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(72) Inventor: **Sogabe, Masuo**
Tsurugashima-shi, Saitama-ken (JP)

(74) Representative: **Hering, Hartmut, Dipl.-Ing.**
Patentanwälte
Berendt, Leyh & Hering
Innere Wiener Strasse 20
81667 München (DE)

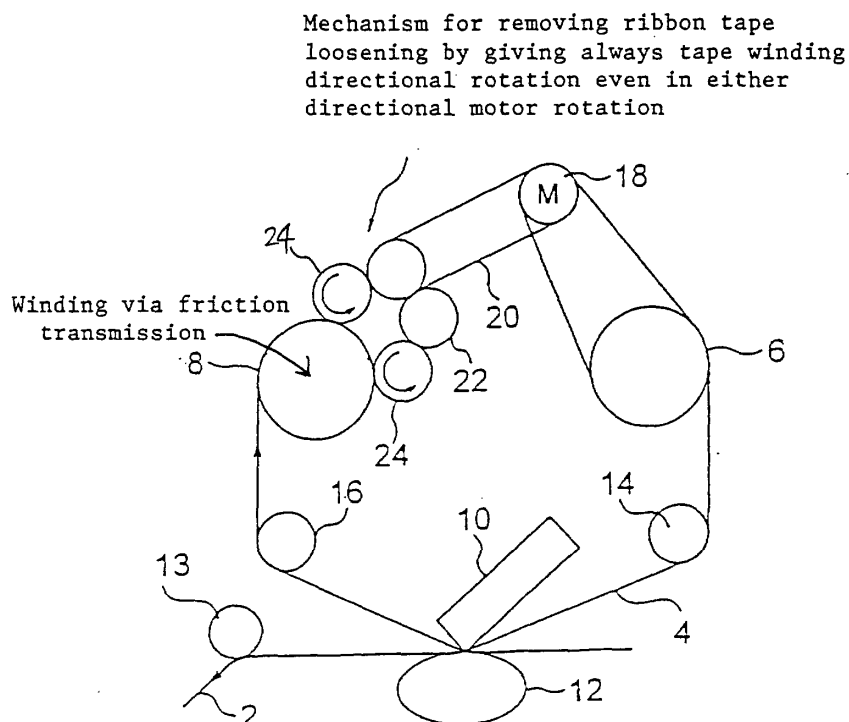
(71) Applicant: **Daisey Machinery Co., Ltd.**
Tsurugashima-shi, Saitama-ken 350-2217 (JP)

(54) **Line thermal head letter printing method**

(57) Line thermal head letter printing method is improved to feed ribbon tape synchronously with transfer velocity of print object sheet from immediately after start of printing so as to obtain high quality letter printing. Ribbon tape master roll (6) is driven by stepping motor (18) so as to feed necessary amount of ribbon tape (4). Rib-

bon tape winding roll (8) is driven via friction transmission so as to wind the ribbon tape (4) at velocity higher than that of transferring print object sheet (2). There occurs no loosening of ribbon tape hot release portion at tip of line thermal head (10) and high quality letter printing is obtained.

Fig. 1



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Description

[0001] The present invention relates to a line thermal head letter printing method of a synchronous type for making a letter printing by feeding a hot release type thermal transfer ribbon tape following a transfer velocity of a print object sheet and especially relates to a line thermal head letter printing method in which feeding- and winding of the ribbon tape are improved.

[0002] In recent years, there are often cases where letters and marks, such as date of manufacture, tastable time period and series number of manufacture, are printed on a packaging material differently for each of objects to be printed. In such cases, the printing is often done by feeding a hot release type thermal transfer ribbon tape following a transfer velocity of a sheet as an object to be printed, such as a packaging material film, (herein referred to as "a print object sheet") and by supplying a line thermal head, such as that called a corner edge type or an end face type, which is pressed against the ribbon tape, with electricity.

[0003] In case the printing is done on the print object sheet, which is being transferred with a high velocity, by the line thermal head using the hot release type thermal transfer ribbon tape, when a portion to be printed of the print object sheet comes, it is necessary that the ribbon tape is wound to be fed synchronously with the velocity of the print object sheet. For this purpose, that is, in order to wind the ribbon tape to feed it synchronously with the velocity of the print object sheet in time for start of the printing, a rise time is needed.

