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Feier et al.

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[54] **STORE FOR BAND-SHAPED INFORMATION CARRIERS**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **226/25,** 226/26, 226/42, 226/88, 226/118

[51] **Int. Cl.** **B65h 25/00**

[58] **Field of Search** ..... 226/118, 119, 113, 25, 226/26, 88, 195, 42; 179/100.2 Z

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Primary Examiner—Allen N. Knowles

[57] **ABSTRACT**

An enclosed store for an endless band-shaped information carrier in which a movable endless conveyor belt is arranged so as to support and assist movement of the lowermost loops of the stored endless carrier toward the outlet of the store or toward a means responsive to the information on said carrier whereby possible breakage and binding of the carrier is diminished.

18 Claims, 10 Drawing Figures

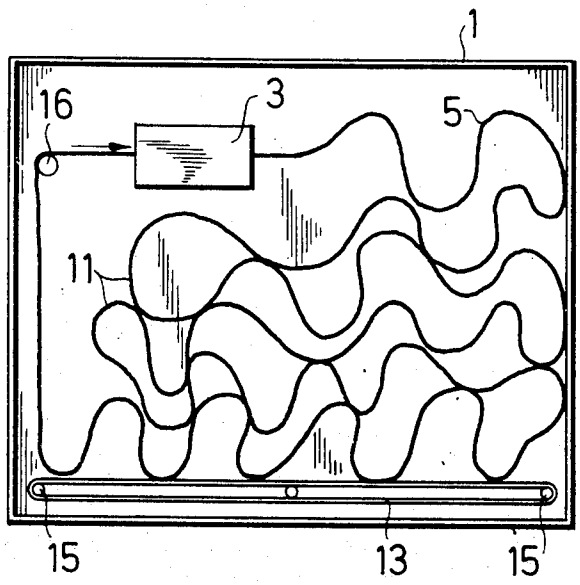


Fig.1

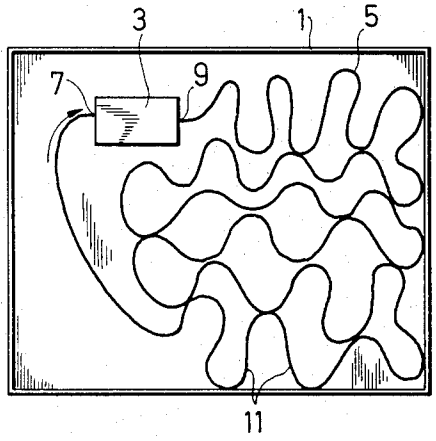


Fig.2

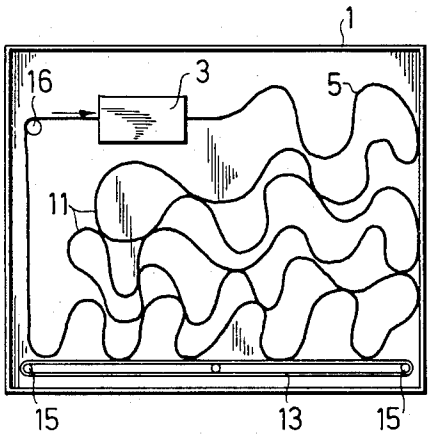


Fig.3

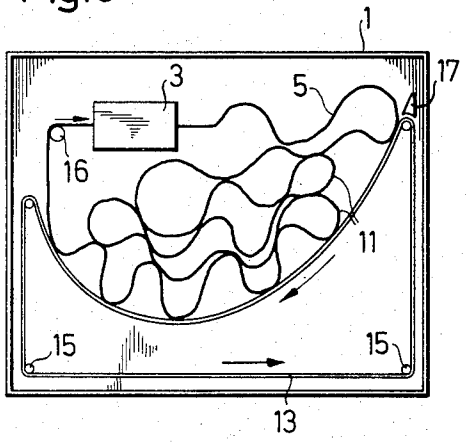


Fig.4

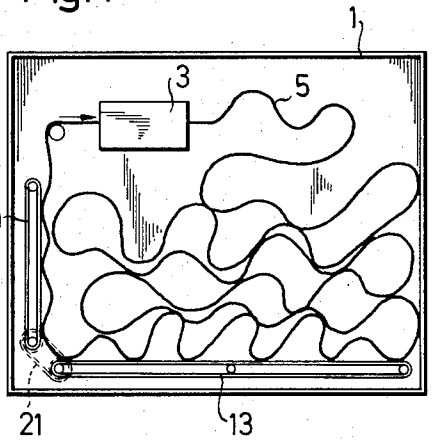


Fig.5

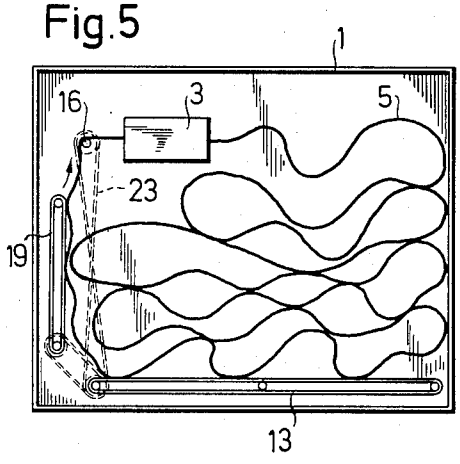


Fig.6

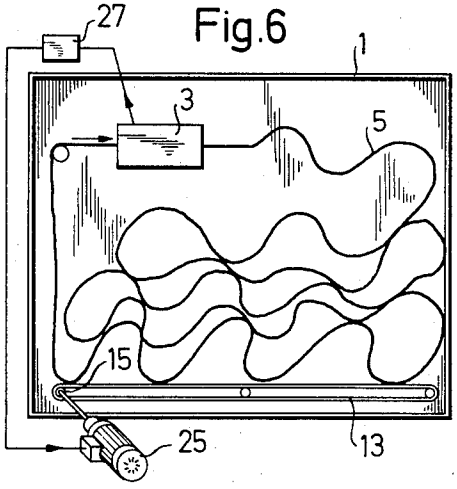


Fig.7

