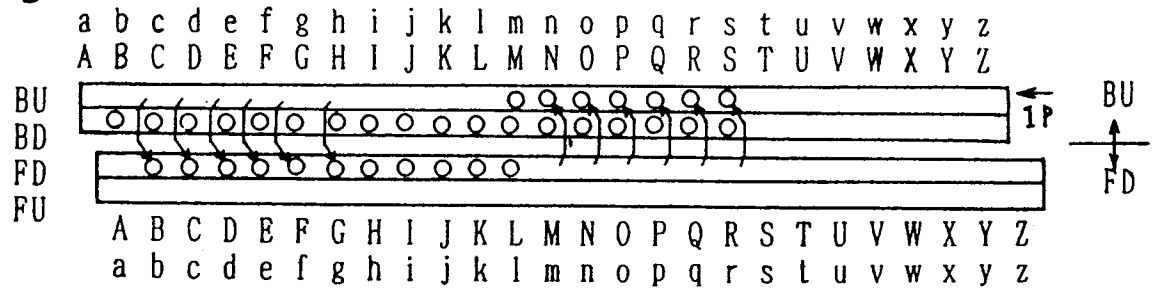


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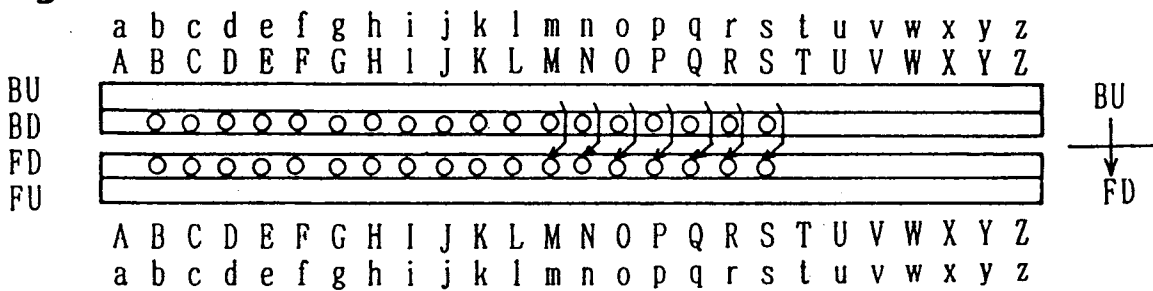


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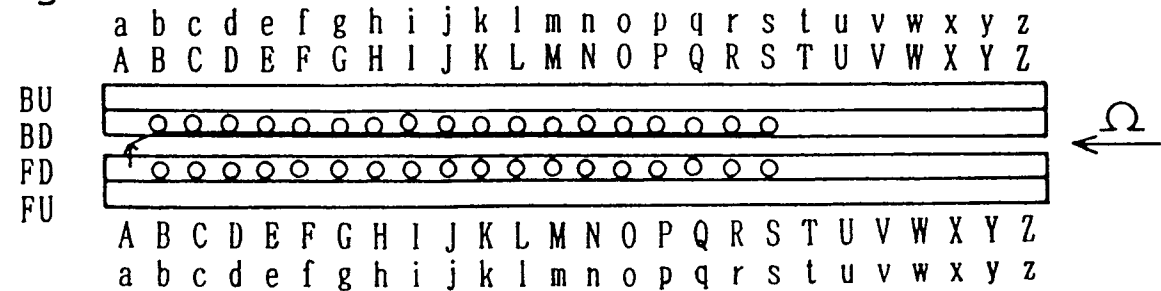


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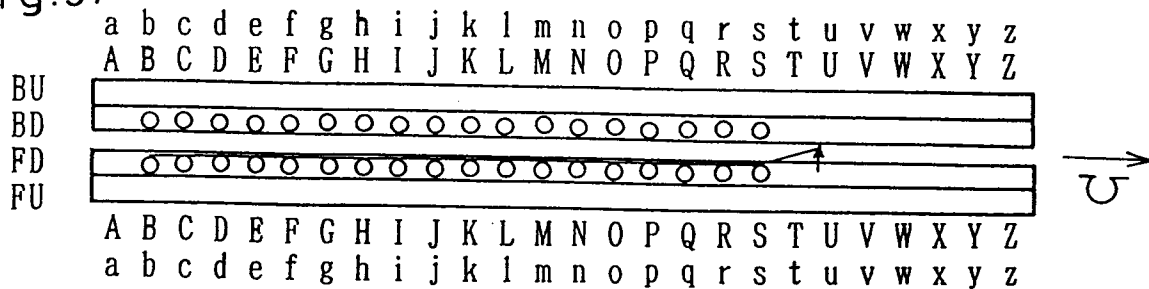


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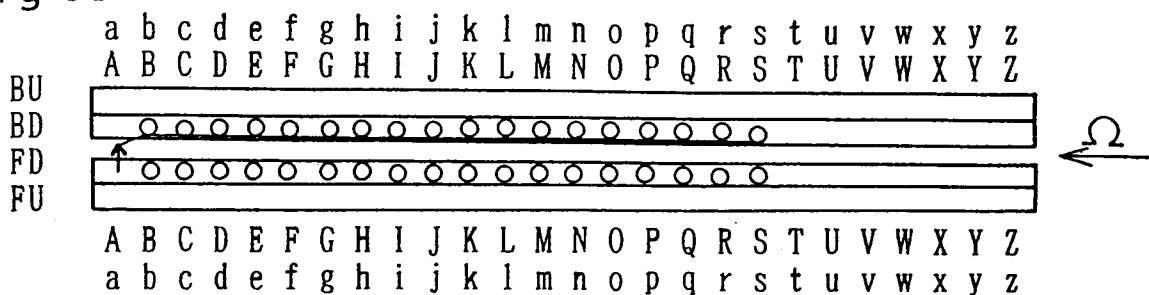


