United States Patent

Dewas

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[54] WEAVING MACHINES WITH CONTINUOUS WEFT FEED

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[52] **U.S. Cl.**.....**139/123**

[51] **Int. Cl.**.....**D03d 47/18**

[58] **Field of Search**.....139/122 R, 127 R

[56] **References Cited**

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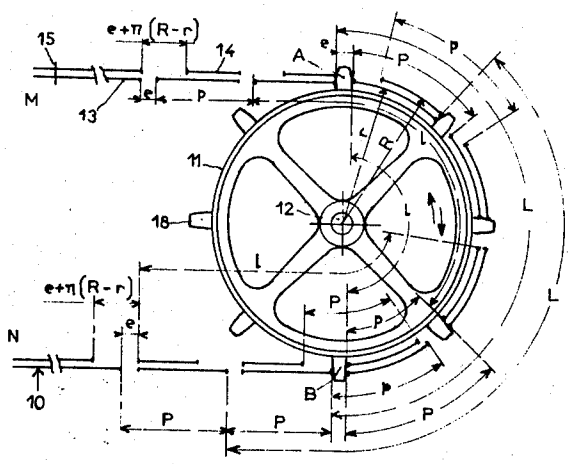
[57] **ABSTRACT**

The arrangement according to the invention consists in the provision, over at least one part of the length of one of the strips of which the tape consists, of perforations corresponding to the dimensions and to the pitch of the teeth of the wheel on the engaging radius of the said strip, while the corresponding perforations of the other band or bands are given an additional length of a magnitude and direction corresponding to the difference in length between the engaging arc, based on the middle fiber, by which engagement is made with the strip or strips having enlarged perforations, on the one hand, and that by which engagement is made with those having normal perforations, on the other hand, this arrangement being applicable in the converse manner to the respective strips in other parts of the tape.

5 Claims, 7 Drawing Figures



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SHEET 1 OF 2

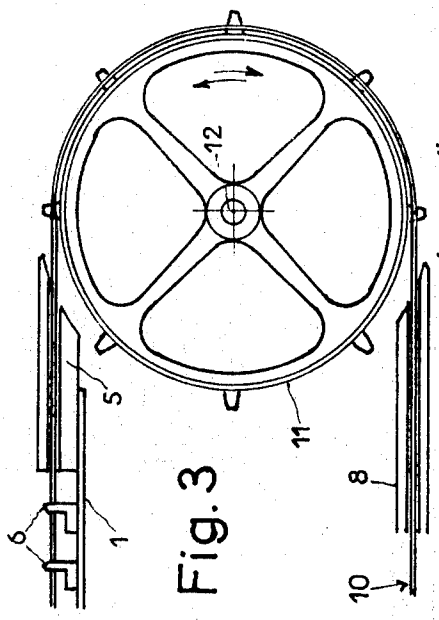
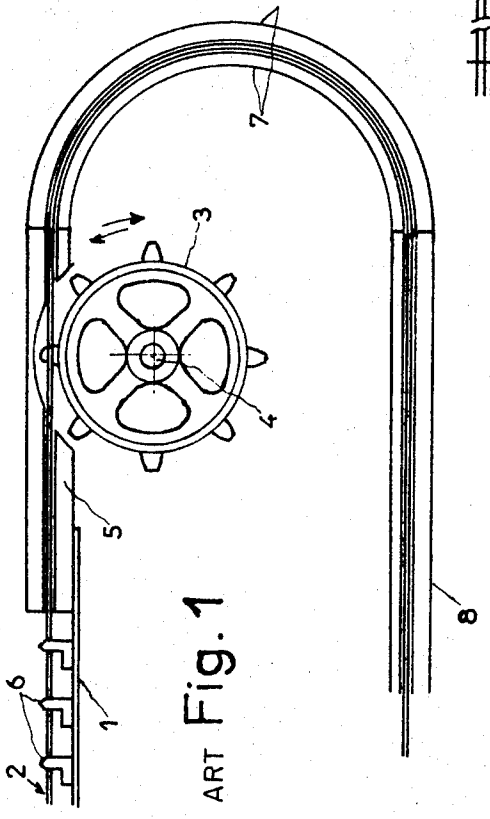