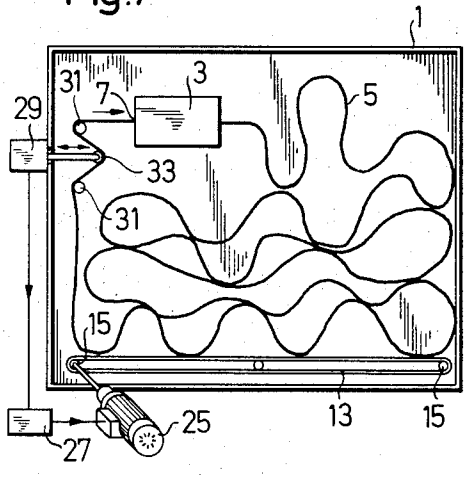


Fig.8

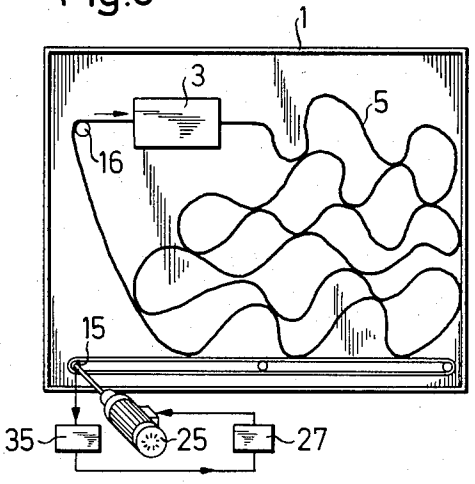


Fig.9

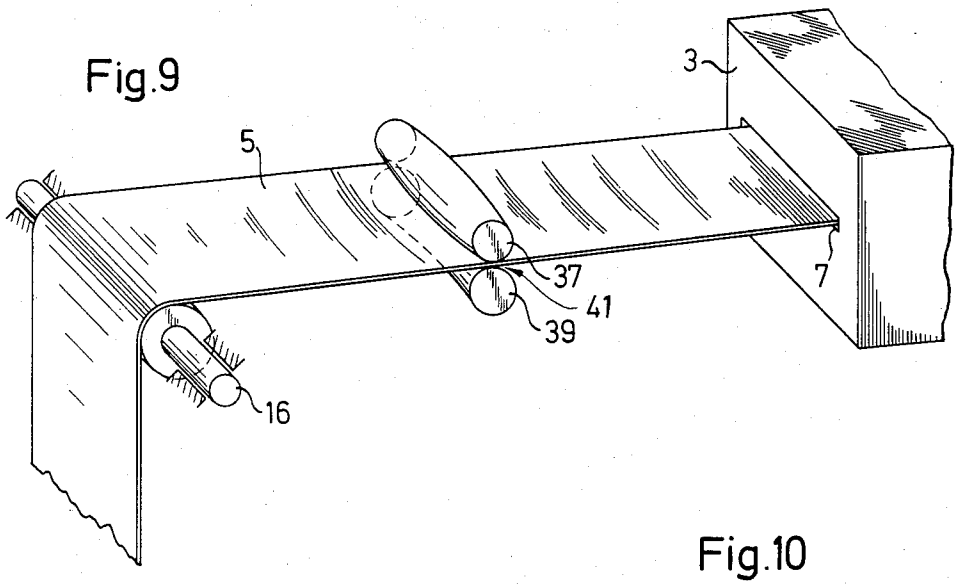
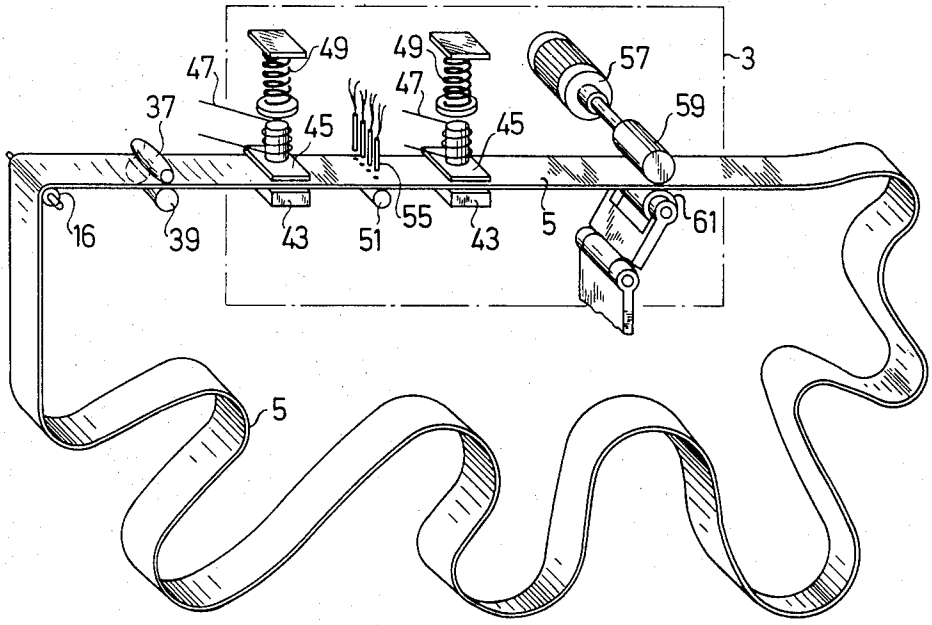


Fig.10



STORE FOR BAND-SHAPED INFORMATION CARRIERS

This invention relates to a store for band-shaped information carriers.

Tape stores should, on the one hand, permit of a trouble-free transport of the information carrier by means of at least one drive motor continuously or stepwise past a recorder and/or reader during the reading and/or storing of information and, on the other hand, be able to accommodate tapes of the greatest possible length. They therefore normally consist of a cuboidal container wherein the information carriers are deposited with the automatic formation of superposed loops. However, this has the serious disadvantage, especially in the case of tape lengths of about 50 metres or more and tape speeds of several metres per second, that considerable force has to be applied to pull the information carriers out of the tape store; with continuous operation, this results in rapid wear and frequent breaking of the information carrier. The cause of this disadvantage is that a heavy weight rests on the loops lying in the lower part of the tape store and this leads to a high friction of the information carrier and to a strong bend of the individual loops in the lower part of the tape store.

In accordance with this invention a store for a band-shaped information carrier is provided at the bottom with a conveyor belt which is supported on rollers and by means of which the lowermost loop of the deposited information carrier can be transported in the direction of the inlet to the recorder and/or reader. The conveyor belt may either rest on freely supported rollers and hence be automatically set in motion by the friction with the information carrier when the recorder and/or reader is operated, or it may be coupled with a separate driving device.

The invention presents the essential advantage that the forces required for pulling the lowermost loop of the information carrier out of the tape store are substantially smaller than those required for a container without conveyor belt so that a very even passage of the information carrier through the recorder and/or reader results, stoppages due to the drive of the information carrier being overloaded no longer occur and the high wear caused by the strong friction on all guides and in the lower part of the container is substantially reduced.

