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(54) **Method and apparatus for thermal printing suitable for large printing area.**

(57) An apparatus and a method for thermally printing desired printing patterns on a printing object is disclosed using a carbon ribbon having thermally transferable carbon black on its front side. A printing head placed on a first track creates the desired printing patterns on carbon ribbon and a thermal transfer roller placed on a second track presses the front side of the carbon ribbon onto the printing object to thermally transfer the desired printing pattern from the carbon ribbon to the printing object. The carbon black is expended thereby and the expended carbon ribbon is guided in a closed loop to the front side of the unexpended carbon ribbon at the printing head to take extraneous images there.

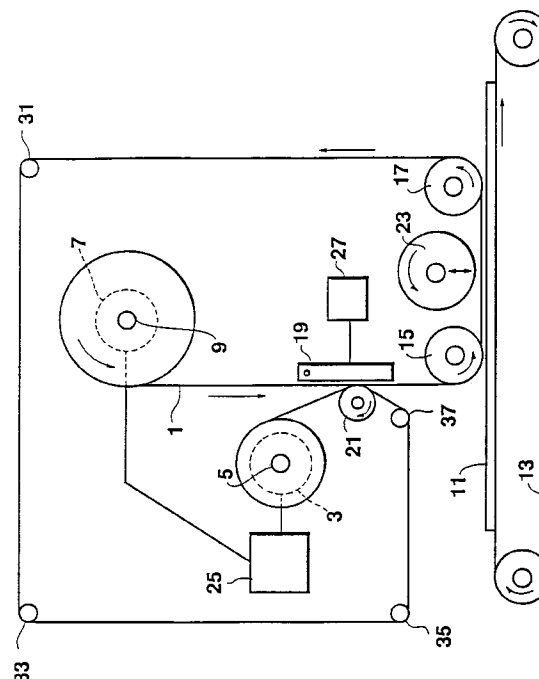


FIGURE 1

The present invention relates to an apparatus and a method for thermally printing desired printing patterns on a printing object by using a carbon ribbon having thermally transferable carbon track on its front side as set forth in the Preambles of Claims 1 and 6, respectively. An apparatus and a method of this kind is known from US-A-4 739 343.

In this document, a thermal printing system for postage meter mailing machine application is disclosed in which the carbon ribbon is imprinted from its rear side by a printing heading having the pattern of an extraneous image. This extraneous image is transferred by the printing head onto a scavenging roller so that positive printing pattern remains on the carbon ribbon which is subsequently transferred by thermally printing onto a printing object. A blade is associated to the scavenging roller which dislodges the ink transferred thereto from the carbon ribbon so that the scavenging roller is always prepared to receive ink from the carbon ribbon.

From US-A-4 740 798 a transfer-type thermal printing device is known making use a carbon ribbon which is imprinted by a printing head so that a predetermined pattern of ink is removed from the ribbon, so that a printing pattern remains on the ribbon which is subsequently transferred by application of heat to a printing object. The ink of the predetermined pattern initially removed from the ribbon is transferred in the printing head onto the rear side of the ribbon expended by the utilization in the printing station where the ribbon is brought in contact with the printing object.

It is the object of the present invention to provide an apparatus and a method for thermal printing as set forth in the Preamble of Claim 1 and 6, respectively, which make it possible to print patterns on large printing areas at a high accuracy.

This object is attained by the features of Claim 1 respectively, as far as the apparatus is concerned, and by the features of Claim 6 as far as the method is concerned. Preferred embodiments thereof are subject matter of the dependent claims.

The invention has the specific advantage that the extraneous ink pattern is transferred onto the front side of the carbon ribbon which has been expended upon the transfer of the printing pattern onto the printing object. The front side of such carbon ribbon is specifically adapted to receive ink as it had been specifically prepared therefore upon manufacture of such ribbon.

Other features and advantages of the present invention will become apparent from the following description taken in conjunction with the accompanying drawing. The only figure is a schematic diagram of an embodiment of an apparatus for thermal printing according to the present invention:

In this embodiment there is provided a ribbon winding reel 3, rotatable around an axis 5 which is connected to a motor (not shown), for winding a car-

bon ribbon 1, and a ribbon supplying reel 7, rotatable around an axis 9 which is connected to another motor (not shown), around which the carbon ribbon 1 is initially wound and from which the carbon ribbon 1 is taken out as it is wound around the ribbon winding reel 3.

The carbon ribbon 1 is suspended downwards from ribbon supplying reel 7 in a U-shape by means of a pair of guiding rollers 15 and 17 provided below the ribbon supplying reel 7 and a ribbon guiding roller 31, respectively, so that starting from the ribbon supplying reel 7 the carbon ribbon 1 moves along its U-shaped track first along a first vertical track of a sufficient length in a vertical direction and then along a horizontal track of a sufficient length in a horizontal direction before guided along a second vertical track extending to said guiding roller 31. The carbon ribbon 1 has a front surface covered by carbon black which is facing outwards from an outer circumference of the U-shaped track.