Fig. 3



PRIOR ART Fig. 1

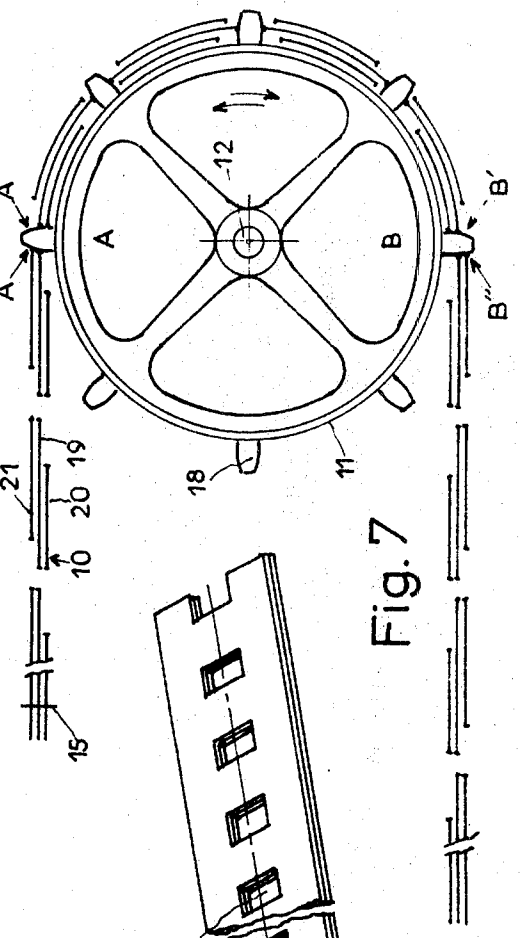
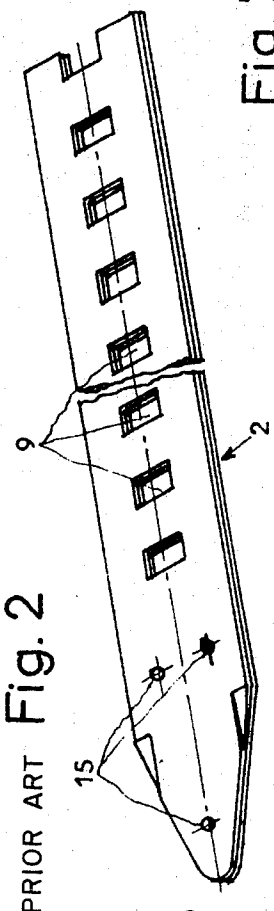


Fig. 7



PRIOR ART Fig. 2

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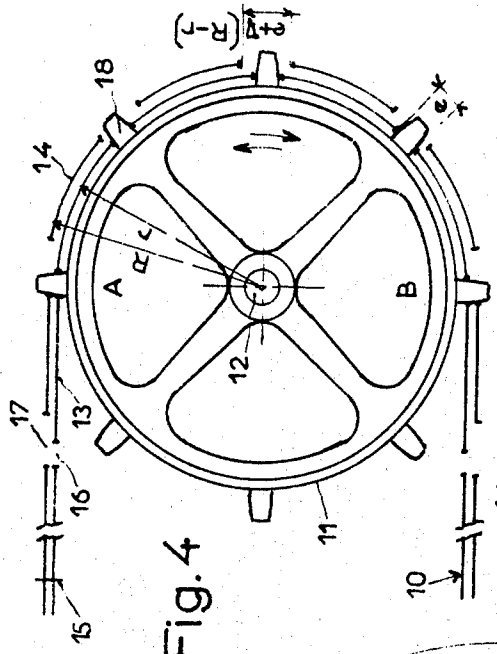