[0004] Because of such rise time, there is necessarily caused a delay in the start of the winding of the ribbon tape. Despite such delay in the start of the winding of the ribbon tape, as the ribbon tape, which is in contact with the print object sheet, is fed upon start of the printing, there may be caused a loosening of the ribbon tape hot release portion at a tip of the head in the initial stage of the printing immediately after the start of the printing, which often results in the problem that there is caused a place where no printing is done at a head portion of the printing or the printing is out of order because of no good hot release, and it has been found that this problem arises in the case where the printing is done on the print object sheet which is being transferred at a high velocity of 10 inch/second or more.

[0005] As mentioned above, in the conventional letter printing method for printing letters by using a line thermal head supplied with electricity and a hot release type thermal transfer ribbon tape, there is a problem that a printing of a desired quality may not necessarily be done at the starting time of the printing.

[0006] In view of the problem in the prior art, it is an object of the present invention to provide a line thermal head letter printing method by which a hot release type thermal transfer ribbon tape may be fed synchronously with a transfer velocity of a print object sheet from immediately after a start of printing so that a high quality

printing may be obtained.

[0007] In order to attain the mentioned, object in the letter printing method for printing letters on the print object sheet, which is being transferred, by using the line thermal head and the hot release type thermal transfer ribbon tape, the present invention provides a line thermal head letter printing method comprising steps of: feeding a necessary amount of the ribbon tape at a velocity synchronized with a transfer velocity of the print object sheet by using a stepping motor, and winding the ribbon tape via a friction transmission by a power rotating at a velocity higher than that of the print object sheet being transferred.

[0008] By employing the mentioned letter printing method, winding of the ribbon tape is done while the ribbon tape is being stretched via the friction transmission by the power rotating at the velocity higher than that of the transferring print object sheet, thus the ribbon tape is so wound that a tension acts on the ribbon tape continuously, there occurs no loosening of the ribbon tape hot release portion at a tip of the head and the hot release of the ribbon tape takes place always in a good condition.

[0009] While a ribbon tape winding side wants to so stretch the ribbon tape at the velocity higher than that of the transferring print object sheet, there is an effect of a torque of the stepping motor provided on a ribbon tape feeding side and the ribbon tape is in no case fed at a velocity higher than that fed by a drive mechanism using the stepping motor.

[0010] Also, in the letter printing method according to the present invention, if both of the feeding and the winding of the ribbon tape are done by a roll drive and a feeding amount of the ribbon tape is detected, by a rotary encoder, then it will be preferable as an inked face of the ribbon tape may not be damaged.

[0011] Thus, according to the letter printing method of the present invention, a clear and high quality printing can be done also on the print object sheet which is being transferred at a velocity higher than 10 inch/second or more with which there has been a problem.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Fig. 1 is an explanatory constructional view of a construction example of a letter printing device for working a letter printing method according to the present invention.

[0013] Fig. 2 is an explanatory constructional view of a partial variation example of the construction of the letter printing device of Fig. 1.

[0014] Herebelow, a letter printing method according to the present invention will be described concretely using an embodiment illustrating this method. Fig. 1 shows one example of a letter printing device for working the letter printing method of the present invention. In Fig. 1, numeral 2 designates a print object sheet which is being transferred to a direction shown by arrow. Numeral 4

designates a thermal transfer ribbon tape, which is fed from a ribbon tape master roll 6 to be wound around a ribbon tape winding roll 8 while being disposed on the print object sheet 2 on the way. The ribbon tape winding roll 8 is rotated by a power transmitted from a power transmission mechanism, described later, via a friction transmission by a sliding clutch.

[0015] Numeral 10 designates a line thermal head and numeral 12 designates a platen unit comprising a plate or roller. The platen unit 12 is disposed under the line thermal head 10, thereby the print object sheet 2 and the thermal transfer ribbon tape 4 are put between the line thermal head 10 and the platen unit 12 so that a letter printing may be done on the print object sheet 2. Numeral 13 designates a sheet velocity detecting encoder for detecting a transfer velocity of the print object sheet 2.

