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SUPPORT FOR THE RECORDING OF SOUNDS AND IMAGES AND APPARATUS FOR THE USE THEREOF

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Fig.1

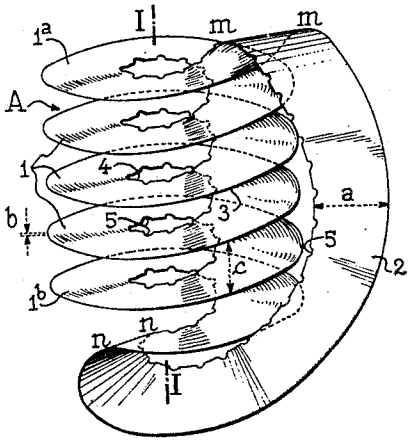


Fig.2

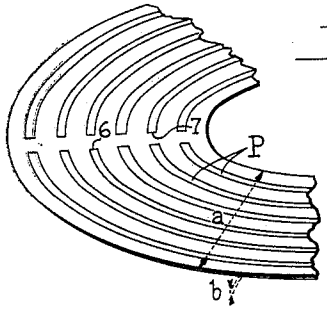


Fig.3

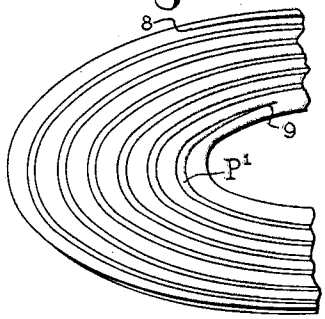


Fig.4

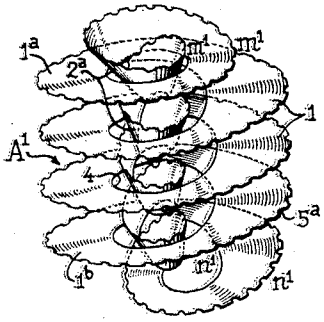


Fig.6