In the case of start/stop operation of the information carrier, the use of the known tape stores at high speeds had the further disadvantage that a loop forms immediately before the inlet slot to the recorder and/or reader. In order to obviate also this disadvantage, a further development of the invention provides a passage slot formed before the inlet slot by guide and stabilising rollers. The guide and stabilising rollers are preferably provided with convex or concave surfaces in order to impart a curved shape to the information carrier and to prevent the latter from forming looos before the inlet slot and from breaking when restarted.

The invention will be described below with reference to the accompanying drawing, taking some embodiments as examples.

FIG. 1 shows a known tape store;

FIGS. 2 to 8 show different embodiments of the tape store of the invention;

FIG. 9 shows an improvement to the tape store of the invention;

FIG. 10 shows a reader for a container of the invention.

The known tape store 1 of FIG. 1 consists of a cuboidal box which is arranged underneath a recorder and/or reader 3 or completely surrounds the latter. The width of the tape store is somewhat greater than that of a band-shaped information carrier 5 which forms an endless loop. When the recorder and/or reader 3 is operated, the information carrier 5 is pulled out of the tape store 1 through an inlet slot 7 by means of a driving device (not shown in FIG. 1) and returned to the tape store 1 through an outlet slot 9. As indicated in FIG. 1, the information carrier 5 is automatically deposited in several layers or loops 11 which are interconnected. The longer the information carrier and the greater the weight of the information carrier 5 in the tape store 1, the more tightly are the various loops 11 superposed and the higher is the friction on the guides and in the lower layers, resulting in a high wear. Moreover, there is the disadvantage that during transport in the direction of the arrow a substantial part of the information carrier 5 accumulates in the bottom right-hand corner of the tape store 1 in FIG. 1 so that even greater forces are required for pulling out the lower loops.

In the tape store 1 of the invention illustrated in FIG. 2 a conveyor belt 13 which is guided on freely supported rollers 15 is provided in the lower part. Due to the fact that the lowermost loops of the information carrier 5 are firmly pressed against the conveyor belt 13 because of their own weight and the filling of the tape store, each advance of the information carrier in the direction of the arrow results in a corresponding advance of the conveyor belt 13. A freely supported guide roller 16 is preferably arranged shortly before the inlet slot 17.

It is possible to provide support surfaces instead of the rollers 15 or between the rollers 15, in order to obviate a sagging of the conveyor belt.

Whereas the embodiment illustrated in FIG. 2 comprises a conveyor belt 13 which is horizontally arranged and extends transversally, the conveyor belt 13 of FIG. 3 is concavely curved on the side on which the information carrier 5 rests; the contact surface of the information carrier and hence the friction of the latter with the conveyor belt 13 are thus substantially increased. In addition, a wedge 17 can be provided in the top right-hand corner in order to prevent the information carrier from getting between the wall of the tape store and the returning part of the conveyor belt 13.

In the embodiment of FIG. 4, a second conveyor belt 19 is provided, in addition to the conveyor belt 13; this is preferably arranged vertically and is coupled with the drive of the conveyor belt 13 by means of a gear, a belt transmission 21 or the like. In operation, the information carrier 5 is firmly pressed against the conveyor belt 19 because of the tight packing inside the tape store 1 and of its motion caused by the conveyor belt 13. As a result, part of the energy required for driving the conveyor belt 13 is supplied by the second conveyor belt 19 and the information carrier is evenly distributed not only in the bottom left-hand corner but also in the top left-hand corner of the tape store 1.

According to FIG. 5 the guide roller 16 can be coupled in the embodiments of FIGS. 2 to 4 to the drive of

the conveyor belt 13 by means of a further belt transmission 23 or the like. In this way it is achieved that the information carrier 5 which is firmly placed around the guide roller 16 by its driving device causes an automatic drive of the conveyor belts 13 and 19, even in the case of adverse friction conditions in the lower part of the tape store.

In the embodiments of FIGS. 6 to 8 the conveyor belt 13 is automatically driven by a motor, for example, an electromotor 25, by coupling one of the rollers 15 with the driving shaft of the motor. This measure has the advantage that the information carrier is always deposited on a moving conveyor belt, independently of the special friction conditions. The use of an electromotor of variable speed is particularly advantageous.

However, the speed of the electromotor 25 can also be controlled or regulated and for this purpose can be coupled, for example, via a control device 27 with a suitable measuring element.

According to FIG. 6, the transport speed of the information carrier 5 can be measured with the measuring element, but the driving speed of the conveyor belt 13 can also be made dependent on the transport speed of the information carrier by coupling one of the rollers 15 via mechanical gears or the like with the driving device.