[0016] Numeral 14 designates a rotary encoder and guide roller, which detects a feeding velocity of the ribbon tape and at the same time guides a feeding of the ribbon tape. Numeral 16 designates a guide roller, which guides the feeding of the ribbon tape. Numeral 18 designates a stepping motor, which rotates the ribbon tape master roll 6 to feed the ribbon tape in the amount needed for the printing.

[0017] A drive force of the stepping motor 18 is transmitted to the ribbon tape winding roll 8 via a belt 20, a transmission roll 22 and a one-way clutch gear 24 so as to drive the ribbon tape winding roll 8 rotationally.

[0018] The power transmission mechanism comprises the belt 20, the transmission roller 22 and the one-way clutch gear 24 and is constructed such that the ribbon tape winding roll 8 is rotated always in a tape winding direction even if the stepping motor 18 rotates in either direction so as to remove a loosening of the ribbon tape 4.

[0019] Also, a transmission ratio or the drive force which is transmitted from the stepping motor 18 to the ribbon tape winding roll 8 is so set that a stretching force acts always on the ribbon tape 4 as a diameter of the ribbon tape winding roll 8 changes.

[0020] In the letter printing device constructed as mentioned above, the ribbon tape master roll 6 is driven by the stepping motor 18 so that the ribbon tape 4 is fed at a velocity equal to the transfer velocity of the print object sheet 2 and at the same time the power rotating at a velocity higher than the transfer velocity of the print object sheet 2 is transmitted to the ribbon tape winding roll 8 via the friction transmission by the sliding clutch so that the ribbon tape 4 is wound around the ribbon tape winding roll 8.

[0021] Thus, a tension acts always on the ribbon tape 4 so that there occurs no loosening of the ribbon tape hot release portion at the tip of the line thermal head 10 and the ribbon tape 4 may be wound around the ribbon tape winding roll 8 always with a good condition of the hot release. Hence, a clear letter printing can be done using the hot release type ribbon tape.

[0022] As mentioned above, while the ribbon tape 4 receives a stretching force acting toward the ribbon tape winding roll 8, as there is acting the torque of the stepping motor 18 on the ribbon tape 4, the ribbon tape 4 is in no case fed more than needed beyond the velocity fed by the drive mechanism using the stepping motor 18.

[0023] Also, when the ribbon tape 4 is to stand still, as a stationary torque can be obtained by using the stepping motor 18, the ribbon tape 4 is in no case dragged by a contact resistance or an electrostatic force with the print object sheet 2.

[0024] Also, in the illustrated letter printing device, as the feeding amount of the ribbon tape 4 is monitored by the rotary encoder and guide roller 14, an amount of the ribbon tape 4 fed during the time of acceleration or deceleration in the process to follow the velocity of the print object sheet 2 can be fed back to be rewound around the ribbon tape master roll 6 only by rotating the stepping motor 18 reversely, hence a consumption of the ribbon tape 4 can be saved.

[0025] Further, in the present letter printing device, as the feeding and the winding of the ribbon tape 4 are done both by the roll drive, even when the roll of the ribbon tape is made with the inked face being on the outer side, the inked face of the ribbon tape is in no case damaged by a load while moving on a transfer path. Also, as there is no press feed mechanism using a drive roller, there are greatly reduced a dirt of a feed roller and a falling of sticking matters and an excellent print quality can be maintained.

[0026] Furthermore, in the range of the feeding velocity of the ribbon tape of 10 inch/second or less, even if the relation of the feeding and the winding in the present system of the roll drive is reversed so as to drive the winding roll, there is acting no load on the inked face and an excellent print quality can be maintained.

[0027] In the letter printing device as described above, while the ribbon tape master roll 6 and the ribbon tape winding roll 8 are driven by the single stepping motor 18, the construction may be made such that the ribbon tape master roll 6 and the ribbon tape winding roll 8 are driven separately by two stepping motors 18, 26, as shown in Fig.2. In this case, the ribbon tape winding roll 8 is driven by the stepping motor 26 via a sliding clutch.

[0028] If the drive is so done by the separate drive motors, there is no need of providing a power transmission mechanism comprising a one-way clutch gear and the like as in the device shown in Fig. 1.