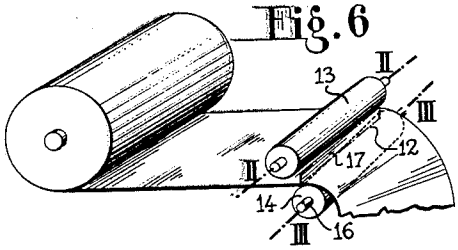


Fig.5

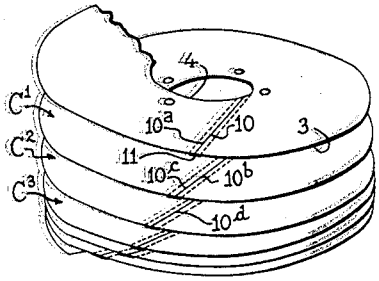


Fig.7

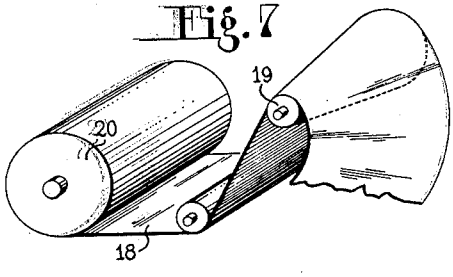


Fig.8

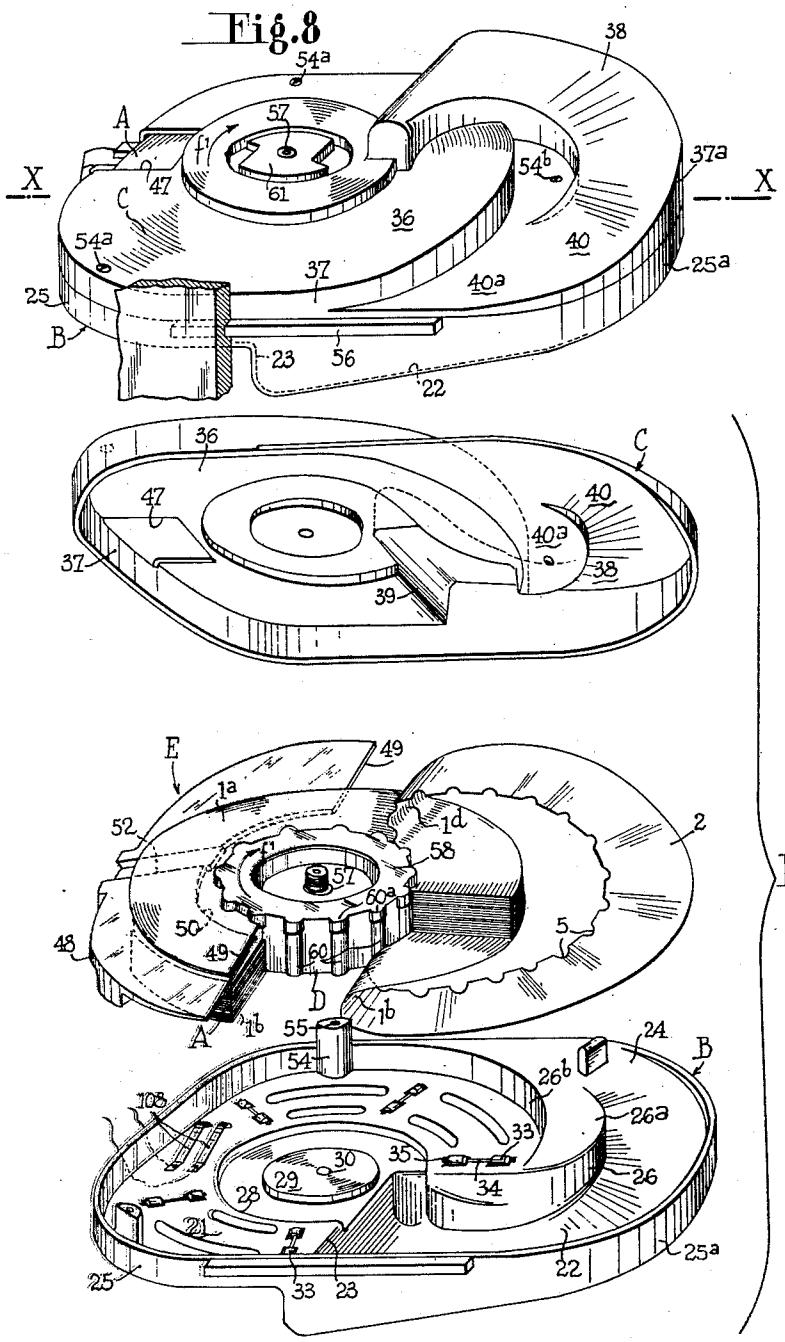

38
54a
A
57
X
47
61
54b
37a
X
C
36
40
54a
37
40a
25a
25
B
23
56
22
36
C
47
40
40a
37
38
39
E
49
1a
52
1d
2
58
57
60a
50
5
48
49
60
D
1b
1b
55
A
24
B
54
26b
108
26a
33
35
30
29
34
26
28
21
22
25a
25
33
23