In FIG. 7 there is used a measuring element 29 by means of which the tensile stress exerted on the information carrier 5 is measured shortly before the inlet slot 7, by guiding the information carrier in known manner via a pair of rollers 31 and a roller 33 which is under the tension of a spring. As soon as the tensile stress exceeds an acceptable value, the speed of the conveyor belt 13 is increased or the automatic drive of the conveyor belt 13 is started only at this moment.

In the embodiment of FIG. 8, finally, the weight of the information carrier 5 in the bottom left-hand corner of the tape store 1 is used as guide quantity, in that a measuring element 35 measuring the weight acts upon the control device 27. The measuring element 35 may also have optical or mechanical feelers if it is only a matter of ascertaining that the information carrier actually rests on the left-hand part of the conveyor belt 13.

In FIG. 9 a passage slot 41 formed by two guide and stabilising rollers 37 and 39 is provided between the guide roller 16 and the inlet slot 7. The rollers 37, 39 may be freely supported or stationary. The surface of the roller 37 is convex, that of the other roller 39 is concave so that they form an arch-like passage slot 41 which correspondingly arches the information carrier 5 and gives it a stable form between the guide roller 16 and the inlet slot 7 so that it cannot form a loop. Especially in the case of the start/stop operation, the information carrier is thus prevented from breaking due to the strong jolt caused by a rapid start.

FIG. 10 illustrates a reader 3 which can be used in combination with the tape store 1 of the invention. The endless information carrier 1 transported in the direction of the arrow is passed inside the reading apparatus 3 between two breaking devices each of which consists of a brake plate 43 and a counter-plate 45 which can be adjusted against the pressure of a spring 49 and put out of action by means of an electro magnet 47. Between the two braking devices is the reader which in the case of a punched tape store may consist of an illuminating device 51 and a plurality of photocells 55 connected to an evaluation circuit. The information carrier 5 is transported by means of an electro-motor 57 the driving shaft of which is connected to a drive roller 59 the information carrier being pressed against the rubber surface of the latter my means of a pressure roller 61 which can be swivelled away.

The invention is not limited to a specific embodiment but can be modified in many ways. For example, the materials of which the conveyor belts 13 and 19 consist are of no importance provided they develop a sufficiently strong friction with the information carrier 5 for the latter or the conveyor belt to be automatically carried along. Textile or rubber bands have proved particularly expedient and are also suitable as surface of the guide roller 16.

The invention can moreover be used in combination with any recorder and/or reader even if the latter has itself no driving device for the information carrier but has to be provided with an additional driving device. The dimensions of the tape store 1 are also arbitrary.

Furthermore, it is possible to use, instead of the guide and stabilising rollers 37, 39, other means such as guide plates or guide members of bent wire for arching the information carrier. Finally, another modification of the invention can be brought about by arranging in the embodiments of FIGS. 2 and 4 to 8 guide plates in the bottom corners of the tape store 1, which prevent the corners from being filled with loops. With the use of the tape store 1 of the invention it is possible to achieve with punched tape readers speeds of 2,500 characters per second in continuous operation or in start/stop operation.

The guide and stabilising rollers 37, 39 of FIG. 9 are optionally provided with lateral guide elements.

The claims defining this invention are as follows:

1. An enclosed store for an endless band-shaped information carrier in which said carrier is disposed in free, generally superposed, continuous loops, the uppermost portion of the carrier passing through means responsive to the information on said carrier and then falling freely onto the top of the superposed continuous loops, said enclosed store comprising, lateral walls, transverse walls and a bottom wall, a movable endless conveyor belt extending across and within the lower portion of said enclosed store, and at least two rotatable means for supporting said belt, at least the lowermost loop of said carrier resting on and engaging said belt whereby withdrawal of the lowermost loop of said carrier from the bottom of the superposed continuous loops for passage toward the information responsive means is facilitated.

2. An enclosed store as claimed in claim 1 wherein said conveyor belt extends substantially horizontally across the bottom of said enclosed store.

3. An enclosed store as claimed in claim 1 and further comprising a second movable endless conveyor belt extending substantially vertically along the transverse wall adjacent said information responsive means for receiving and transporting said carrier as it leaves said first endless conveyor belt.

4. An enclosed store as claimed in claim 3 and further comprising means for coupling said second conveyor belt to said first conveyor belt for movement thereby.