Fig. 4

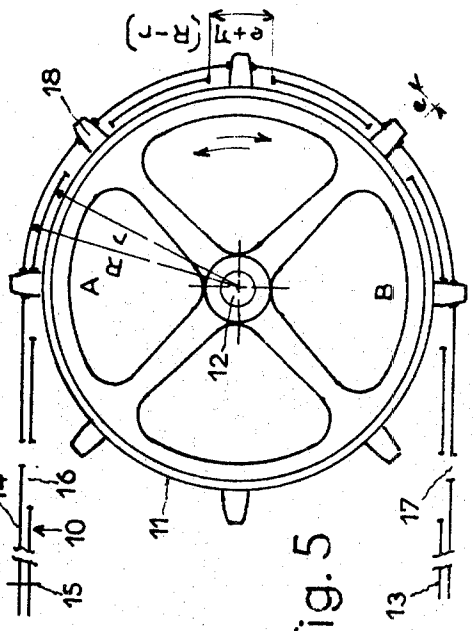

Fig. 5

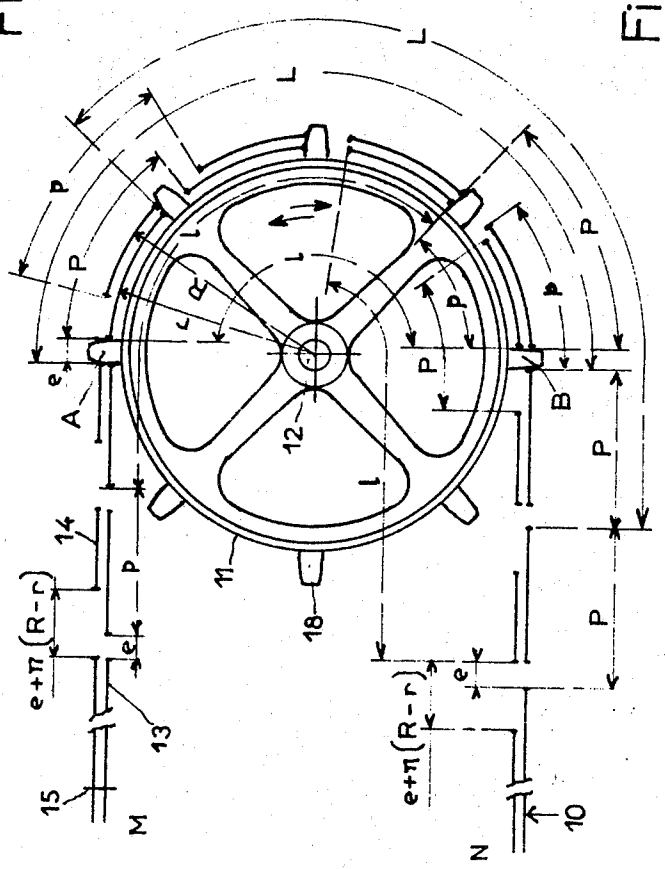

Fig. 6

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WEAVING MACHINES WITH CONTINUOUS WEFT FEED

The invention relates to weaving machines with continuous weft feed from bobbins situated outside the shed, comprising at least one weft inserter at the end of a tape of which the path of traval outside the shed is generally determined by an upper horizontal guide and an arcuate guide, usually extending over half a circumference, followed by a conduit extending underneath the machine to the interior of the latter, the said tape consisting of at least two superimposed strips firmly interconnected solely by their front end comprising the weft inserter, this system enabling them to perform relative movements in the curved portions of their path of travel, the said strips also having perforations which engage a toothed tape-driving wheel.

In conventional machines of this type the return devices guiding the tape to the bottom of the machine usually consist of fixed members with which the said tape is in frictional contact.

Now these machines are subjected to more and more exacting operational demands or/and entail increasingly great widths, so that the tape is caused to move at a considerable speed, its friction in the return movement members leading to a serious temperature increase, an abnormal wear on the tape and in a loss of motive power.

In order to remedy this situation, the applicant has conceived the idea of using a toothed wheel as a member for returning and driving the tape, but this process cannot be applied when the tape consists of at least two perforated strips which are superimposed by the known method, as the strips of which the tape consists are wound on different diameters, so that the perforations of the respective strips will not remain accurately aligned with one another at the various points of the "engaging arc."

The present invention provides a solution to this problem, by an arrangement of which the principle consists of the provision, over at least one part of the length of one of the strips of which the tape consists, of perforations corresponding to the dimensions and to the pitch of the teeth of the wheel on the engaging radius of the said strip, while the corresponding perforations of the other band or bands are given an additional length of a magnitude and direction corresponding to the difference in length between the engaging arc, based on the middle portion, by which engagement is made with the strip or strips having enlarged perforations, on the one hand, and that by which engagement is made with those having normal perforations, on the other hand, this arrangement being applicable in the converse manner to the respective strips in other parts of the tape.