Fig.9

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Fig. 10

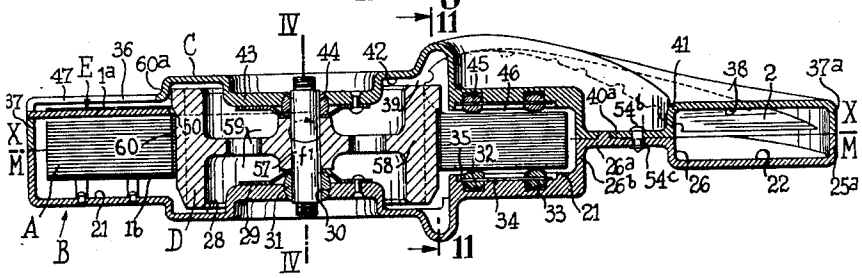
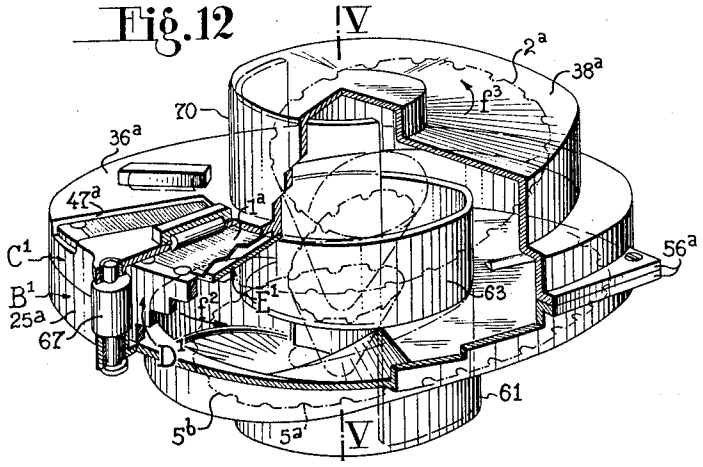


