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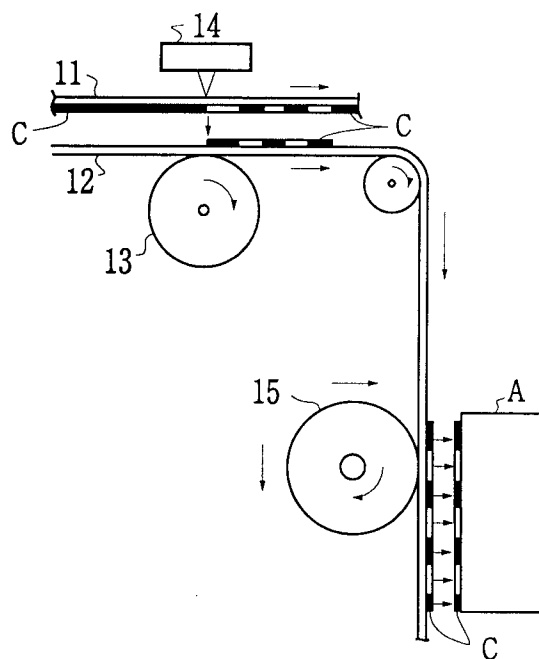
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D-80538 München (DE)(54) **Method and apparatus for thermal transfer type printing.**

(57) A thermal transfer type printing, capable of realizing an efficient mirror image formation by a printing head with a small amount of heat generation, without causing a difficulty concerning a software creation, a slow printing speed, or a high cost for a production of new printing patterns. A platen roller conveys an intermediate film for receiving the applied material thermally transferred from a film, with respect to a printing head while the printing head is forming the desired printing pattern on the intermediate film such that the printing head and the intermediate film are relatively moved in one direction in a case of forming a normal image of the desired printing pattern on the intermediate film whereas the printing head and the intermediate film are relatively moved in another direction opposite to that one direction in a case of forming a mirror image of the desired printing pattern on the intermediate film.

FIG.8**EP 0 680 835 A2**

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a method and an apparatus for thermal transfer type printing using an efficient mirror image formation by a printing head.

Description of the Background Art

A typical conventionally known thermal transfer type printer, such as that used in a word processor for instance, generally comprises a film having a carbon (applied material) which is thermally transferrable, and a thermal printing head for thermally transferring the carbon from the film to a paper (printing target object).

In order to carry out a mirror image printing by this type of a printer, it is possible to consider the use of a scheme for inverting the originally provided normal printing pattern by means of a software as an output of a printing head, or a scheme for newly producing a mirror image printing pattern as an output of a printing head.

However, the former scheme for outputting the mirror image printing pattern by inverting the normal printing pattern by means of a software is associated with a difficulty concerning a creation of a suitable software, and in addition, there is a drawback that the printing speed is going to be rather slow because of the time necessary for the inversion operation by the software.

On the other hand, the latter scheme for directly outputting the mirror image printing pattern requires the production of new mirror image printing patterns, and there is a drawback that such a production of new mirror image printing patterns is costly.

In the conventionally known thermal transfer type printer, the above noted problems related to the mirror image printing have been largely unnoticed because the mirror image printing itself has been rarely required, except for some highly specialized cases such as that of a production of an original for a block print.

However, the above noted problems related to the mirror image printing are also relevant to the normal image printing in a type of printer proposed earlier by the present inventor, which typically has a schematic configuration as shown in Fig. 1.

This printer of Fig. 1 comprises a film 1 having a carbon (applied material) C which is thermally transferrable, an intermediate film 2 for receiving the carbon C thermally transferred from this film 1 and transferring the received carbon C over to a printing target object A by means of the thermal transfer, a platen roller 3 for conveying this inter-

mediate film 2 beneath the film 1, a printing head 4 provided over the film 1 in a vicinity of this platen roller 3 for thermally transferring the carbon C in a form of a desired printing pattern from the film 1 to the intermediate film 2 conveyed by the platen roller 3, and a thermal transfer roller 5 for thermally transferring the carbon C from the intermediate film 2 to the printing target object A by heating the intermediate film 2.

Now, in a case of printing characters

"印刷"

(pronounced "insatsu", which means printing in Japanese) as shown in Fig. 2 by using this printer of Fig. 1, the film 1 and the intermediate film 2 are conveyed from right to left in Fig. 2, while the printing head 4 heats the film 1 in a shape corresponding to these characters, in a manner of a line scanning over these characters from a left end of a character

"印"

25

to a right end of a character

"刷".

30

As a result, the film 1 is sequentially heated in a shape of these characters from a left end to a right end, such that eventually a normal printing pattern of these characters is formed on the intermediate film 2 by the carbon C transferred from the film 1 to the intermediate film 2, as shown in Fig. 2, looking from the film 1 side. However, when such a normal printing pattern is thermally transferred to the printing target object A by the thermal transfer roller 5, the resulting printed image is going to be the mirror image in which each character is inverted as shown in Fig. 3, looking from the intermediate film 2 side, and a desired printing of the normal image of these characters cannot be achieved.

For this reason, in order to achieve the desired printing of the normal image of these characters, it is necessary to form a mirror image printing pattern of these characters on the intermediate film 2 at a stage depicted in Fig. 2.

Here, however, the formation of the mirror image printing pattern on the intermediate film 2 in this printer of Fig. 1 is going to be associated with the difficulty concerning the software creation, the slow printing speed, or the high cost for the production of new printing patterns, as noted above.

In view of this situation, the present inventor has already proposed a printer for effectively avoiding these problems, which typically has a schematic configuration as shown in Fig. 4, where the elements similar to those appeared in Fig. 1 are given the same reference numerals as in Fig. 1. In this printer of Fig. 4, the carbon C on the film 1 is thermally transferred onto the intermediate film 2 by the printing head 4 provided beneath the intermediate film 2, such that the film 1 is heated by the printing head 4 from the intermediate film 2 side.

In this printer of Fig. 4, even when the printing head 4 heats the film 1 in a shape of the normal image as shown in Fig. 5, looking from the printing head 4 side, the carbon C thermally transferred onto the intermediate film 2 is going to form a printing pattern in a shape of an upside down mirror image as shown in Fig. 6, looking from the film 1 side, so that when this printing pattern is thermally transferred onto the printing target object A by the thermal transfer roller 5, the desired printing of the normal image of the characters can be achieved as shown in Fig. 7, looking from the intermediate film 2 side.

However, in this printer of Fig. 4, the film 1 must be heated by the printing head 4 in a state of having the intermediate film 2 present therebetween, so that there has been a drawback that it is necessary to increase the amount of heat generation by the printing head 4.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a method and an apparatus for thermal transfer type printing, capable of realizing an efficient mirror image formation by a printing head with a small amount of heat generation, without causing a difficulty concerning a software creation, a slow printing speed, or a high cost for a production of new printing patterns.

According to one aspect of the present invention there is provided an apparatus for thermal transfer type printing, comprising: film means for carrying a thermally transferrable applied material; and printing means for thermally transferring the applied material in a shape of a desired printing pattern from the film means to a printing target object by applying heat to a desired part of the applied material on the film means in a shape of the desired printing pattern; wherein the printing means and the film means are relatively moved in one direction in a case of printing a normal image of the desired printing pattern whereas the printing means and the film means are relatively moved in another direction opposite to said one direction in a case of printing a mirror image of the desired

printing pattern.