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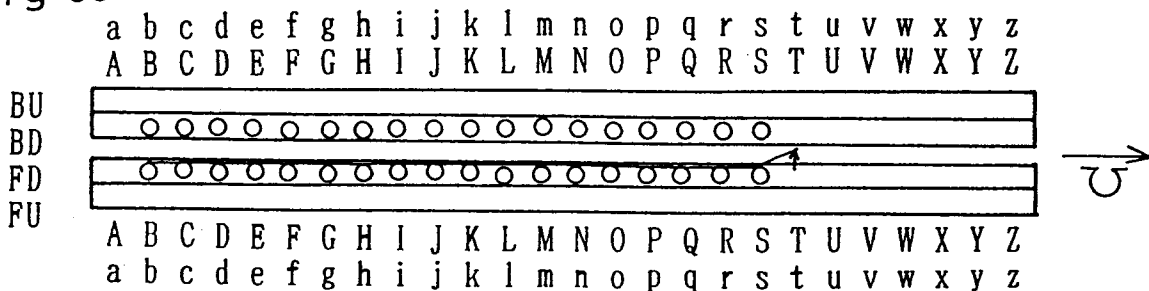


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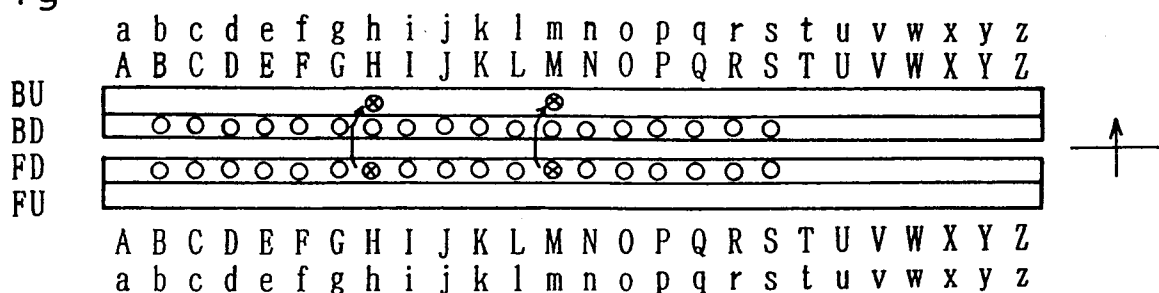


Fig.55

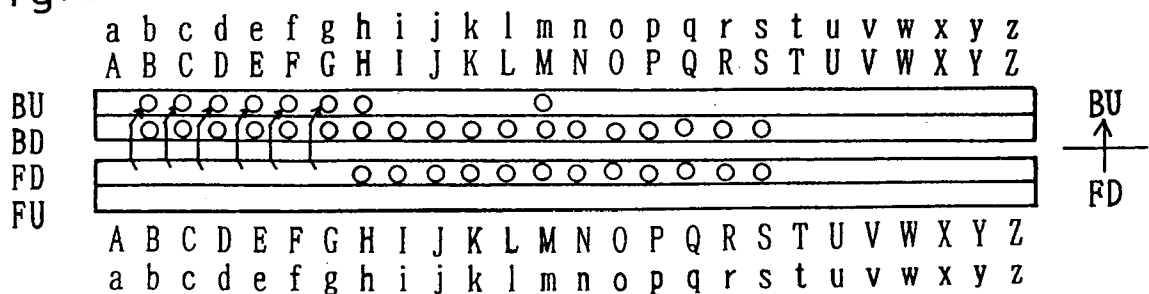


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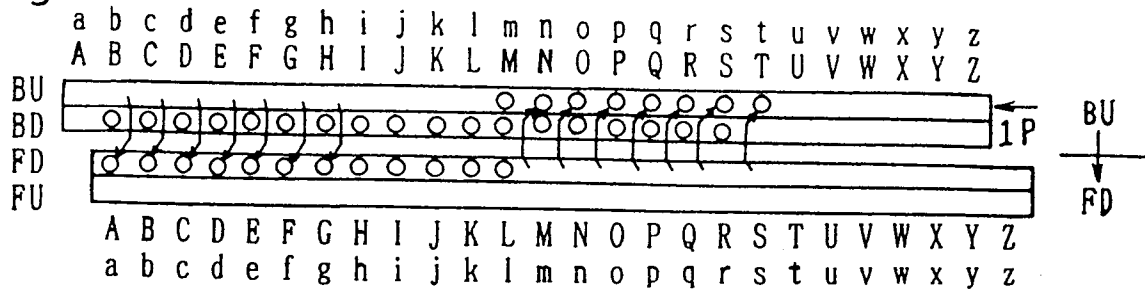