Fig. 12



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Fig. 11

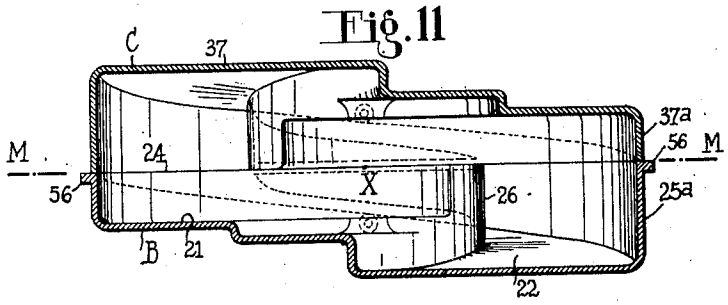


Fig. 14

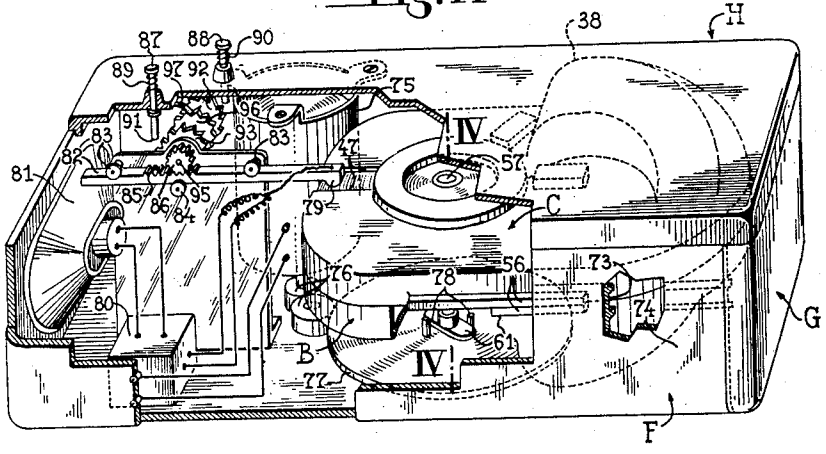


Fig. 15

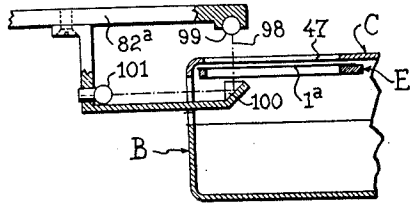
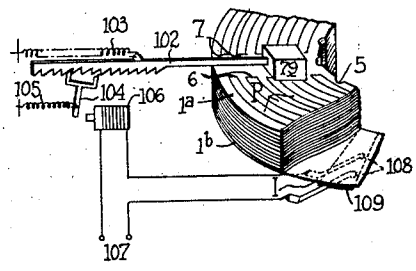
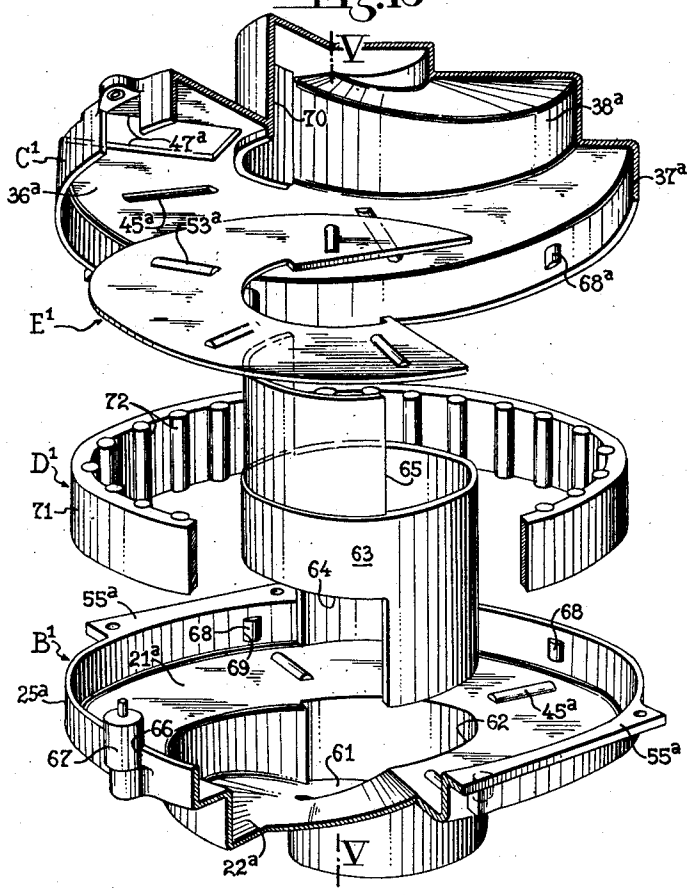


Fig. 16



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Fig.13



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3,095,200

SUPPORT FOR THE RECORDING OF SOUNDS AND IMAGES AND APPARATUS FOR THE USE THEREOF

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Filed Mar. 31, 1958, Ser. No. 725,114
Claims priority, application France Apr. 2, 1957
32 Claims. (Cl. 274—11)

The present invention relates to the recording and reproduction of sounds and images.

It is known that there are generally used, for the recording or reproduction of sounds or the reproduction of cinematographic or television images, supports in the form of tapes or films of great length which are unwound from a supply spool and wound onto a take-up spool, the support to be recorded or the recorded support passing from one spool to the other in a recording or reproducing device. Whatever the arrangement, the recording or reproducing apparatus is space-consuming owing to the presence of the two spools.

The invention is intended to overcome the difficulties inherent in the use of recording tapes of great length unwound from a spool and wound onto another and in particular to reduce the size of the apparatus.

An object of the invention is to provide, on the one hand, a virgin support for recording characterized in that it comprises a very thin flexible band which is such as to be capable of receiving the desired recording and which is coiled on itself in the form of a helicoid or helical band whose coils are capable of subsiding so that they bear against one another owing to the flexibility of the band, the overall thickness of the helical band ordinarily being equal to the sum of the thicknesses at its coils and the two end coils being interconnected by a short portion of said band which latter is therefore an endless band, rounded notches being provided along the whole of the length of the inner or outer edge of the band for the purpose of driving in rotation the superimposed coils forming the helical band; and, on the other hand, said support after obtaining a recording thereon, hereinafter termed recorded band.

The short portion which interconnects the two ends of the helical band by passing round the latter could be disposed either outside the helical band or in the axial space provided by the longitudinal edge of the helically coiled band and forming the inner edge of the successive coils of the band.