At the middle of the first vertical track extending from the ribbon supplying reel 7, there is provided a printing head 19 for imprinting desired patterns on the carbon ribbon 1. This printing head 19 is pivotally supported such that it can be separated from the carbon ribbon 1, and is controlled by a printing controller unit 27 in which predetermined printing patterns are pre-programmed such that various desired printing patterns can be obtained from combinations of the pre-programmed printing patterns.

On the opposite side of the printing head 19 with respect to the carbon ribbon 1, there is provided a platen roller 21 for maintaining an accuracy in printing by the printing head 19 on the carbon ribbon 1. The carbon ribbon 1 is taken around to be inserted between the platen roller 21 and the carbon ribbon 1 through additional rollers 31, 33, 35 and 37, such that the used carbon ribbon 1 moves in a direction opposite to new carbon ribbon 1 coming from the ribbon supplying reel 7.

This routing is necessary in order to bring the front surface of the used carbon ribbon 1 to face the printing head 19. The front surface of the used carbon ribbon 1 must face the printing head 19 since for the carbon ribbon 1 to be able to receive the carbon black it is necessary to have a particular chemical treatment done, and this chemical treatment is usually given to the front surface of the carbon ribbon 1 which is being covered by carbon black initially.

Underneath the horizontal track for the carbon ribbon 1 a belt conveyor 13 is provided on which a printing object 11 is carried along the horizontal direction with a printing surface facing the front surface of the carbon ribbon 1.

On the opposite side of the belt conveyor 13 with respect to the carbon ribbon 1, between the pair of guiding rollers 15 and 17, a thermal transfer roller 23 is disposed which rotates at a circumferential speed

which equals that of the carbon ribbon 1, and is vertically movable so that at its lower position the carbon ribbon 1 moving underneath the thermal transfer roller 23 is pressed down onto the printing surface of the printing object 11 moving below the carbon ribbon 1 on the conveyor belt 13.

Thus, in this embodiment, the printing head 19 and the thermal transfer roller 23 are arranged to be spatially separated from each other substantially, as they are arranged along the vertical and horizontal directions, respectively. This feature allows this embodiment of an apparatus for thermal printing to print large printing patterns on a large printing surface, since the imprinting by the printing head 19 can be done for the carbon ribbon 1 over a length of the vertical track beyond the printing head 19, while the thermal transfer by the thermal transfer roller 23 takes place at the spatially separated horizontal track.

The drives of the ribbon winding reel 3, and the ribbon supply reel 7 are controlled by the motor control unit 25 so as to obtain a smooth and desirably controlled motion of the carbon ribbon 1 along its track.

The used carbon ribbon 1 is then wound around the ribbon winding reel 3 which is provided in a vicinity of the platen roller 21.

The used carbon ribbon 1 is usable as the medium to take extraneous negative (or positive) images underneath the printing head 19, because after the printing is performed at the thermal transfer roller 23, all the carbon blacks covering the carbon ribbon 1 are transferred away from the carbon ribbon 1 such that after passing the horizontal track the carbon ribbon 1 is just a transparent sheet.

Thus, according to this embodiment, the carbon ribbon 1 is used both for printing the desired printing patterns as well as taking extraneous negative (or positive) images when the printing patterns are to be imprinted by the printing head 19, so that no separate medium for taking extraneous negative (or positive) images is required.

Claims

1. An apparatus for thermally printing desired printing patterns on a printing object (11) by using a carbon ribbon (1) having thermally transferable carbon black on its front side, comprising:
means (3, 7, 15, 17) for moving the carbon ribbon (1) along a first track and then along a second track which is spatially separated from the first track,
conveyor means (13) for carrying a printing object (11) along the second track below the carbon ribbon (1);
printing head means (19) placed on the first track for creating the desired printing patterns on the

carbon ribbon (1) on the first track by imprinting the rear side of said ribbon (1);
a platen roller (21) placed on an opposite side of the printing head means (19) with respect to the carbon ribbon (1); and
thermal transfer roller means (23) placed on the second track for pressing the front side of the carbon ribbon (1) onto the printing object (11) on the conveyor means (13) so as to thermally transfer the desired printing patterns from the carbon ribbon (1) to the printing object (11);
transfer of the printing pattern expends the carbon ribbon (1); and
the expended carbon ribbon (1) is utilized for taking extraneous images by inserting the expended carbon ribbon (1) between the platen roller (21) and the front side of the unexpended carbon ribbon (1) in the vicinity of the printing head means (19) such that the extraneous images are placed on the front side of the expended carbon ribbon (1).