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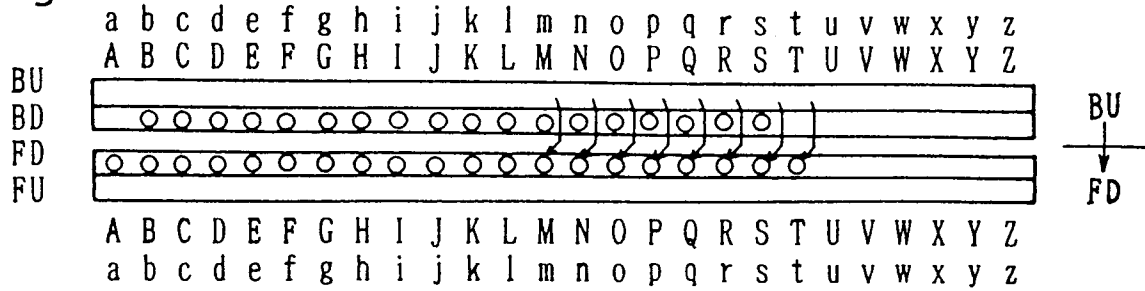


Fig.58

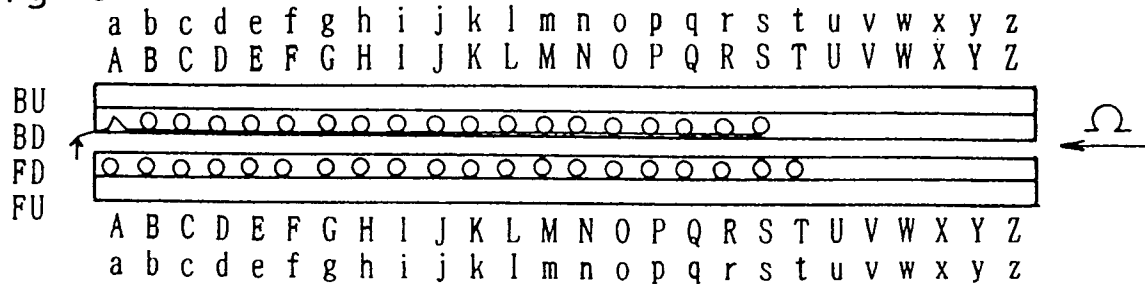


Fig.59

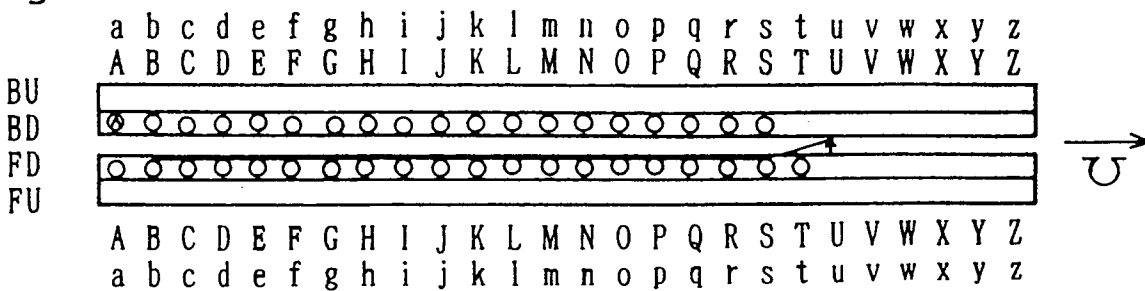


Fig.60

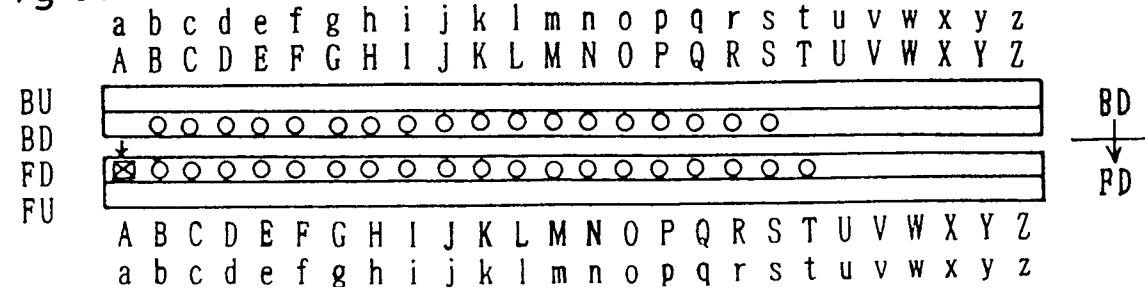


Fig.61

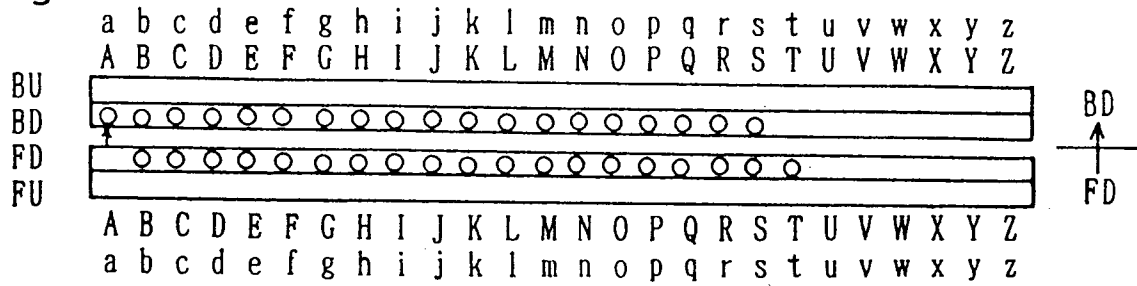


Fig.62