According to another aspect of the present invention there is provided an apparatus for thermal transfer type printing, comprising: film means for carrying a thermally transferrable applied material; intermediate film means for receiving the applied material thermally transferred from the film means; printing head means for forming a desired printing pattern on the intermediate film means by applying heat to a desired part of the applied material on the film means in a shape of the desired printing pattern; platen roller means for conveying the intermediate film means with respect to the printing head means while the printing head means is forming the desired printing pattern on the intermediate film means, such that the printing head means and the intermediate film means are relatively moved in one direction in a case of forming a normal image of the desired printing pattern on the intermediate film means whereas the printing head means and the intermediate film means are relatively moved in another direction opposite to said one direction in a case of forming a mirror image of the desired printing pattern on the intermediate film means; and thermal transfer means for thermally transferring the desired printing pattern formed on the intermediate film means to a printing target object.

According to another aspect of the present invention there is provided a method of thermal transfer type printing, comprising the steps of: providing film means for carrying a thermally transferrable applied material; and thermally transferring the applied material in a shape of a desired printing pattern from the film means to a printing target object by applying heat from a printing head means to a desired part of the applied material on the film means in a shape of the desired printing pattern, while relatively moving the printing means and the film means in one direction in a case of printing a normal image of the desired printing pattern, and relatively moving the printing means and the film means in another direction opposite to said one direction in a case of printing a mirror image of the desired printing pattern.

According to another aspect of the present invention there is provided a method of thermal transfer type printing, comprising the steps of: providing film means for carrying a thermally transferrable applied material; providing intermediate film means for receiving the applied material thermally transferred from the film means; forming a desired printing pattern on the intermediate film means by applying heat from printing head means to a desired part of the applied material on the film means in a shape of the desired printing pattern; conveying the intermediate film means with respect to the printing head means by platen roller means while

the printing head means is forming the desired printing pattern on the intermediate film means, such that the printing head means and the intermediate film means are relatively moved in one direction in a case of forming a normal image of the desired printing pattern on the intermediate film means whereas the printing head means and the intermediate film means are relatively moved in another direction opposite to said one direction in a case of forming a mirror image of the desired printing pattern on the intermediate film means; and thermally transferring the desired printing pattern formed on the intermediate film means to a printing target object by thermal transfer means.

Other features and advantages of the present invention will become apparent from the following description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic diagram of one conventional thermal transfer type printer.

Fig. 2 is an illustration of a printing pattern formed on an intermediate film in the printer of Fig. 1.

Fig. 3 is an illustration of a printed image resulting from the printing pattern of Fig. 2 in the printer of Fig. 1.

Fig. 4 is a schematic diagram of another conventional thermal transfer type printer.

Fig. 5 is an illustration of a heating pattern by a printing head in the printer of Fig. 4.

Fig. 6 is an illustration of a printing pattern formed on an intermediate film in the printer of Fig. 4.

Fig. 7 is an illustration of a printed image resulting from the printing pattern of Fig. 6 in the printer of Fig. 4.

Fig. 8 is a schematic diagram of a first embodiment of a thermal transfer type printer according to the present invention.

Fig. 9 is an illustration of a printing pattern formed on an intermediate film in the printer of Fig. 8, which also shows the printing pattern of Fig. 5 for the sake of comparison.

Fig. 10 is an illustration of a printed image resulting from the printing pattern of Fig. 9 in the printer of Fig. 8.

Fig. 11 is a schematic diagram of a second embodiment of a thermal transfer type printer according to the present invention.

Fig. 12 is a schematic diagram of a third embodiment of a thermal transfer type printer according to the present invention.

Fig. 13 is a detailed diagram of a printing head portion in the printer of Fig. 12.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to Fig. 8, the first embodiment of a thermal transfer type printer according to the present invention will be described in detail.

This printer of Fig. 8 comprises a film 11 having a carbon (applied material) C which is thermally transferrable, an intermediate film 12 for receiving the carbon C thermally transferred from this film 11 and transferring the received carbon C over to a printing target object A by means of the thermal transfer, a platen roller 13 for conveying this intermediate film 12 beneath the film 11, a printing head 14 provided over the film 11 in a vicinity of this platen roller 13 for thermally transferring the carbon C in a form of a desired printing pattern from the film 11 to the intermediate film 12 conveyed by the platen roller 13, and a thermal transfer roller 15 for thermally transferring the carbon C from the intermediate film 12 to the printing target object A by heating the intermediate film 12.

In this configuration of Fig. 8, the film 11 and the intermediate film 12 are conveyed in a direction opposite to that in which the printing head 14 sequentially generates a heating pattern in a shape corresponding to the desired image to be printed such as that of characters, symbols, figures, etc., in a manner of a line scanning over the desired image to be printed from one end to another end. Thus, in this first embodiment, a direction into which the film 11 and the intermediate film 12 are conveyed with respect to the heating pattern generated by the printing head 14 is opposite to that used in the conventional printer of Fig. 1 or Fig. 4 described above.

To this end, the platen roller 13 is rotated in a direction opposite to a direction of rotation used in the conventional printer of Fig. 1 for a case of forming a normal image printing pattern by the carbon C on the intermediate film, while the printing head 14 is controlled to sequentially generate the heating pattern in a shape corresponding to the desired image to be printed, in the same manner as in the conventional printer of Fig. 1 for a case of forming a normal image printing pattern by the carbon C on the intermediate film.

As a result, in this printer of Fig. 8, the carbon C thermally transferred from the film 11 to the intermediate film 12 is going to form a mirror image printing pattern as shown in a right half of Fig. 9, looking from the film 11 side. For the sake of comparison, a left half of Fig. 9 also shows a normal image printing pattern resulting in the conventional printer of Fig. 1, which is depicted together with the right half of Fig. 9 only for the sake of explanation.

More specifically, in the conventional case, the heating pattern for a portion "a" is generated by the printing head first, and as the intermediate film moves to the left, the subsequent heating patterns such as those for portions "b" and "c" are sequentially generated, until the heating pattern for a portion "d" is finally generated, so as to produce the normal image printing pattern of the characters on the intermediate film as shown in the left half of Fig. 9. In contrast, in this first embodiment, the heating pattern for a portion "a" is generated by the printing head 14 first, and as the intermediate film moves to the right, the subsequent heating patterns such as those for portions "b" and "c" are sequentially generated, until the heating pattern for a portion "d" is finally generated, so as to produce the mirror image printing pattern of the characters on the intermediate film 12 as shown in the right half of Fig. 9.

Here, it should be noted that the heating patterns sequentially generated by the printing head 14 are the same as in the conventional case of Fig. 1, but the resulting printing pattern is an inversion of that obtained in the conventional case because of the opposite direction into which the film 11 and the intermediate film 12 are conveyed. In other words, in the conventional case shown in the left half of Fig. 9, the film and the intermediate film are conveyed in a direction for sequentially arranging the heating patterns on the intermediate film in a shape of the normal image, whereas in this first embodiment shown in the right half of Fig. 9, the film 11 and the intermediate film 12 are conveyed in a direction for sequentially arranging the heating patterns on the intermediate film in a shape of the mirror image.