Due to this special arrangement, it can easily be seen that at least certain teeth of the driving wheel can simultaneously contact perforation flanks which are superimposed and which are therefore each capable of taking up the respective share of the load which they are required to bear as a result of the acceleration and deceleration stresses to which the tape is subjected.

The perforations can be provided according to this principle in several different ways, as will appear in due course, and an external guide may or may not be used for the curved portion of the tape.

The invention will be understood more clearly from the following description and from a study of the attached drawings, which show schematically, as examples without any limitative effect, various ways in which the improvement to which the invention relates can be constructed.

In the aforementioned drawings :

FIG. 1 is an elevation of one end of a slay of a weaving machine with weft feed from large bobbins situated outside the shed, the guides and the guide bow for the tape, and also the wheel for driving the needle, according to prior art, the side of the guides nearest to the observer having been removed.

FIG. 2 shows, on a larger scale and in perspective, the configuration presented by a tape with two strips, according to prior art.

FIG. 3 is an elevation of the general layout of the construction covered by the invention, the functions of driving the tape and returning it to the bottom of the machine being performed by a toothed wheel, the side of the guiding devices which is nearest to the observer having been removed.

FIG. 4 is an elevation in which the tape is assumed to have been cut along its axis, the conditions under which the tape engages, in a first embodiment of the invention, being shown schematically.

FIG. 5 is a view provided on the same principle to that of FIG. 4, showing a second embodiment of the invention.

FIG. 6 is a view provided on the same principle to those of FIGS. 4 and 5, showing an embodiment of the invention obtained by combining the two methods shown in the aforementioned FIG. 4 and 5.

FIG. 7 is a view drawn on the same principles as FIGS. 4 and 5, showing one embodiment of the invention, as applied to a tape made up of three strips.

As regards FIGS. 1 and 2, based on prior art, 1 is the slay, 2 the tape, 3 the toothed wheel carried by a shaft 4 to which a reciprocating rotatory motion is imparted, 5 the horizontal upper guide situated outside the shed and forming a tangent to the upper part of the said wheel, and followed by the guides 6 which penetrate the shed, 7 the bow by which the tape is returned to the bottom of the loom, where the said tape is guided in the lower channel 8, the movement of the tape in the bow 7 involving friction and a strip brake effect. The two strips of the tape 2 are provided with registering perforations 9, as it is only in the form of a rectilinear rack that the said tape engages the upper part of the wheel 3.

In the general layout of the construction covered by the invention, as shown in FIG. 3, the tape 10 is flexing round the wheel 11, which both operates it and returns it to the bottom of the machine. The wheel 11 is caused to rotate in alternating directions by the shaft 12, which itself is actuated by a mechanism not shown in the drawing ; 5 and 8 are the upper guiding device, outside the shed, and the lower guide channel, respectively.

In the case of FIGS. 4 and 5 the tape 10 consists of two strips 13 and 14, superimposed and interconnected solely by their front extremities, e.g. by means of rivets 15. This end of the tape comprises the weft inserter (not shown).

The upper zone of the wheel 11 is marked "A," and this same letter "A" will be used for those parts of the tape which are situated in the same zone of the wheel. Similarly, "B" will be employed for that part of the tape which is situated in the lower zone "B" of the wheel.

In these FIGS. 4 and 5 the inner strip 13 of the tape is provided with perforations 16, while the outer strip 14 is provided with perforations 17.

In a first embodiment, shown in FIG. 4, the length of the perforations 16 of the inner strip 13, as considered in the direction of engagement, corresponds to the thickness "e" of the teeth 18 of the wheel 11, and the pitch of these perforations is equal to the circumferential pitch of the said teeth, measured half-way across the thickness of the strip 13. Whatever the position of the tape, the front and rear engagement flanks of all the perforations 16 of that part of the inner strip which is flexing round the wheel, are in contact with the flanks of the teeth 18. As a contrast, the perforations 17 of the outer strip 14 are provided, in respect of the perforations 16 of the inner strip 13, with an extra length, situated on that side of the engagement flank of the perforations of the said outer strip which is further away from the front extremity of the tape; said extremity, as already mentioned, comprises the weft inserter.