[0029] According to the letter printing method of the present invention, the necessary amount of the ribbon tape is fed at the velocity synchronized with the transfer velocity of the print object sheet by using the stepping motor and this ribbon tape is wound via the friction transmission by the power rotating at the velocity higher than that of the transferring print object sheet, thereby the ribbon tape is stretched continuously via the friction transmission by the drive force of the velocity higher

than that of the print object sheet so that there occurs no loosening of the ribbon tape hot release portion at the tip of the head and the hot release of the ribbon tape takes place always in a good condition.

[0030] Thus, according to the letter printing method of the present invention, a clear and high quality printing can be done also on the print object sheet which is being transferred at the velocity higher than 10 inch/second or more with which there has been a problem. 5

[0031] It is understood that the invention is not limited to the particular construction and arrangement herein illustrated and described but embraces such modified forms thereof. 10

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Claims

1. A line thermal head letter printing method for printing letters on a print object sheet, which is being transferred, by using a line thermal head and a hot release type thermal transfer ribbon tape, **characterized in** comprising steps of: 20

feeding a necessary amount of said ribbon tape (4) at a velocity synchronized with a transfer velocity of said print object sheet (2) by using a stepping motor (18), and 25

winding said ribbon tape (4) via a friction transmission by a power rotating at a velocity higher than that of said print object sheet (2) being transferred. 30

2. A line thermal head letter printing method as claimed in Claim 1, **characterized in that** both of the feeding and the winding of said ribbon tape (4) are done by a roll drive and a feeding amount of said ribbon tape (4) is detected by a rotary encoder (14). 35

3. A line thermal head letter printing method as claimed in Claim 1 or 2, **characterized in that** there is provided a construction that the power for winding said ribbon tape (4) is obtained from said stepping motor (18) via a power transmission mechanism comprising a one-way clutch gear (24). 40 45

4. A line thermal head letter printing method as claimed in Claim 1 or 2, **characterized in that** there is provided a construction that the power for winding said ribbon tape (4) is obtained from a second stepping motor (26) which is different from said stepping motor (18). 50

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Fig. 1

Mechanism for removing ribbon tape
loosening by giving always tape winding
directional rotation even in either
directional motor rotation