The mirror image printing pattern formed on the intermediate film 12 in this manner is then thermally transferred from the intermediate film 12 to the printing target object A such as a corrugated cardboard by the thermal transfer roller 15, to obtain the resulting printed image in a form of the normal image of the desired image to be printed as shown in Fig. 10, looking from the intermediate film 12 side.

Thus, according to this first embodiment, it is possible to form the mirror image printing pattern on the intermediate film 12 by simply reversing the direction of rotation of the platen roller 13 from that for a case of forming the normal image printing pattern. In other words, it is possible to thermally transfer the carbon C in a shape of the mirror image to the intermediate film 12 even through the printing head 14 is controlled to sequentially generate the same heating patterns as in a case of forming the normal image printing pattern.

As a consequence, there is no need for the inversion by means of a software, and therefore it

is possible to avoid causing a difficulty concerning a software creation as well as a slowing of the printing speed. Moreover, there is no need for newly producing mirror image printing patterns, so that it is possible to avoid causing a high cost for a production of new printing patterns. Furthermore, the printing head 14 heats the film 11 directly in order to thermally transfer the carbon C from this film 11 to the intermediate film 12, so that it is possible to suppress the amount of heat generation required at the printing head 14 to be small, compared with a conventional printer of Fig. 4 described above.

It is to be noted that the intermediate film 12 has been moved to the right in the above description for the purpose of forming the mirror image printing pattern on the intermediate film 12, but this moving of the intermediate film 12 to the right direction is not essential to the present invention, and what is essential to the present invention is the moving of the intermediate film 12 to a direction opposite to that for a case of forming the normal image printing pattern, so that the direction to which the intermediate film 12 should be moved can be a left direction, an upward direction, or a downward direction, as long as it is opposite to the direction for a case of forming the normal image printing pattern. For instance, a case of printing the characters shown in Fig. 10 upside down is effectively equivalent to looking at Fig. 9 from upside down orientation, in which case the intermediate film 12 is going to be moved to the left direction for the purpose of forming the mirror image printing pattern on the intermediate film 12.

Referring now to Fig. 11, the second embodiment of a thermal transfer type printer according to the present invention will be described in detail. Here, the elements similar to those appeared in Fig. 8 are given the same reference numerals as in Fig. 8.

In this printer of Fig. 11, the intermediate film 12 in the first embodiment described above is omitted and replaced by the printing target object A itself, and the printing head 14 is moved with respect to the film 11 and the printing target object A located directly beneath the film 11. Here, the printing head 14 is controlled to move normally in a certain fixed direction so as to thermally transfer the normal image printing pattern formed by the carbon C from the film 11 to the printing target object A, but in a case of the mirror image printing, the printing head 14 is controlled to move in a direction opposite to that certain fixed direction so as to thermally transfer the mirror image printing pattern formed by the carbon C from the film 11 to the printing target object A.

In this second embodiment, the same advantageous effects as achieved in the first embodiment

described above can also be enjoyed for a case of the mirror image printing.

Referring now to Figs. 12 and 13, a third embodiment of a thermal transfer type printer (thermal printer) according to the present invention will be described in detail.

This thermal printer of Fig. 12 includes a black film member 710, a red film member 720, and an intermediate film member 800. The black film member 710 carries on one side a carbon black C1 as a thermally transferrable applied material for printing, while the red film member 720 carries on one side a carbon red C2 as a thermally transferable applied material for printing. On the other hand, the intermediate film member 800 carries no applied material initially, and receives the carbon black C1 and the carbon red C2 thermally transferred from the black film member 710 and the red film member 720.

The black film member 710 and the red film member 720 are initially provided inside a printer body in a state of being rolled up on cartridge type first black roll out reel 711 and first red roll out reel 721, respectively. Then, the black film member 710 is rolled out with the carbon black C1 facing inwards, guided into a vicinity of a platen roller 900 by a plurality of guide rollers 712 and a black printing head 713 located around the platen roller 900, and rolled up by a first black roll up reel 714. Similarly, the red film member 720 is rolled out with the carbon red C2 facing inwards, guided into a vicinity of the platen roller 900 by a plurality of guide rollers 722 and a red printing head 723 located around the platen roller 900, and rolled up by a first red roll up reel 724.

The first black roll out reel 711 and the first red roll out reel 721 are detachably attached to a first black roll out motor shaft 715 and a first red roll out motor shaft 725, respectively, each of which is connected with a braking motor (not shown) for generating a prescribed braking torque to provide a constant tension to the respective one of the black film member 710 and the red film member 720.

The first black roll up reel 714 and the first red roll up reel 724 are detachably attached to a first black roll up motor shaft 716 and a first red roll up motor shaft 726, respectively, each of which is connected with a torque motor (not shown) for rolling up the respective one of the black film member 710 and the red film member 720 at a constant tension.

The intermediate film member 800 is initially provided inside a printer body in a state of being rolled up on a cartridge type second roll out reel 810. Then, the intermediate film member 800 is rolled out from this second roll out reel 810, guided by a plurality of guide rollers 811 and a feed forward roller 812 to the platen roller 900 around

which it is wound, guided by printing guide rollers 813 to have its one side which received the black carbon C1 and the red carbon C2 to be parallelly facing toward a surface of a printing target in a form of a cardboard A, and rolled up by a second roll up reel 214.

The second roll out reel 810 is detachably attached to a second roll out motor shaft 815 connected with a braking motor (not shown) for generating a prescribed braking torque to provide a constant tension to the intermediate film member 800. The feed forward roller 812 operates to feed the intermediate film member 800 at a high speed. The second roll up reel 816 is detachably attached to a second roll up motor shaft 816 connected with a torque motor (not shown) for rolling up the intermediate film member 800 at a constant tension.

The platen roller 900 is attached to a stepping motor 901 as shown in Fig. 13, and controls the motion of the intermediate film member 800 around this platen roller 900 accurately.

Each of the black printing head 713 and the red printing head 723 is equipped with a multiplicity of dot shaped heat generating resistor elements, and an amount of current flowing through each of these heat generating resistor elements is controlled by a black printing controller (not shown) and a red printing controller (not shown), respectively.

As shown in detail in Fig. 13, the black printing head 713 is located around the platen roller 900 at an upper stream side of the intermediate film member 800, while the red printing head 723 is located around the platen roller 900 at a lower stream side of the intermediate film member 800. Each of the black and red printing heads 713 and 723 is made to be pivotable about a fixed end by means of a spring 920 and an air cylinder 940, such that a free end can be moved toward or away from the platen roller 900 by this pivotal motion.

The spring 920 draws the free end of the respective one of the black and red printing heads 713 and 723 toward the platen roller 900 such that the respective one of the black and red film members 710 and 720 is pressed against the intermediate film member 800 wound around the platen roller 900 by a constant force. Here, the drawing force exerted by the spring 920 can be adjusted by means of an adjustment bolt 930 attached to the spring 920. On the other hand, the air cylinder 940 pulls the free end of the respective one of the black and red printing heads 713 and 723 away from the platen roller 900.

In this third embodiment, the black printing head 713 and the red printing head 723 are controlled to thermally transfer the portions of the carbon black C1 and the carbon red C2 on the black film member 710 and the red film member

720 that are necessary for forming a desired printing pattern to be printed on the intermediate film member 800.