It may be seen that, thanks to this arrangement, while the two strips 13 and 14 occupy relatively invariable positions from the weft inserter as far as part A of the tape, the outer strip 14 undergoes, in respect of the inner strip 13, an angular retardation, which increases as the relevant points of the two strips, departing together from the zone A, approach zone B. By selecting, for the extra length of the perforations 17 of the outer strip 14, a magnitude equal to the difference in developed length between the respective engagement arcs of

the two strips, i.e. $\pi(R-r)$, the engagement flank of the outer strip **14**, situated on the enlarged side of the perforation, is caused to contact the corresponding tooth flank once again, upon entering the zone B. We thus have at all times two superimposed perforation flanks (one of each of the strips) on the front side of the zone A perforations and on the rear side of the perforations for the zone B of the wheel, so that the two strips of the tape participate in the forces to be transmitted to the tape in its two respective directions of motion.

FIG. **5** shows another embodiment, in which it is the outer strip **14** that is provided with perforations of a length corresponding to the thickness of the teeth **18** of the wheel **11** ; it is thus to the perforations **16** of the inner strip **13** that the modification through the enlargement of the perforations is applied, on that side of the engagement flank of the said perforations which is nearer to the front end of the tape, i.e. the end comprising the weft inserter.

Due to the inertia of the weft inserter the stresses between the teeth of the wheel and the tape **10** are mainly exerted between the weft inserter and the zone A, i.e. in a direction corresponding to a compressive stress exerted on the tape or else in that corresponding to an extension of the same portion. FIG. **4** shows that in the zone A the two strips participate in the compressive stresses to which the tape is subjected, and that in zone B there is only one ; as a contrast, only one strip participates in the extension of the tape in zone A, whereas both strips are involved in zone B.

The converse distribution applies in the arrangement illustrated in FIG. **5**.

Where only one strip is affected in zone A, the other only participates in the stress by its contact in B, and this participation can be affected by the relative elasticity of the tape, applied to a greater length of strip ; it may thus be of advantage to adopt an arrangement which causes both strips to participate in the stresses in zone A in both directions of stress. Now the stresses in the two different directions relate to the two respective halves of the length of the tape, i.e. the compression of the tape relates to that half of its length which is situated on the side corresponding to the weft inserter, while the extension relates to the other half of the length, and efforts have therefore been made to find a means of applying the system shown in FIG. **4** to the first half of the length and that shown in FIG. **5** to the second. This has been made possible by adopting the concept of a transition zone, positioned half-way along the length of the tape, preferably in the zone which engages at the moment when the stresses applied to the tape are reversed, this zone only undergoing negligible stresses between the two zones of converse stresses.

FIG. **6** shows a method of providing this transition zone, confined to the length of the arc over which the tape is flexing onto the wheel, and illustrated in its engagement position on the said arc. That part of the tape which is situated between the weft inserter and the zone A of the wheel **11**, i.e. the part MA, is constructed in accordance with the method shown in FIG. **4** ; the part NB, situated between the rear end N of the tape and the zone B of the wheel **11**, is constructed in accordance with the method shown in FIG. **5**. When the wheel causes the part MA to enter the engagement zone, this results, for each of the perforation pitches of the said part MA, in a shifting of the two strips over that arc of the circumference of which the developed length is equal to the pitch p of the inner strip **13** in the zone MA, i.e. to the pitch of the arc of radius r ; when the part NB engages the engaging zone of the wheel **11**, the movements of the tape take place as a function of the pitch p of the outer strip **14** in the zone NB, i.e. the pitch according to the arc of radius R. Furthermore, the outer strip must possess, over the entire length of the engaging arc, that length between external perforation flanks which is equal to the development L of the total engaging are measured on the radius R on both sides of those teeth of the wheel **11** which are situated at A and B, while the inner strip **13** must possess, between the inner flanks of these same teeth, that length between inner perforation flanks which is equal to that of the circular arc l. If the term "front flanks" is adopted for the perforation flanks situated on that side of the perforations which corresponds to the weft inserter and the term "rear flanks" is adopted for the opposite flanks, the perforations are produced as follows :

on the outer strip, at pitch P for the front flanks and at pitch p for the rear flanks ;

on the inner strip, at pitch p for the front flanks and at pitch P for the rear flanks.