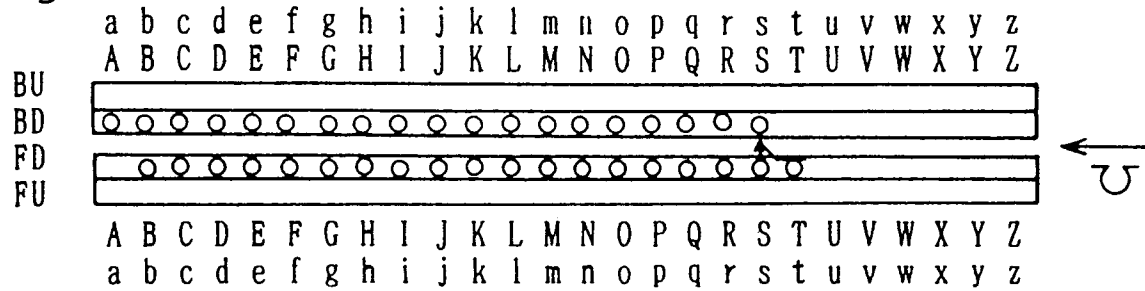


Fig.63

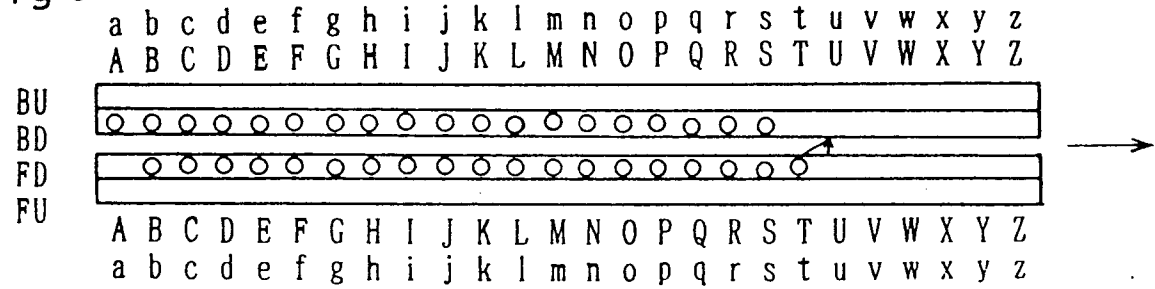


Fig.64

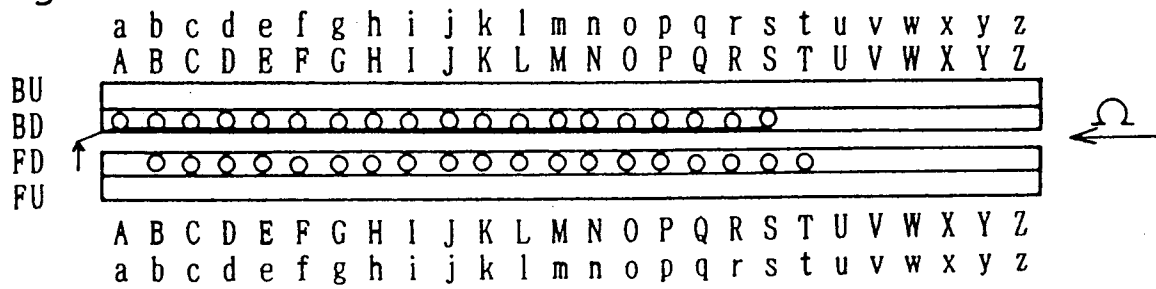


Fig.65

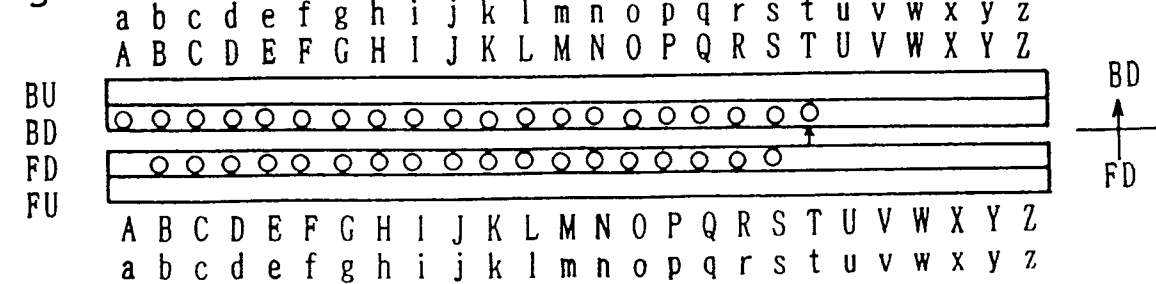


Fig.66

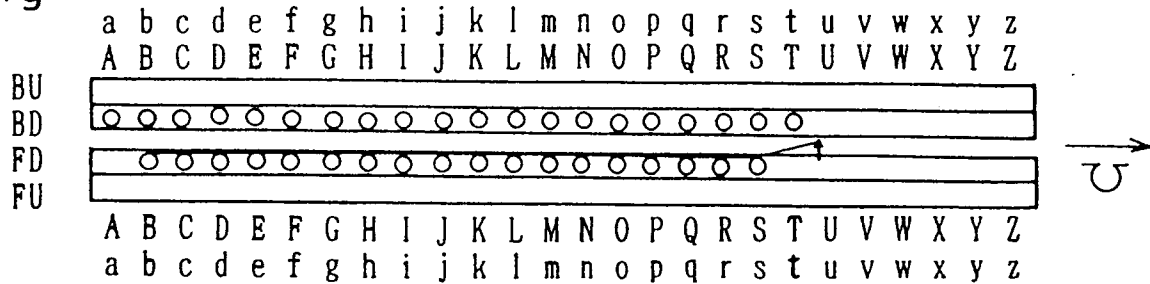


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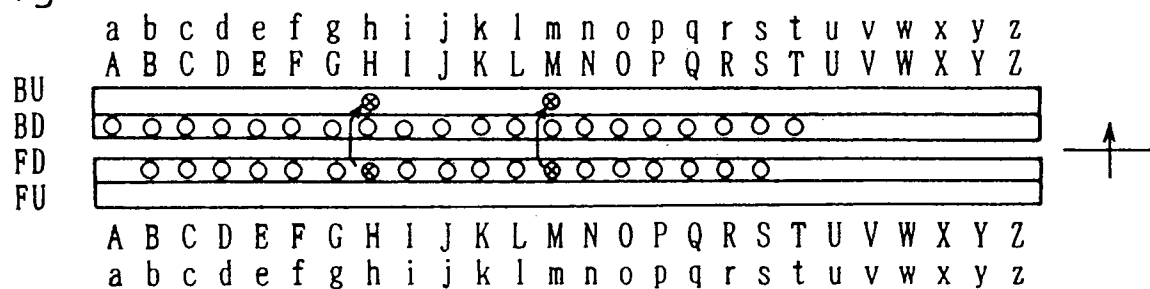