Except for a time of the thermal transfer described above, the black printing head 713 and the red printing head 723 are moved away from the platen roller 900, and while the black printing head 713 and the red printing head 723 are located away from the platen roller 900, the black film member 710 and the red film member 720 are not rolled up.

Between the printing guide rollers 813, there is provided a thermal transfer roller 910, which is movable in a direction along the intermediate film member 800 as well as in a direction of moving toward or moving away from the intermediate film member 800.

At a time of the thermal transfer of the desired printing pattern from the intermediate film member 800 to the cardboard A, the thermal transfer roller 910 is moved toward the intermediate film member 800 to press the intermediate film member 800 against the cardboard A while heating the intermediate film member 800, and rolls along the intermediate film member 800 between the printing guide rollers 813, to print the entire desired printing pattern formed by the carbon black C1 and the carbon red C2 onto the cardboard A.

Here, this thermal transfer roller 910 has its surface portion formed by a soft layer with the hardness of about 30 such that the intermediate film member 800 can be tightly pressed against the surface of the printing target even when the surface of the printing target is not smooth as in a back side surface of a corrugated cardboard. Thus, this thermal printer is capable of achieving an accurate printing even on a curved surface or a rough surface.

Also, the cardboard A is automatically conveyed into the thermal transfer printing position between the printing guide rollers 813 by means of a belt conveyer (not shown).

In this configuration of Fig. 12, the black film member 710, the red film member 720, and the intermediate film member 800 are conveyed in a direction opposite to that in which the black printing head 713 and the red printing head 723 sequentially generate heating patterns in shapes corresponding to the respective desired images to be printed in black and red, such as that of characters, symbols, figures, etc., in a manner of a line scanning over each desired image to be printed from one end to another end, just as in the first embodiment described above.

To this end, the platen roller 900 is rotated in a direction opposite to a direction of rotation used in a case of forming a normal image printing pattern by the carbon black C1 and carbon red C2 on the

intermediate film member 800, while the black printing head 713 and the red printing head 723 are controlled to sequentially generate the heating patterns in shapes corresponding to the respective desired images to be printed, in the same manner as in a case of forming a normal image printing pattern by the carbon black C1 and the carbon red C2 on the intermediate film member, just as in the first embodiment described above.

Now, the operation of this thermal printer of Fig. 12 will be described.

As the printing operation starts, the command signal for the desired printing pattern is supplied from a printer control unit (not shown) of the thermal printer to the black printing controller (not shown) and the red printing controller (not shown), where this command signal commands each of the black printing head 713 and the red printing head 723 to apply heat to a region in a shape of a positive mirror image of the black and red portions in the desired printing pattern, respectively, just as they are expected to appear on the cardboard A when the printing is made.

Then, the black printing head 713 is moved toward the platen roller 900 to press the intermediate film member 800 against the black film member 710, and the currents are supplied only to those heat generating resistor elements located within a region in the shape of the positive mirror image of the black portion in the desired printing pattern, so as to generate the heat in a region in the shape of the positive mirror image of the black portion in the desired printing pattern. Here, the platen roller 900 is accurately rotated by means of the stepping motor 901 to place the appropriate portion of the intermediate film member 800 at the heating position of the black printing head 713.

As a result, the heat generated by the black printing head 713 is transmitted to the black film member 710, and the carbon black C1 located within a region in the shape of the positive mirror image of the black portion in the desired black printing pattern is thermally transferred from the black film member 710 to the intermediate film member 800. When this thermal transfer of the carbon black C1 for the black portion in the desired printing pattern is finished, the black printing head 713 is moved away from the intermediate film member 800 and the rolling out of the black film member 710 is stopped.

Next, the intermediate film member 800 is rolled by the platen roller 900 to move a region having the black portion in the desired printing pattern formed therein to the heating position of the red printing head 723.

Then, the red printing head 723 is moved toward the platen roller 900 to press the intermediate film member 800 against the red film member 720,

and the currents are supplied only to those heat generating resistor elements located within a region in the shape of the positive mirror image of the red portion in the desired red printing pattern, so as to generate the heat in a region in the shape of the positive mirror image of the red portion in the desired printing pattern. Here, again, the platen roller 900 is accurately rotated by means of the stepping motor 901 to place the appropriate portion of the intermediate film member 800 at the heating position of the red printing head 723.

As a result, the heat generated by the red printing head 723 is transmitted to the red film member 720, and the carbon red C2 located within a region in the shape of the positive mirror image of the red portion in the desired red printing pattern is thermally transferred from the red film member 720 to the intermediate film member 800. When this thermal transfer of the carbon red C2 for the red portion in the desired printing pattern is finished, the red printing head 723 is moved away from the intermediate film member 800 and the rolling of the red film member 720 is stopped.

After the desired printing pattern is formed on the intermediate film member 800 by the thermally transferred carbon black C1 and the carbon red C2 in this manner, the intermediate film member 800 with the desired printing pattern formed thereon is moved by the platen roller 900 over the cardboard A until the desired printing pattern is placed at the thermal transfer printing position of the thermal transfer roller 910 provided over the cardboard A.

Next, the heated thermal transfer roller 910 is moved toward the intermediate film member 800 to press the intermediate film member 800 against the cardboard A, and then rolled along the intermediate film member 800 between the printing guide rollers 813, from the platen roller 900 side to the second roll up reel 814 side. As a result, the desired printing pattern formed on the intermediate film member 800 is thermally transferred onto the surface of the cardboard A, such that the positive normal image of the desired printing pattern is printed on the cardboard A. After this thermal transfer of the desired printing pattern is finished, the thermal transfer roller 910 is moved away from the intermediate film member 800 such that the intermediate film member 800 is separated from the cardboard A.

Then, the thermal transfer roller 910 returns back to its initial position at the platen roller 900 side, and the intermediate film member 800 is fed forward for a prescribed amount by the feed forward roller 812 while the prescribed amount of the intermediate film member 800 is rolled up by the second roll up reel 814.

When the printing of the desired printing pattern is finished in this manner, the cardboard A

with the desired printing pattern printed thereon is conveyed out from the thermal printer by the belt conveyer (not shown), and a new cardboard A to be printed next is conveyed into a thermal transfer printing position in the thermal printer between the printing guide rollers 813. During this conveying and positioning of the previous and new cardboards A, the formation of the new desired printing pattern is carried out by the black and red printing heads 713 and 723 in the manner described above. Then, the intermediate film member 800 with the new desired printing pattern formed thereon is moved to the thermal transfer printing position over the new cardboard A, and the printing of the new desired printing pattern onto the new cardboard A is carried out in the manner described above.

In this third embodiment, the same advantageous effects as achieved in the first embodiment described above can also be enjoyed for a case of the mirror image printing.

In addition, the black and red printing heads 713 and 723 are located around the single common platen roller 900, so that the region of the intermediate film member 800 on which the black portion of the desired printing pattern is thermally transferred by the black printing head 713 can be moved accurately to the heating position of the red printing head 723 by the rotation of the platen roller 900 caused by the stepping motor 901, so that the problem of the deviated coloring can be prevented almost completely.

Moreover, as only one platen roller 900 is involved, the controlling in the thermal printer can be simplified and the size of the thermal printer can be reduced.