Experiments have shown that it is very easy to move before a fixed station, at which the recording or reproducing device is located, all the successive points of the band, one of the end coils being progressively transformed into the connecting loop whereas said loop provides at the same time and progressively a new coil at the other end of the helical band. The latter could carry either a plurality of parallel recordings, each of which is limited to the developed length of the endless band or a single recording composed of a series of helical coils, the length of each of the latter corresponding to the complete development of the band.

These recordings could be, as desired:

(*a*) Magnetic sound recordings, in which case the band is constituted in the known manner for conventional magnetic bands or tapes, that is, by a support of plastic material covered with a magnetizable coating or layer.

(*b*) Magnetic image recordings and in particular for television transmission, the support being of the type mentioned in paragraph (*a*).

(*c*) Optical sound recordings, in which case the support is similar to that for cinema film, that is, it is formed

of a transparent film covered with a coating of light-sensitive emulsion.

(*d*) Sound recordings in the form of a groove, in which case the support is capable of being cut or embossed; for example plastic material.

(*e*) Photographic image recordings, in which case the support is of the aforementioned type comprising a transparent film rendered light-sensitive.

Another object of the invention is to provide methods of producing the aforementioned support.

Another object of the invention is to provide a loader-magazine for the aforementioned support, said magazine being adapted to permit the continuous passage of the band before a fixed utilization station in the form of a recorder or reproducing device.

Another object of the invention is to provide an apparatus for utilizing the support.

Further features and advantages of the invention will be apparent from the ensuing description, with reference to the accompanying drawings, to which the invention is in no way restricted.

In the drawings:

FIG. 1 is a diagrammatic perspective view of a virgin or unrecorded support embodying the invention, in which the short portion interconnecting the end coils consists of an outer loop;

FIG. 2 is a partial perspective view of a small portion of a coil of the same support, after recording;

FIG. 3 is a similar view of a modification of the support;

FIG. 4 is a diagrammatic perspective view of another support embodying the invention in which the portion interconnecting the two end coils is disposed within the helical band or helicoid in the form of an auxiliary connecting helicoid;

FIGS. 5, 6 and 7 are diagrams relating to the various ways of producing the supports shown in FIGS. 1 and 4;

FIG. 8 is a perspective view, with a part cut away, of the magazine for the support shown in FIGS. 1 to 3;

FIG. 9 is an exploded perspective view of the case body, its cover and the rotatable hub for driving the band support which is partly cut;

FIG. 10 is a longitudinal sectional view of the magazine;

FIG. 11 is a sectional view taken along line **11—11** of FIG. 10;

FIG. 12 is a perspective view with a part cut away, of a modification of the magazine for utilization of the band shown in FIG. 4;

FIG. 13 is a perspective exploded view, with parts cut away, of the mazagine shown in FIG. 12;

FIG. 14 is a perspective view, with parts cut away of an apparatus utilizing the band shown in FIG. 1 with the magazine shown in FIGS. 8–11;

FIG. 15 is a partial sectional view of a modification of the magazine for sound reproduction by means of a photoelectric cell, and

FIG. 16 is a diagrammatic perspective view of an electro-mechanical device for moving the recording or reproducing head at the end of each of a series of recordings disposed in parallel side-by-side relation on the support band.

Description will now be given in succession of the supports embodying the invention, some methods of producing these supports, magazines for the supports and lastly an apparatus for receiving these magazines.

I. *Supports*

Referring to FIG. 1, the support consists of a band or tape A which is wound in the form of a helicoid having an axis I—I. The number of coils **1** may be relatively great and be as much as a hundred coils or more. The two end coils 1^a and 1^b are interconnected by a short

portion or band forming a loop 2, which passes round the outside of the helicoid.