5. An enclosed store as claimed in claim 1 and further comprising a guide roller adjacent the top of the

transverse wall adjacent said information responsive means for directing said information carrier thereto.

6. An enclosed store as claimed in claim 5 and further comprising means for coupling said guide roller to said conveyor.

7. An enclosed store as claimed in claim 1 and further comprising means for driving one of said at least two rotatable roller means.

8. An enclosed store as claimed in claim 7 wherein said driving means comprises an electromotor and further comprises means for controlling the speed of said electromotor as a function of the speed of the information carrier.

9. An enclosed store as claimed in claim 7 and further comprising means responsive to the tensile stress of said carrier adjacent said information responsive means for controlling the speed of said driving means.

10. An enclosed store as claimed in claim 1 and further comprising guide elements disposed in the lower corners of said enclosed store for preventing loops of said carrier from being disposed in the corners.

11. An enclosed store for an endless band-shaped information carrier in which said carrier is disposed in free, generally superposed, continuous loops, the uppermost portion of the endless carrier passing through means responsive to the information on said carrier and falling freely onto the top of the superposed continuous loops, said enclosed store comprising: lateral walls; transverse walls and a bottom wall, a movable endless conveyor belt extending across and within the lower portion of said enclosed store; at least two rotatable means for supporting said conveyor belt, at least the lowermost loop of said carrier resting on and engaging said belt whereby withdrawal of the lowermost loop of said carrier from the bottom of the superposed continuous loops for passage toward the information responsive means is facilitated; a guide roller adjacent the top of the transverse wall adjacent said information responsive means for directing said information carrier thereto, and guide means between said guide roller and said information responsive means for providing said carrier with a transverse curve about a longitudinal axis thereof to prevent looping of said carrier adjacent said information responsive means.

12. An enclosed store as claimed in claim 11 wherein said guide means comprises guide plates for providing the transverse curve in said carrier.

13. An enclosed store as claimed in claim 11, further comprising guide elements disposed in the lower corners of said enclosed store for preventing loops of said carrier from being disposed in the corners.

14. An enclosed store as claimed in claim 11 comprising means for coupling said guide roller to said conveyor.

15. An enclosed store as claimed in claim 11 comprising means for driving one of said at least two rotatable means.

16. An enclosed store for an endless band-shaped information carrier in which said carrier is disposed in free, generally superposed, continuous loops, the uppermost portion of the endless carrier passing through means responsive to the information on said carrier, said enclosed store comprising: lateral walls, transverse walls and a bottom wall, a movable endless conveyor belt extending across and within the lower portion of said enclosed store; at least two rotatable means for supporting said conveyor belt, at least the lowermost loop of said carrier resting on and engaging said belt whereby transport of the lowermost loop of said carrier toward the information responsive means is facilitated; a guide roller adjacent the top of the transverse wall adjacent said information responsive means for directing said information carrier thereto; and guide means between said guide roller and said information responsive means for providing said carrier with a transverse curve about a longitudinal axis thereof to prevent looping of said carrier adjacent said information responsive means, said guide means comprising a pair of rollers, one having a convex surface and the other a complementary concave surface for providing the transverse curve in said carrier.

17. An enclosed store for an endless band-shaped information carrier in which said carrier is disposed in free, generally superposed, continuous loops, the uppermost portion of the endless carrier passing through means responsive to the information on said carrier, said enclosed store comprising: lateral walls, transverse walls and a bottom wall, a movable endless conveyor belt extending across and within the lower portion of said enclosed store; at least two rotatable means for supporting said conveyor belt, at least the lowermost loop of said carrier resting on and engaging said belt whereby transport of the lowermost loop of said carrier toward the information responsive means is facilitated; means for driving one of said at least two rotatable roller means; and means responsive to the weight of the carrier on said conveyor belt for controlling the speed of the driving means.

18. An enclosed store for an endless band-shaped information carrier in which said carrier is disposed in free, generally superposed, continuous loops, the uppermost portion of the endless carrier passing through means responsive to the information on said carrier, said enclosed store comprising: lateral walls, transverse walls and a bottom wall, a movable endless conveyor belt extending across and within the lower portion of said enclosed store, and at least two rotatable means for supporting said conveyor belt, at least the lowermost loop of said carrier resting on and engaging said belt whereby transport of the lowermost loop of said carrier toward the information responsive means is facilitated, wherein the upper surface of said conveyor belt on which the at least lowermost loop of said carrier rests has a longitudinally concave configuration.

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