Furthermore, as the black and red printing heads 713 and 723 are located in a close proximity from each other around the platen roller 900, the distance for which the intermediate film member 800 is moved from the heating position of the black printing head 713 to the heating position of the red printing head 723 can be very short, and the wasteful moving of the intermediate film member 800 becomes unnecessary and the total amount of the intermediate film member 800 required for the printing of the entire desired printing pattern can be reduced.

In addition, the black and red portions in the desired printing pattern are formed on the same region of the intermediate film member 800 by the black and red printing heads 713 and 723, and the black and red portions in the desired printing pattern formed on the intermediate film member 800 are thermally transferred onto the cardboard A altogether at once by the thermal transfer roller 910, so that the thermal transfer type multi-color printing can be realized very easily at a high speed.

Moreover, unlike a conventional method which requires the black and red portions to be formed separately by two separate printers using black and red films, both of the black and red portions of the desired printing pattern can be formed in the same thermal printer, so that there is no need for the alignment of the different color portions, and therefore the highly accurate multi-color printing can be realized, by using only one thermal printer such that the cost required for the multi-color printing can also be reduced.

Also, each of the black and red film members 710 and 720 is rolled only while the heating operation by the respective one of the black and red printing heads 713 and 723 is carried out, so that the consumption of the black and red film members 710 and 720 can be kept at the absolutely necessary minimum level.

It is to be noted here that this third embodiment may be further modified to change the number of film members and the number of the printing heads provided around the platen roller 900 to more than two for the multi-color printing using more than two colors. It is also possible to provide more than one of the platen rollers similar to the platen roller 900 described above around which more than one printing heads are located.

It is also to be noted here that the third embodiment described above are not only applicable to the printing target in a form of the cardboard A as described above, but also applicable to the other printing targets such as a box shaped cardboard, an object made of wood or iron, etc. In addition, the surface of the printing target may not necessarily be a flat surface, and can be a curved surface such as that of a cylindrical printing target.

It is also to be noted that, in this third embodiment, the thermal transfer roller 910 can be moved along the intermediate film member 800 in opposite directions in two successive thermal transfer printing operations, in such a manner that the thermal transfer roller 910 is moved alternately from the platen roller 900 side to the second roll up reel 814 side for one thermal transfer printing operation, and from the second roll up reel 814 side to the platen roller 900 side for next thermal transfer printing, and so on.

It is finally to be noted that, besides those already mentioned above, many modifications and variations of the above embodiments may be made without departing from the novel and advantageous features of the present invention. Accordingly, all such modifications and variations are intended to be included within the scope of the appended claims.

Claims

1. An apparatus for thermal transfer type printing, comprising:
 - film means for carrying a thermally transferrable applied material; and
 - printing means for thermally transferring the applied material in a shape of a desired printing pattern from the film means to a printing target object by applying heat to a desired part of the applied material on the film means in a shape of the desired printing pattern;
 - wherein the printing means and the film means are relatively moved in one direction in a case of printing a normal image of the desired printing pattern whereas the printing means and the film means are relatively moved in another direction opposite to said one direction in a case of printing a mirror image of the desired printing pattern.
2. An apparatus for thermal transfer type printing, comprising:
 - film means for carrying a thermally transferrable applied material;
 - intermediate film means for receiving the applied material thermally transferred from the film means;
 - printing head means for forming a desired printing pattern on the intermediate film means by applying heat to a desired part of the applied material on the film means in a shape of the desired printing pattern;
 - platen roller means for conveying the intermediate film means with respect to the printing head means while the printing head means is forming the desired printing pattern on the intermediate film means, such that the printing head means and the intermediate film means are relatively moved in one direction in a case of forming a normal image of the desired printing pattern on the intermediate film means whereas the printing head means and the intermediate film means are relatively moved in another direction opposite to said one direction in a case of forming a mirror image of the desired printing pattern on the intermediate film means; and
 - thermal transfer means for thermally transferring the desired printing pattern formed on the intermediate film means to a printing target object.
3. The apparatus of claim 2, further comprising:
 - film moving means for moving the film means through a heating position of the printing head means;
 - intermediate film moving means for mov-

ing the intermediate film means through the heating position of the printing head means and a thermal transfer position of the thermal transfer means; and

controlling means for controlling the film moving means and the intermediate film moving means such that the film means and the intermediate film means move through the heating position of the printing head means together while the heat is applied by the printing head means, and the film means is stopped otherwise.

4. The apparatus of claim 2, wherein the film means includes a plurality of film members for carrying thermally transferrable applied material in different colors, and the printing head means includes a plurality of printing heads for forming a plurality of desired printing patterns in said different colors on the intermediate film means by applying heat to a desired part of the applied material on each film member of the film means in a shape of the desired printing pattern. 15
5. The apparatus of claim 4, wherein said plurality of film members are arranged along the intermediate film means to come into contact with the intermediate film means one after another, within a heating position of the printing head means. 20
6. The apparatus of claim 5, wherein the printing head means forms said plurality of desired printing patterns on a single region of the intermediate film means by applying heat to desired parts of the applied material on said plurality of film members in shapes of said plurality of desired printing patterns sequentially, as the single region of the intermediate film means comes in contact with said plurality of film members one after another, and the thermal transfer means thermally transfers said plurality of desired printing patterns formed on the single region of the intermediate means to a printing target object altogether at once. 25
7. The apparatus of claim 4, wherein said plurality of printing heads of the printing head means are located around the platen roller means, in correspondence to said plurality of film members. 30
8. The apparatus of claim 7, further comprising a stepping motor for controlling an angle of rotation of the platen roller means between an application of heat by one of said plurality of printing heads and an application of heat by 35

another one of said plurality of printing heads.

9. A method of thermal transfer type printing, comprising the steps of:
 - providing film means for carrying a thermally transferrable applied material; and
 - thermally transferring the applied material in a shape of a desired printing pattern from the film means to a printing target object by applying heat from a printing head means to a desired part of the applied material on the film means in a shape of the desired printing pattern, while relatively moving the printing means and the film means in one direction in a case of printing a normal image of the desired printing pattern, and relatively moving the printing means and the film means in another direction opposite to said one direction in a case of printing a mirror image of the desired printing pattern. 10
10. A method of thermal transfer type printing, comprising the steps of:
 - providing film means for carrying a thermally transferrable applied material; 15
 - providing intermediate film means for receiving the applied material thermally transferred from the film means; 20
 - forming a desired printing pattern on the intermediate film means by applying heat from printing head means to a desired part of the applied material on the film means in a shape of the desired printing pattern; 25
 - conveying the intermediate film means with respect to the printing head means by platen roller means while the printing head means is forming the desired printing pattern on the intermediate film means, such that the printing head means and the intermediate film means are relatively moved in one direction in a case of forming a normal image of the desired printing pattern on the intermediate film means whereas the printing head means and the intermediate film means are relatively moved in another direction opposite to said one direction in a case of forming a mirror image of the desired printing pattern on the intermediate film means; and 30
 - thermally transferring the desired printing pattern formed on the intermediate film means to a printing target object by thermal transfer means. 35
11. The method of claim 10, further comprising the steps of:
 - moving the film means through a heating position of the printing head means by film moving means; 40

moving the intermediate film means through the heating position of the printing head means and a thermal transfer position of the thermal transfer means by intermediate film moving means; and

controlling the film moving means and the intermediate film moving means such that the film means and the intermediate film means move through the heating position of the printing head means together while the heat is applied by the printing head means, and the film means is stopped otherwise.