This band A, which is composed of one of the materials mentioned hereinbefore and has a face provided with a recording layer which is magnetic, optical or mechanical, has a radial width *a* which in each helical coil extends from the peripheral edge 3 to the edge 4 of the central aperture having a constant diameter in respect of all the coils. This width *a* could be for example about 3 to 5 cm. The thickness *b* of the band is very small, for example 0.1 mm. which, if there are 100 helical coils, provides when the coils rest against one another a total thickness of 1 cm. for the ring which the helical band ordinarily forms, ignoring the loop 2 interconnecting the end coils.

It will be observed that FIG. 1 shows the coils separated from one another, but it is obvious that the pitch *c* of these coils can be varied as desired from a minimum value equal to the thickness *b* when the coils are in abutting relation (which position they assume automatically owing to the flexibility of the band and the force of gravity) to a relatively great value, since the helical band is capable of undergoing considerable deformation owing to the extreme flexibility of the material of which the band is composed.

Further, this endless band comprises notches or recesses 5 along that one of its longitudinal edges defining the apertures 4 in the helical band, these notches being provided as explained hereinafter, to permit driving the band *a* firstly in the course of recording and then in the course of reproducing the recording on the band.

It is clear that the band can be helically coiled in either direction, for instance, it can have a right hand helix as shown in FIG. 1, or a left hand helix.

FIG. 2 shows a portion of a coil of the recorded support or band, this coil comprises a number of tracks P in side by side relation each of which starts at point 6 and terminates at point 7 after having travelled along the entire developed length of the endless band.

The number of these tracks depends of course on the type of recording and on the width *a* of the band. If it concerns magnetic or optical tracks, corresponding to sound recordings, each of these tracks would have the usual width, namely about 1 to 2 mm. The tracks are separated from one another by a small free portion of support and in this case, if the band has a width of 3 to 5 cm., 20 tracks could be recorded. If it concerns a cut or embossed recording, the number of tracks could be still greater. If it concerns a cinema film, the number of rows of images would be of course dependent on the required size of the images.

Each track extending from the end 6 to the end 7 is of great length owing to the large number of coils. Thus for a track whose distance from the axis I—I is 5 cm. and for a support having 100 coils, the length of the track would be $2 \times \pi \times 5 \times 100 = 3142$ cm., that is, the equivalent of a tape more than 30 m. long.

If desired, instead of using a series of parallel tracks P there could be provided for the entire length of the band a single track P_1 (FIG. 3) composed of a series of track coils or turns which are interconnected in an endless manner from one recording end 8 up to other end 9. In this case, in the aforementioned numerical example, the length of the single track would therefore be equal to 3142 cm. multiplied by the number of track coils, would be equivalent to a conventional tape several 100 m. long.

FIG. 4 shows a modification A_1 of the support embodying the invention which is formed of a band wound in the form of a helicoid over the major part of its length thus forming coils 1, the two end coils 1^a and 1^b being interconnected by a portion 2^a located in the axial opening formed by the apertures 4 of the coils 1. The portion 2^a forms between the radial line m^1m^1 and the radial line n^1n^1 an auxiliary helicoid. The notches 5^b are provided on the outer edge of the coils.

The description with reference to the first embodiment also wholly applies to the second embodiment as concerns the type of the band and the tracks thereon.

The supports A and A^1 can be produced in different ways.

II. *Methods of Producing the Supports A and A_1*

One method, shown in FIG. 5, consists in starting with annular discs which are flat and are cut along lines extending from their periphery 3 to their central aperture 4. FIG. 5 shows three discs C^1, C^2, C^3 forming three coils of the helical support. Each of these discs is cut twice along two cutting lines extending from the outer peripheral edge to the inner edge, the cutting lines being preferably rectilinear and substantially oblique relative to a radius; they could advantageously be tangent to the inner edge of the aperture 4. The two cutting lines thus remove a small portion of the disc.

Each disc is thereafter put in the form of a helical coil which subtends an angle at the centre of slightly less than 360° in plan and the two cut edges 10^a and 10^b of the disc C^1 and 10^c and 10^d of the disc C^2 are each connected by adhesive means to one of the edges of the cut formed in the immediately adjacent disc. Thus the edge 10^b of the disc C^1 is connected to the edge 10^c of the disc C^2. In this way joint lines which are slightly angularly offset from one another are obtained.