In other words, in the transition zone :

For the rear flanks of the perforations of the outer strip **14**, the perforations made at pitch p and belonging to the part MA are prolonged as far as B, and for the front flanks of this same outer strip, the perforations made at pitch P and belonging to the part NB are prolonged as far as A ; on the inner strip **13**, the pitch p of the part MA is prolonged as far as B for the front flanks, and the pitch P of the part NB is prolonged as far as A for the rear flanks of the perforations.

This combination of the two perforation pitches causes the said perforations to have a length which increases from A towards B where the inner strip **13** is concerned, while on the outer strip **14** it decreases.

In the case of a tape with more than two strips, one of the latter is always provided with normal perforations, and the perforations of one of the other strips are enlarged according to one or the other of the principles defined farther back in connection with FIGS. **4** and **5** for two strips, with the relevant corrections, in magnitude and in direction respectively, according to the position of these strips in relation to that possessing normal perforations.

FIG. **7** shows an example of the application of this method to a tape **10** having three strips, in which it is the central strip, **19**, that is perforated for normal engagement, the inner strip, **20**, having perforations corrected in accordance with FIG. **5**, while the method shown in FIG. **4** is applied to the outer strip, **21**. This ensures, in zones A and B, engagement contact on the superimposed flanks of the central strip, **19**, and one of the other strips, inner or outer, according to the direction taken by the stresses, and thus simultaneously, either at A′ and B′ or at A″ and B″. This system ensures that in zone A, which is that most directly subjected to the inertia effects of the weft inserter, there will at all times be two strips participating in the stresses, in one direction or in the other.

Obviously, the invention is in no way limited to particular forms of embodiment and that it will be possible to devise alternative forms, detail improvements and uses of equivalent means without thereby departing either from the scope or the spirit of the invention.

Thus, the wheel **11** and the guides **5** and **8** may be independent from the slay **1** and the guides **6**.

I claim:

1. A system for driving a weft inserter actuating tape in a loom, said system comprising a driving wheel rotating alternately in opposite directions, said tape being constituted by a plurality of superimposed strips flexing on said driving wheel over a predetermined arc of said wheel, said driving wheel having regularly spaced peripheral teeth, said superimposed strips having perforations to engage the teeth of said driving wheel, at least one portion of at least one of said strips being provided with normal perforations the pitch and size of which mate with the pitch and size of said teeth of said driving wheel, while each other strip is provided with corresponding perforations each having an extra length equal to the difference between the lengths of the middle portions of said one strip and said other strip, respectively, over said arc of said driving wheel.

2. A system in accordance with claim **1**, comprising a tape consisting of two strips, and characterized by the fact that only the perforations of the outer strip have an extra length equal to the aforementioned difference, on that side of their engaging flank which is the farther away from the front end of the tape, connected to the weft inserter.

3. A system in accordance with claim 1, comprising a tape consisting of two strips, and characterized by the fact that only the perforations of the inner strip have an extra length equal to the aforementioned difference, on that side of their engaging flank which is the nearest to the front end of the tape, connected to the weft inserter.

4. A system in accordance with claim 1, comprising a tape consisting of two strips, and characterized by the fact that the tape possesses three zones of different perforations, namely : in a first zone on substantially its front half-length which is connected to the weft inserter, normal perforations for the inner strip and for the outer strip perforations with the aforesaid additional length on the side of the perforation flanks situated on the side remote from the weft inserter with respect to said perforations ; in a second zone over substantially the rear half length normal perforations on the outer strip and for the inner strip perforations having the aforesaid extra length on the side of the perforation flanks situated, with respect to the latter, on the side of the weft inserter ; and in a third zone a central transition zone in which the length of the perforations of both strips progressively passes from the size of the aforesaid front part to that of the aforesaid rear part.

5. A system according to claim 1, comprising a tape with more than two strips, characterized in that one of the two strips has normal perforations, the perforations of each of the other strips having the aforesaid extra length towards the front or the rear of the tape in accordance with a strip located inwardly or outwardly, respectively, with respect to the strip with normal perforations.

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