- 12.** The method of claim 10, wherein at the step for providing the film means, the film means includes a plurality of film members for carrying thermally transferrable applied material in different colors, and at the forming step, the printing head means includes a plurality of printing heads for forming a plurality of desired printing patterns in said different colors on the intermediate film means by applying heat to a desired part of the applied material on each film member of the film means in a shape of the desired printing pattern.

- 13.** The method of claim 12, wherein at the step for providing the film means, said plurality of film members are arranged along the intermediate film means to come into contact with the intermediate film means one after another, within a heating position of the printing head means.

- 14.** The method of claim 13, wherein at the forming step, the printing head means forms said plurality of desired printing patterns on a single region of the intermediate film means by applying heat to desired parts of the applied material on said plurality of film members in shapes of said plurality of desired printing patterns sequentially, as the single region of the intermediate film means comes in contact with said plurality of film members one after another, and at the thermally transferring step, the thermal transfer means thermally transfers said plurality of desired printing patterns formed on the single region of the intermediate film means to a printing target object altogether at once.

- 15.** The method of claim 12, wherein at the forming step, said plurality of printing heads of the printing head means are located around the platen roller means, in correspondence to said plurality of film members.

- 16.** The method of claim 15, further comprising the step of controlling an angle of rotation of the platen roller means by a stepping motor between an application of heat by one of said plurality of printing heads and an application of heat by another one of said plurality of printing heads.