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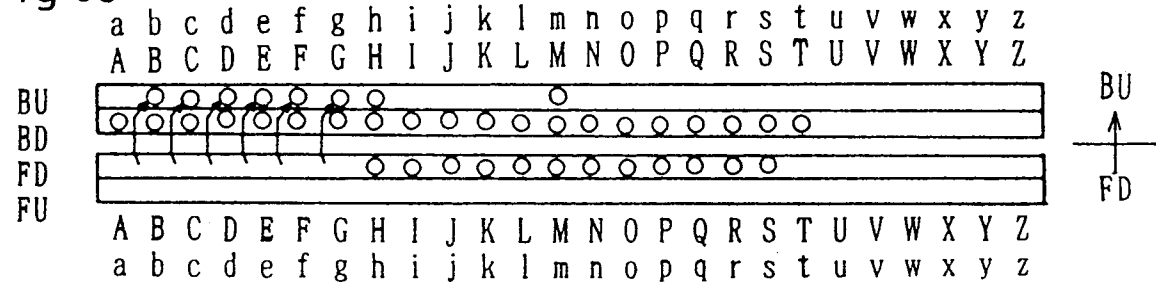


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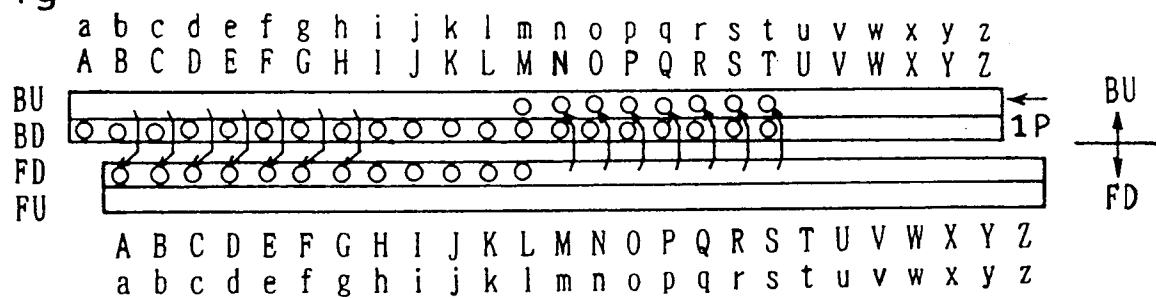


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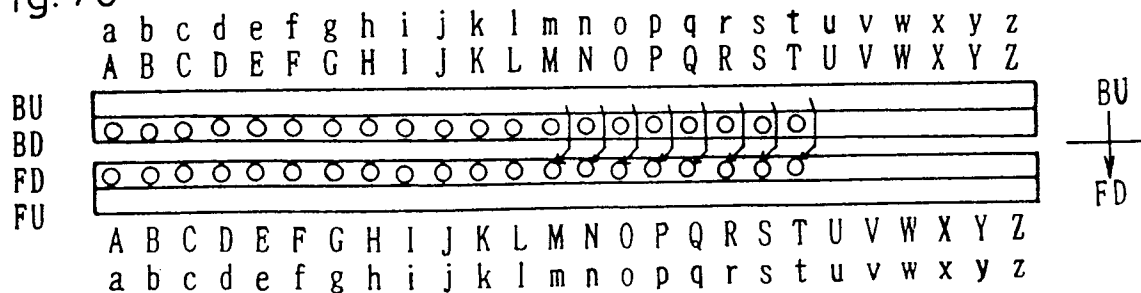