2. The apparatus of Claim 1 wherein the first and second tracks are oriented along different directions.
3. The apparatus of Claim 2, wherein the first and second tracks are oriented along mutually perpendicular directions.
4. The apparatus of Claim 1 wherein the second track is oriented along a horizontal direction.
5. The apparatus of any one of the preceding claims, wherein the extraneous images are negative extraneous images such that the printing patterns appear blank while an outline of the printing patterns appears inked on the printing object (11).
6. A method of thermally printing desired printing patterns on a printing object by using a carbon ribbon having thermally transferable carbon black on its front side, comprising the steps of:
moving the carbon ribbon along a first track and then along a second track which are spatially separated from the first track;
carrying a printing object along the second track below the carbon ribbon;
creating the desired printing patterns on the carbon ribbon on the first track by imprinting the rear side of said ribbon;
pressing the front side of the carbon ribbon onto the printing object on the second track and concurrently applying heat to said pressed ribbon so as to thermally transfer the desired printing patterns on the carbon ribbon to the printing object;
characterized by further comprising the

steps of:

transfer of the printing pattern expends the carbon ribbon and

extraneous images in which the printing patterns are excluded are taken by utilizing the expended carbon ribbon by confronting its front side with the front side of the unexpended carbon ribbon (1) in the vicinity of the printing head means such that the extraneous images are placed on the front side of the expended carbon ribbon.

7. The method of Claim 6 wherein the first and second tracks are provided along different directions.

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8. The method of Claim 7, wherein the first and second tracks are provided along mutually perpendicular directions.

9. The method of Claim 6, wherein the second track is provided along a horizontal direction.

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10. The method of Claim 6, wherein the extraneous images are negative extraneous images such that the printing patterns appear blank while an outline of the printing patterns appears inked on the printing object.

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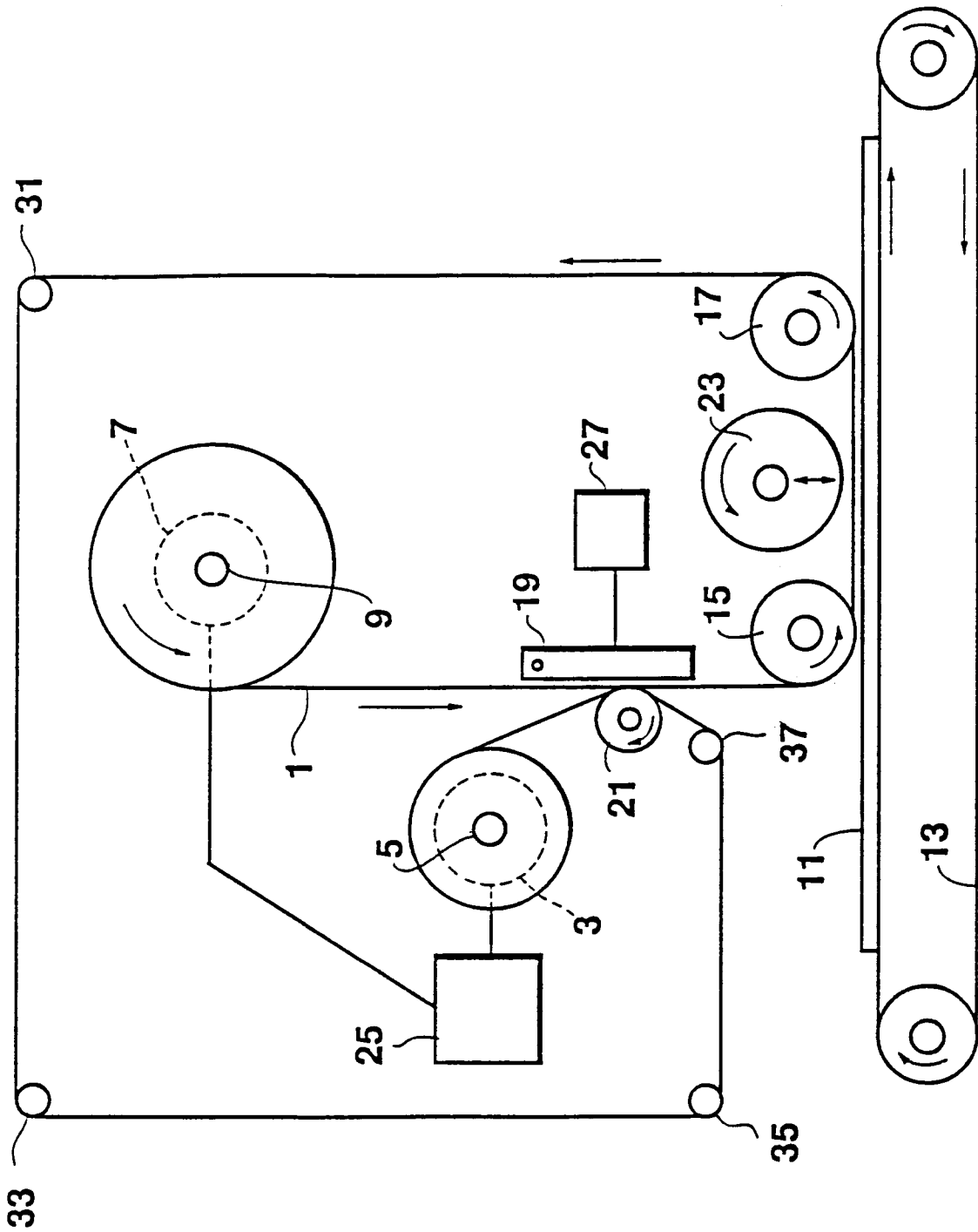


FIGURE 1