FIG.1

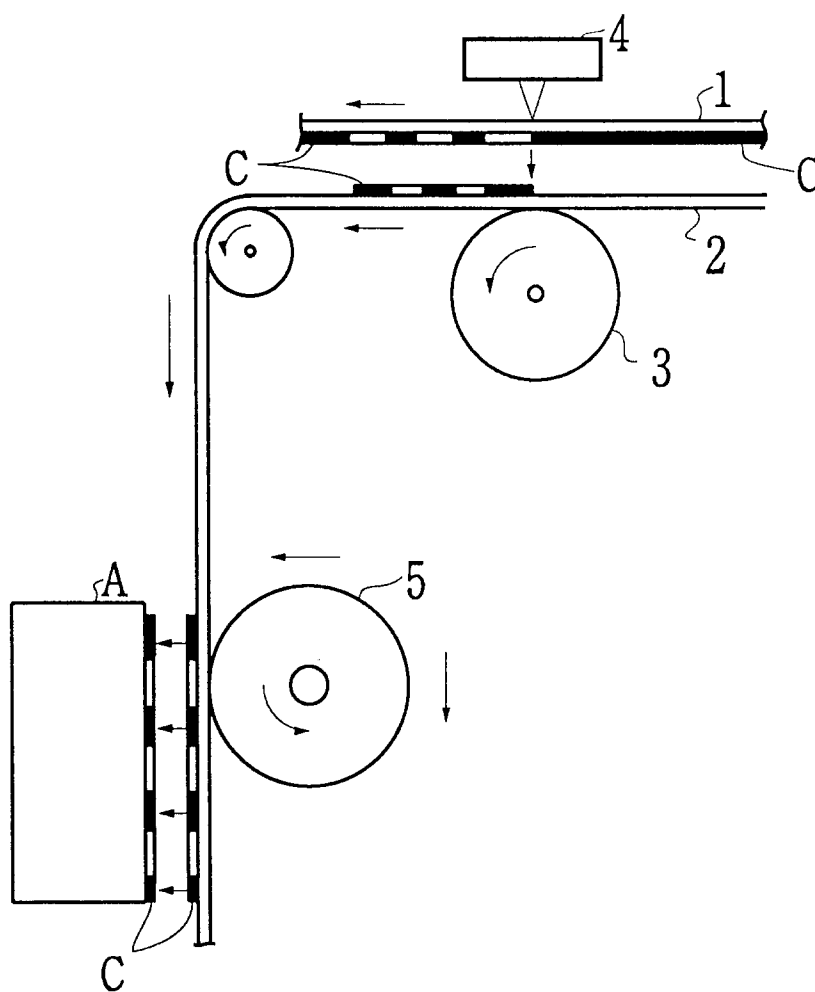


FIG.2
PRIOR ART

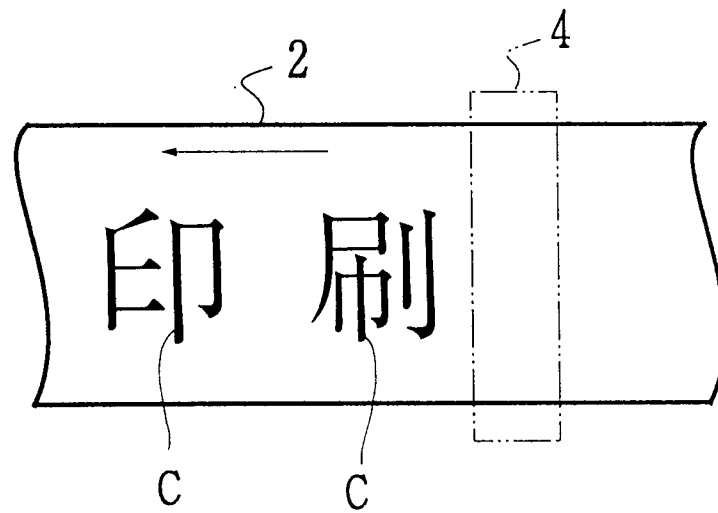


FIG.3
PRIOR ART

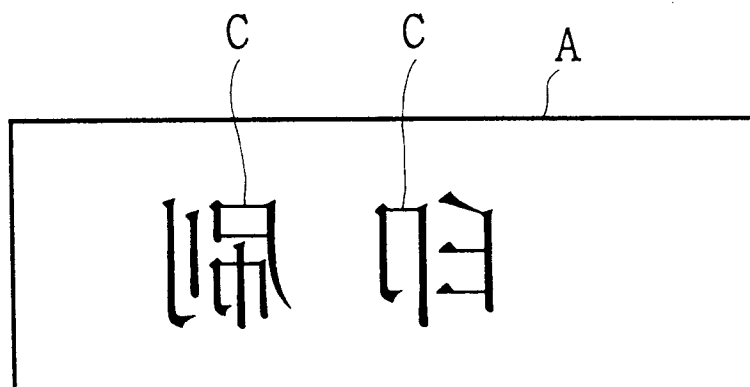


FIG.4
PRIOR ART

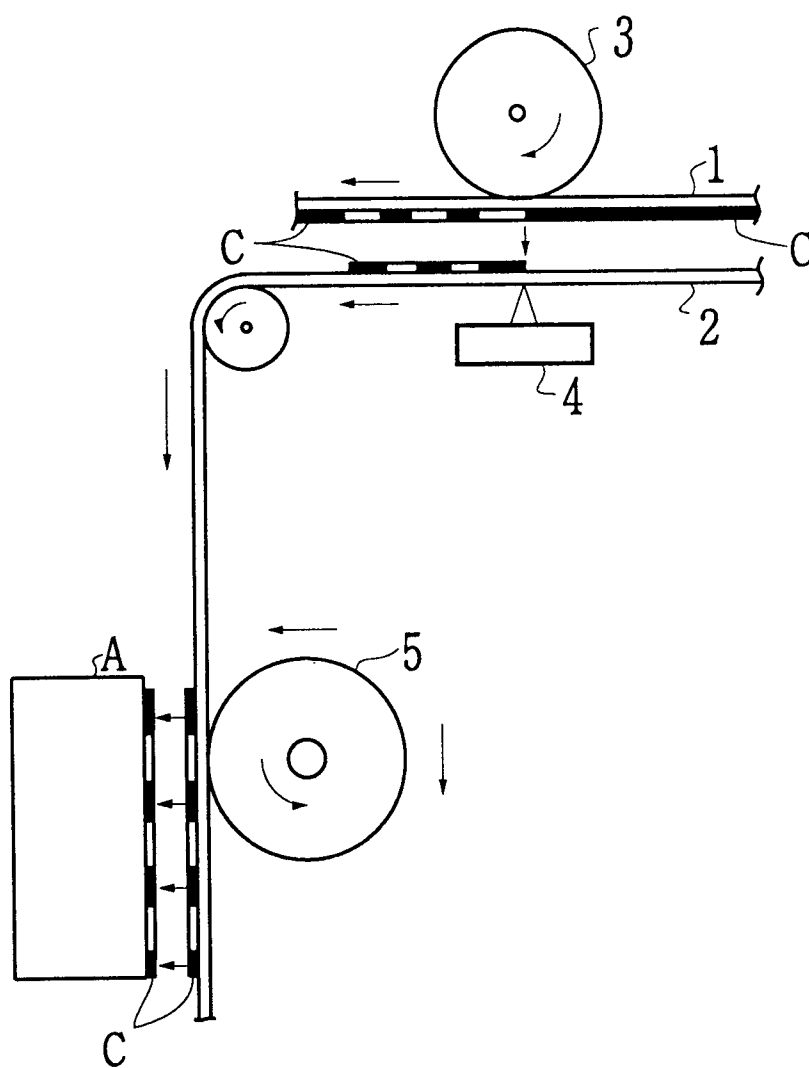


FIG.5
PRIOR ART

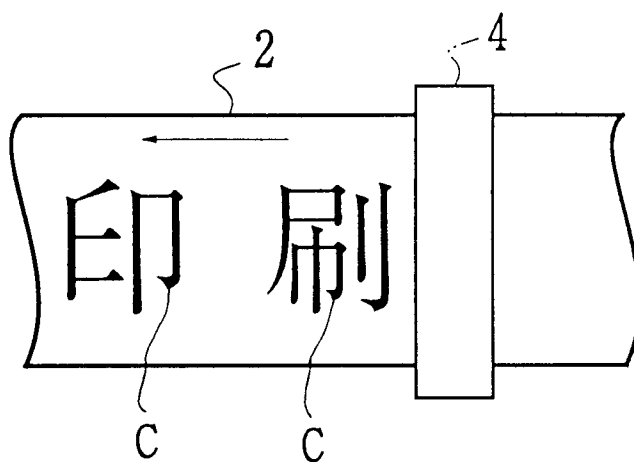


FIG.6
PRIOR ART

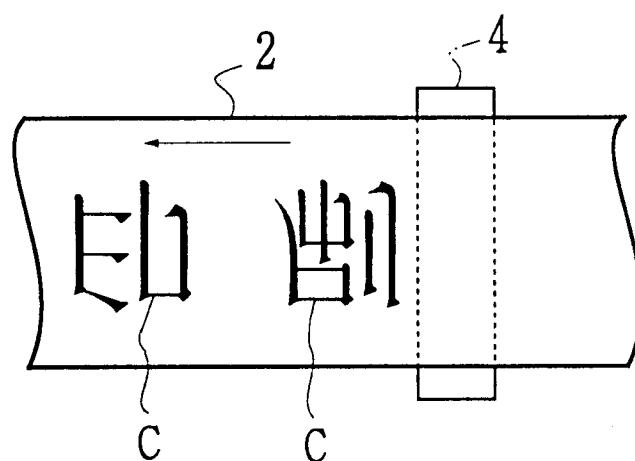