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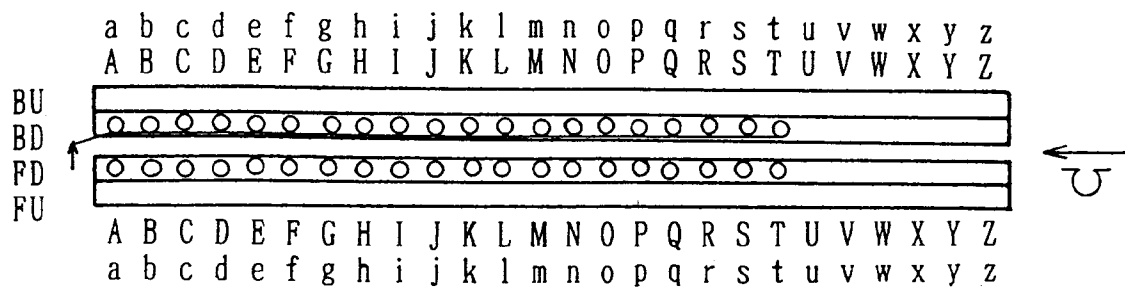


Fig.72

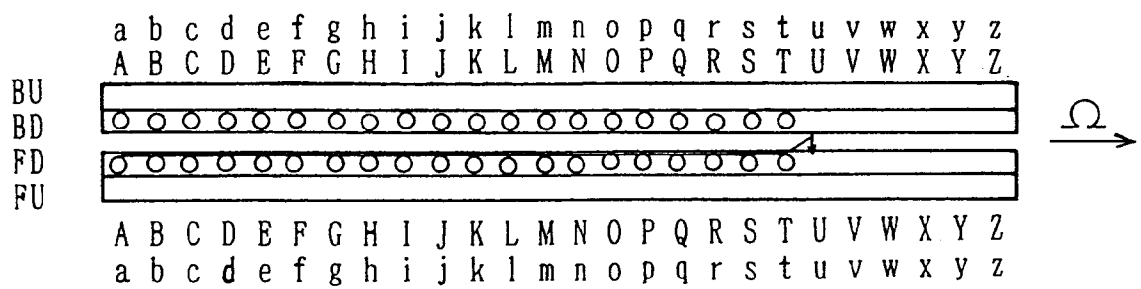


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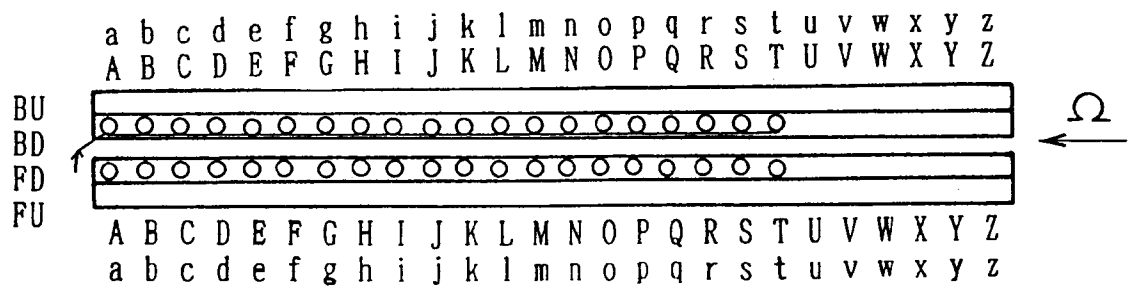


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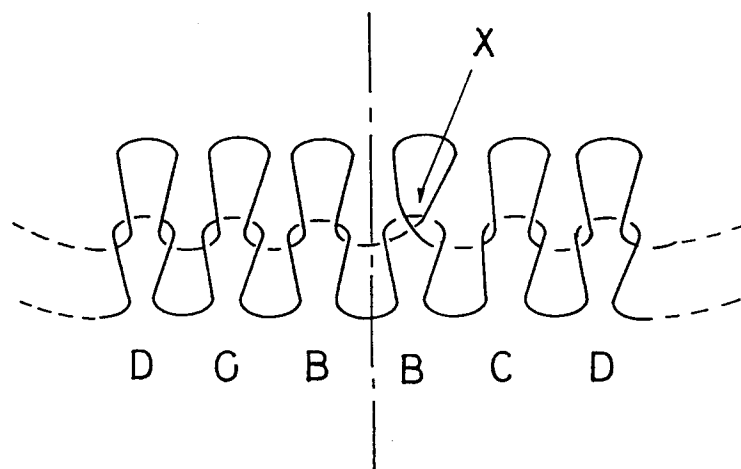