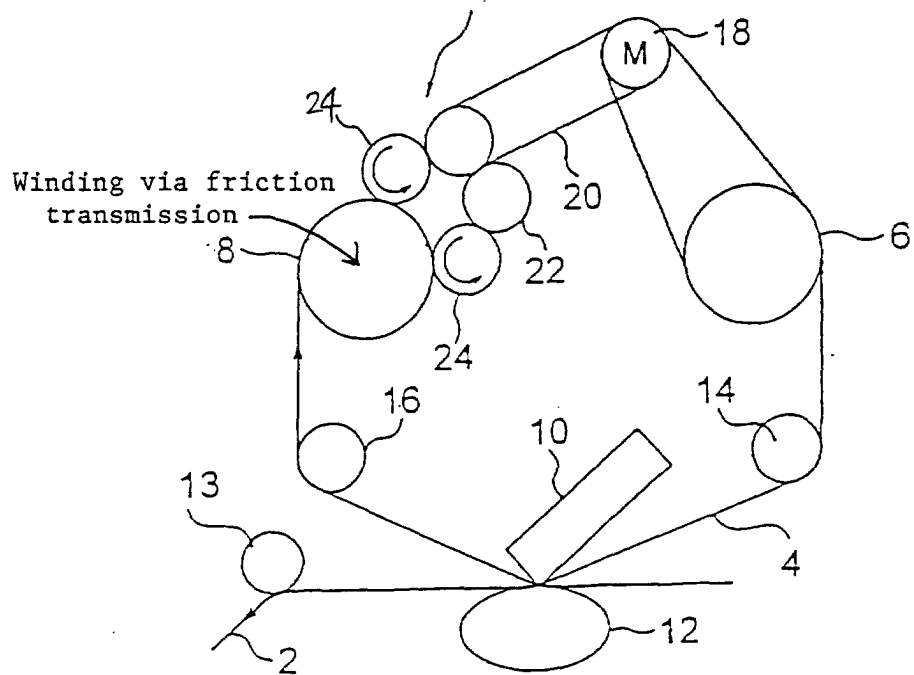
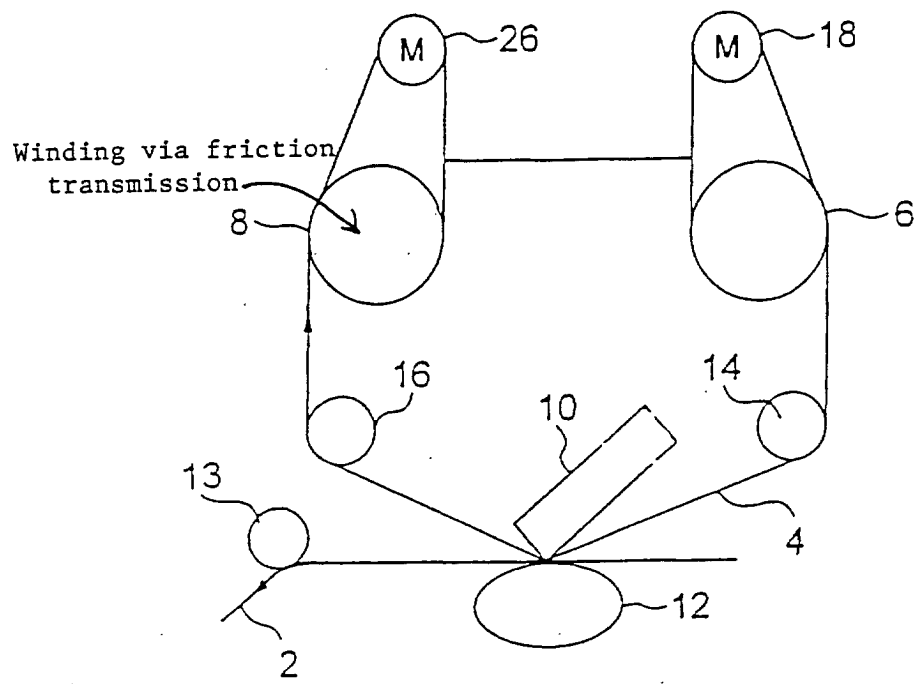


Fig. 2



Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 5 908 251 A (BUCKBY) 1 June 1999 (1999-06-01) * column 1, line 46 - column 2, line 64 * * column 3, line 16 - column 10, line 40; figures 1-4 *	1-4	B41J35/08 B41J17/04 B41J33/36
X	US 5 593 238 A (FOX ET AL.) 14 January 1997 (1997-01-14) * column 2, line 29 - column 3, line 5 *	1,2,4	
A	* column 3, line 33 - column 6, line 31; figures 1-5 *	3	
X	US 5 993 092 A (PALMER) 30 November 1999 (1999-11-30) * column 2, line 38 - column 3, line 50 *	1,2	
A	* column 4, line 3 - column 7, line 22; figures 1-4 *	3,4	
A	WO 99 34983 A (EASYPRINT APS) 15 July 1999 (1999-07-15) * page 14, line 19 - page 27, line 8; figures 1-6 *	1-4	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
A	EP 0 493 942 A (ALCATEL BUSINESS SYSTEMS LIMITED) 8 July 1992 (1992-07-08) * column 1, line 44 - column 2, line 49 * * column 3, line 12 - column 6, line 37; figures 1-5 *	1-4	B41J
A	EP 0 802 117 A (DAISEY KIKAI CO., LTD.) 22 October 1997 (1997-10-22) * column 3, line 20 - column 4, line 58; figures 1-4 *	1-4	
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	10 January 2001	Rivero, C	
CATEGORY OF CITED DOCUMENTS		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	
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			



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EUROPEAN SEARCH REPORT

Application Number
EP 00 11 6970

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A	US 4 104 965 A (ABE) 8 August 1978 (1978-08-08) * column 1, line 54 - column 2, line 45 * * column 3, line 6 - column 6, line 7; figures 1-3 *	1-4	
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 10 January 2001	Examiner Rivero, C
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			

EPO FORM 1503 03.82 (P04001)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 00 11 6970

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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