FIG.7
PRIOR ART

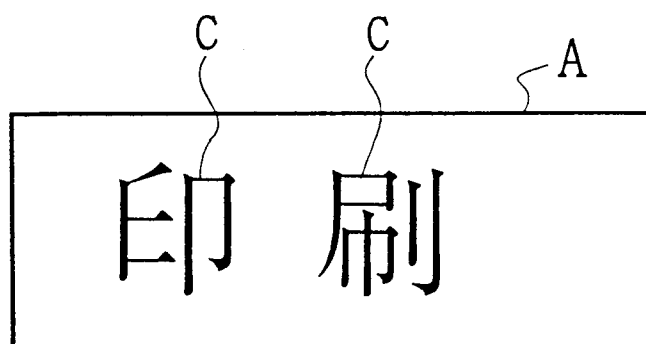


FIG.8

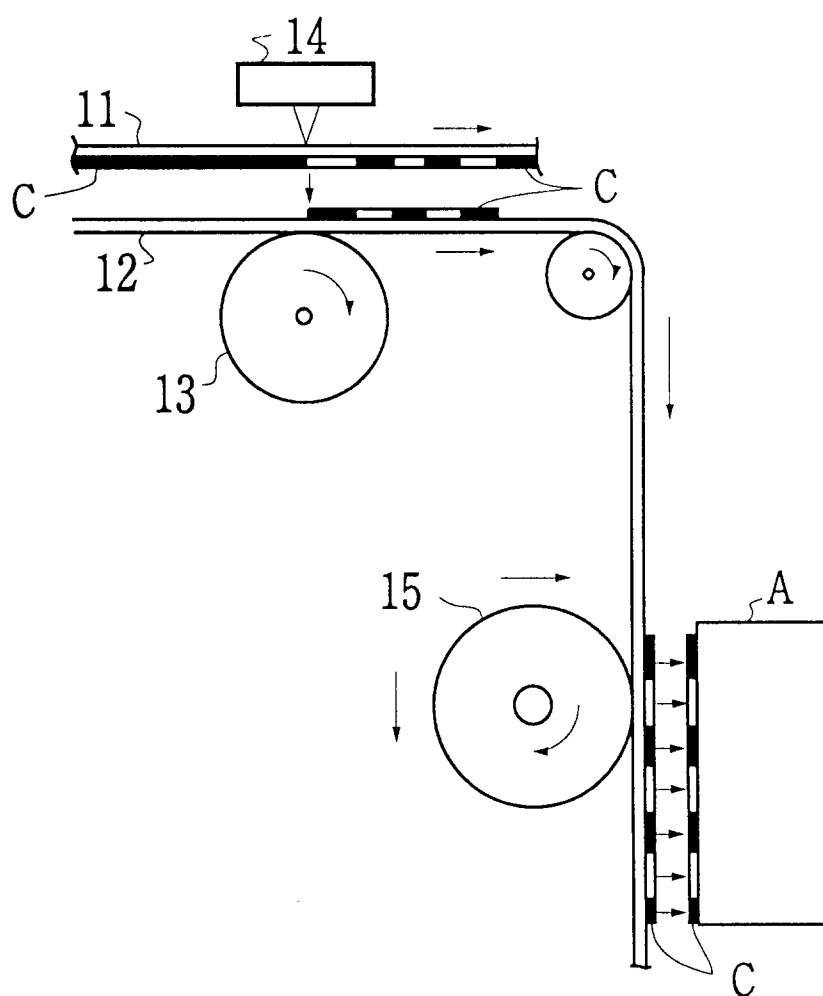


FIG.9

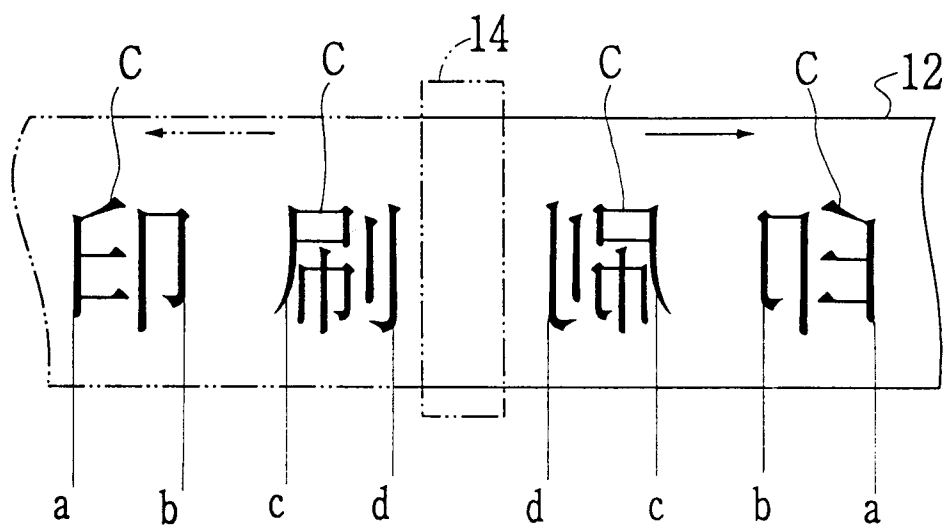


FIG.10

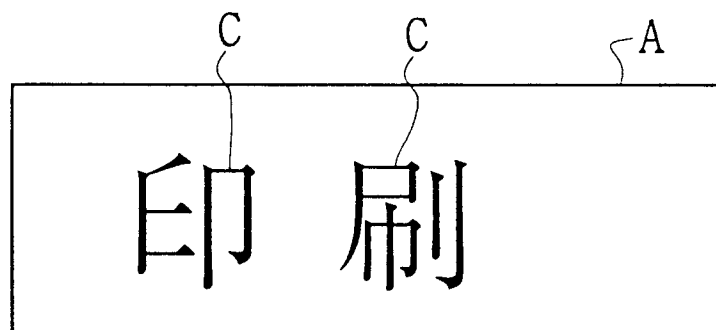


FIG.11

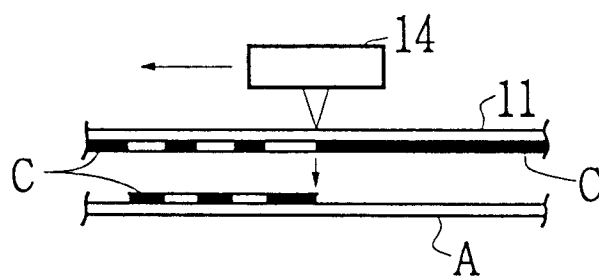


FIG.12

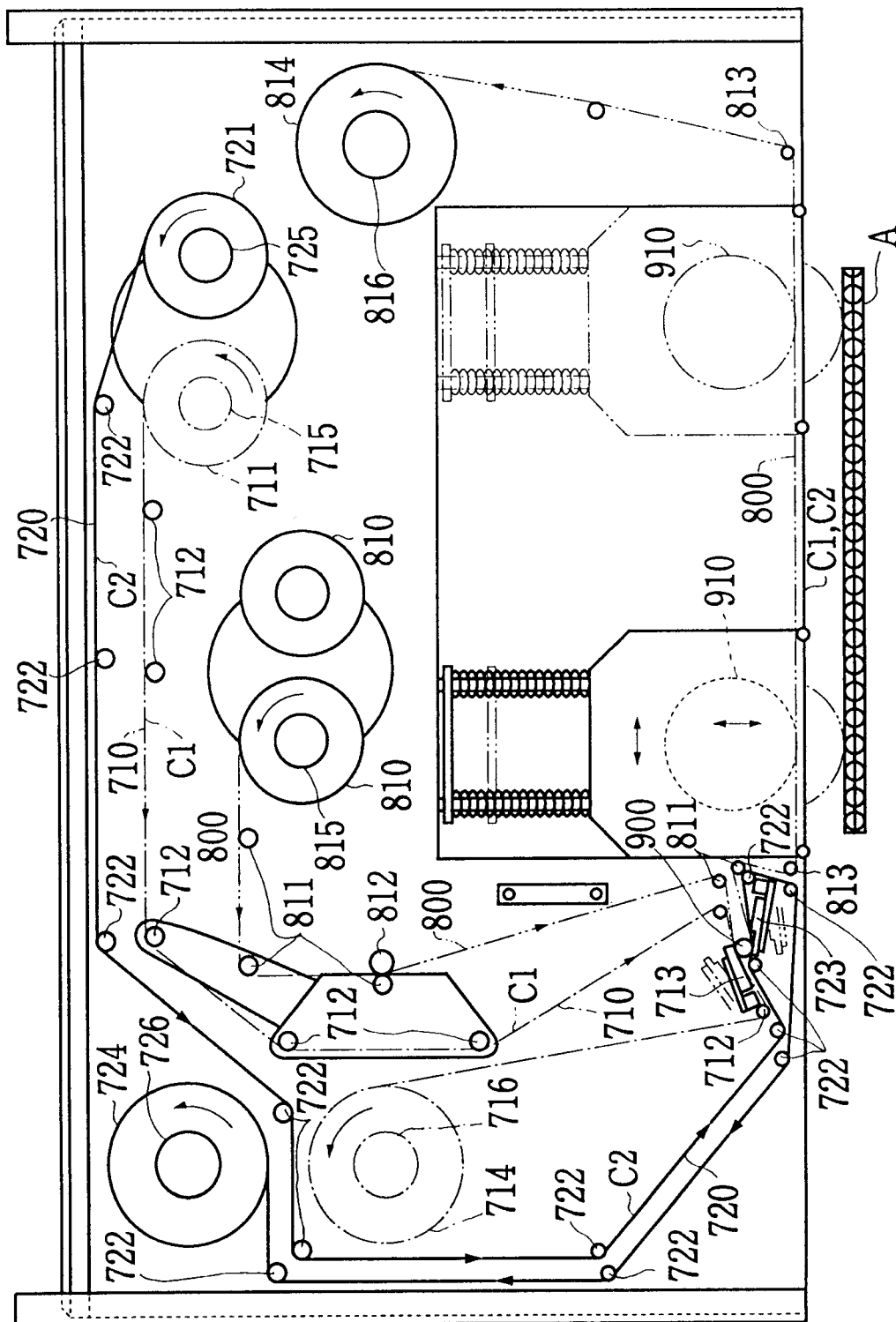


FIG.13