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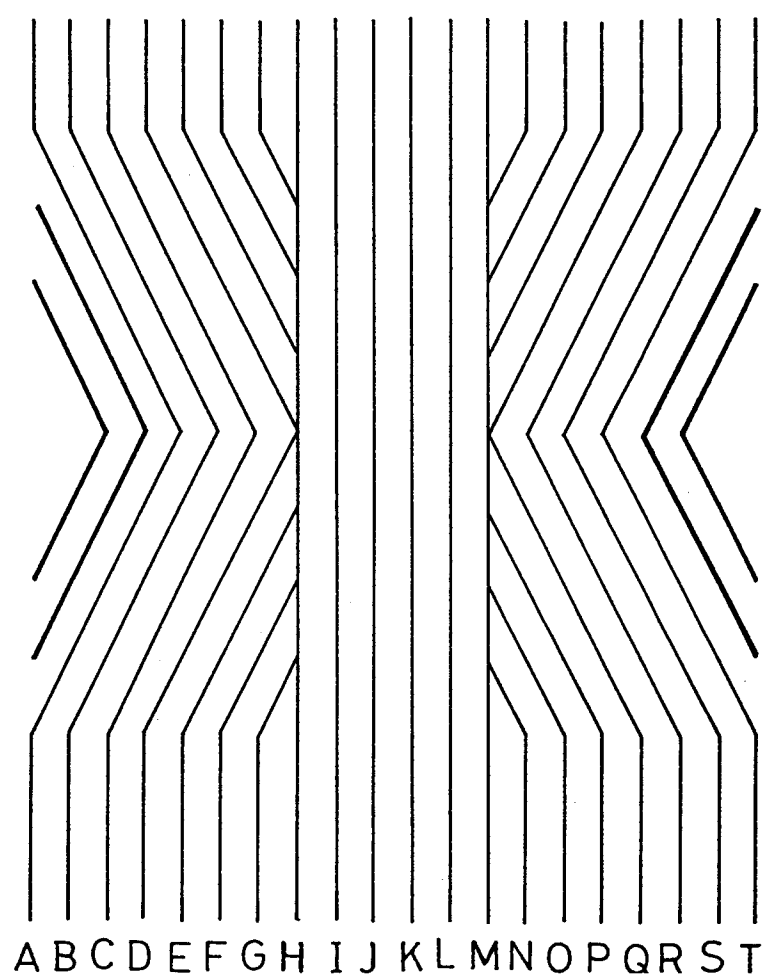


Fig.76

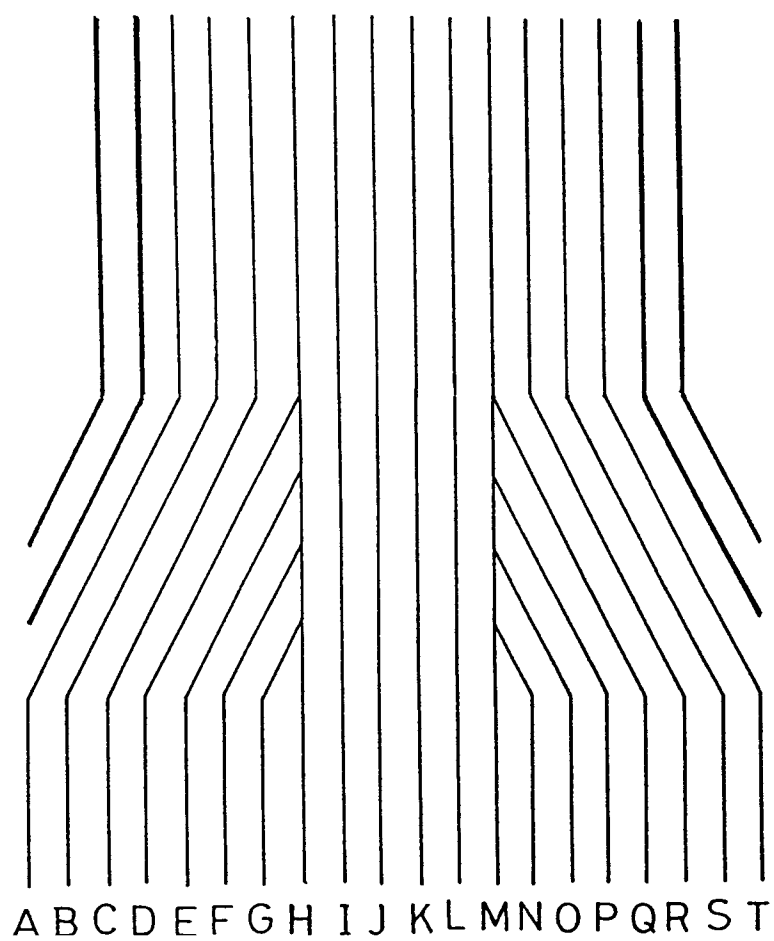


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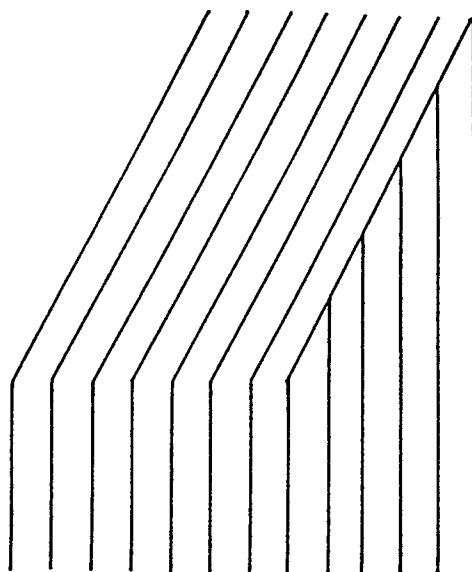


Fig.78

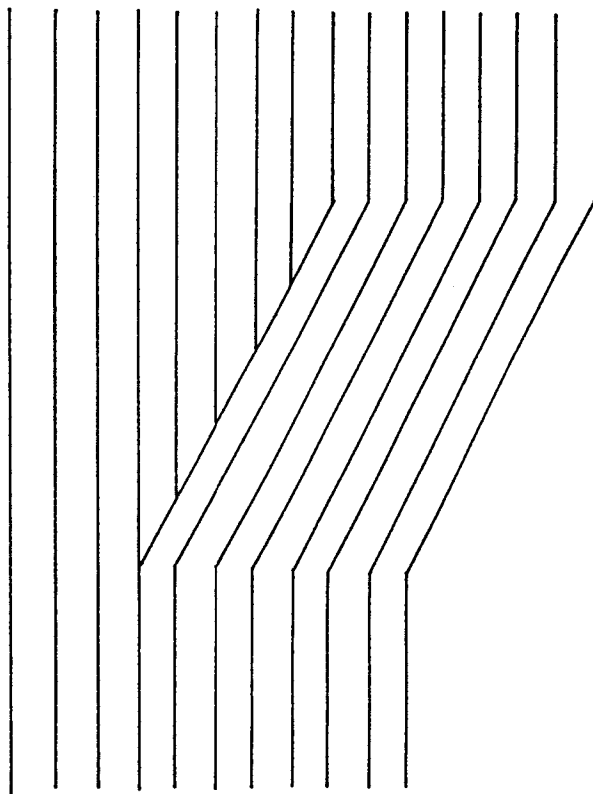
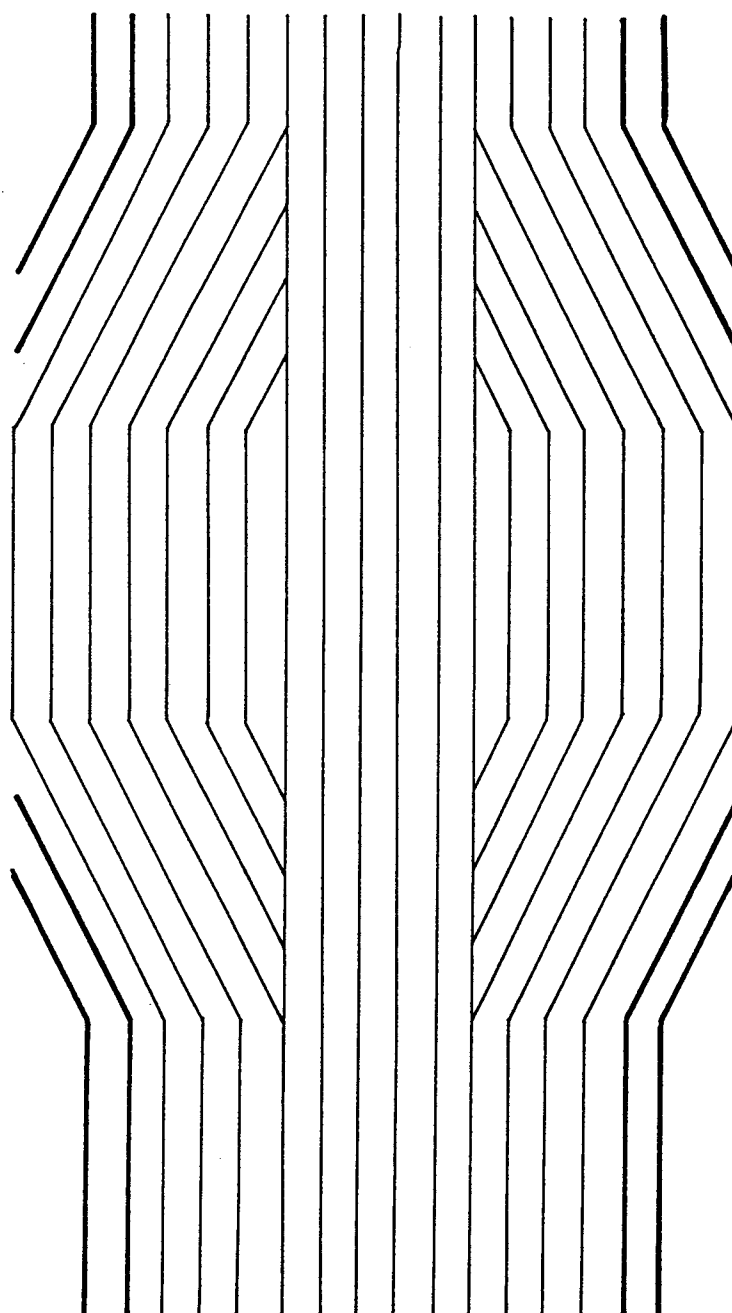


Fig.79





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 30 6056

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	GB-A-2 228 750 (SHIMA SEIKI MFG LTD) * page 7, line 9 - page 10, line 6; figures 5,6 *	1,3	D04B1/24
A	US-A-3 668 898 (BETTS ET AL)		
A	GB-A-1 343 110 (COURTAULDS LTD)		
P,A	DE-C-4 107 316 (UNIVERSAL MASCHINENFABRIK DR. RUDOLF SCHIEBER GMBH)		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			D04B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15 OCTOBER 1992	Examiner VAN GELDER P.A.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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