This manner of proceeding could be used to advantage, since it is very simple, in the case of magnetic or mechanical embossed recordings. The discs could be interconnected without appreciable additional thickness by adhesive strips 11 on the side of the helical band opposite that adapted to receive the recording.

When the required stack of discs has been obtained, the two end coils are interconnected either by the loop 2 (FIG. 1) or by the auxiliary helicoid 2^a (FIG. 4), the connection portion being obtained at the expense of the end coils.

FIG. 6 shows diagrammatically another method of producing the support of the invention, it consisting in rolling a band having a rectangular cross-sectional shape 12 between two rolls 13 and 14 rotatably mounted by their journals 15 and 16 in bearings (not shown in the drawing and disposed in such manner that the axes II—II and III—III of those rolls are slightly convergent. The rolling imparts to the rectangular section 12 a slightly trapezoidal form 17 which results ipso facto in the desired helical coiling of the band. The two ends of the helical band are now interconnected.

A similar result could be obtained by drawing an initially rectilinear band 18 (FIG. 7) over a cone 19, the band being continuously unwound from a supply spool 20.

III. *Magazine for the Support A Having an Outer Loop 2 Shown in FIG. 1 (FIGS. 8–11)*

This improved magazine constitutes a flat-shaped case having a body B and a cover C. Disposed inside the case is a rotating hub D for driving the band A, and a plate E adapted to support the upper coil of the band in the course of recording or reproduction.

The base body B, the cover C and the plate E could be composed of metal, or preferably of a moulded plastic material.

The body B and the cover C are preferably symmetrical relative to a longitudinal line X—X contained in their joint plane M—M.

The body B comprises a base 21 which is flat except in a peripheral region for guiding the loop 2 of the band A where this base has a curved wall 22 which, starting at 23 (FIGS. 8 and 9) at the flat part of the base, extends downwardly at an angle between 60 and 90° to the flat part 21 and preferably with a slight radiused corner, and terminates tangentially at 25 (FIGS. 9 and 11) in the joint plane M—M.

The part 22 of the base forms a guide channel or passageway for the loop 2 of the band A in combination

with a cylindrical portion 25[a] of the lateral wall 25 of the body B and another concentric cylindrical wall 26 which, at the level of the joint plane M—M, is connected by a wall 26[a] to another cylindrical wall 26[b]. The latter, which is eccentric relative to the walls 25[a], 26 defining the guide channel, is adapted to form with the rest of the lateral wall 25 of the body B and the flat part of the base 21 a housing for the hub D and the superimposed coils of the band A.

Said wall 26[b] is substantially centered on an axis IV—IV with which coincides the axis of the recorded or unrecorded band A. To receive the hub D, the base 21 comprises an annular recess 28 (FIGS. 9 and 10) and a central boss 29 provided with a part-spherical central aperture 30 in which is disposed a swivel ball 31 of bronze or other wear-resistant material adapted to perform the function of a bearing for the hub D.

In a number of radial directions intersecting the axis IV—IV, the base 21 comprises pairs of rectangular openings 32 in each of which is disposed so as to protrude upwardly from the base a small roller 33. The two rollers contained in each pair of openings are freely mounted on a spindle 34 engaged in two recesses 35 formed in the base 21. These rollers 33 are adapted to avoid friction against the base of the lowermost coil 1[b] of the helical band 2 (FIGS. 9 and 10).

The cover C comprises a similar arrangement in that it is provided with an upper transverse wall 36 rigid with a lateral wall 37 adapted to be superimposed on the wall 25 of the base body B. The wall 36 is raised in a curved manner at 38 so as to form, with the part 22 of the base of the case, the channel or passageway for the loop 2 of the band A. The curved wall portion 38 extends upwardly from the part 36 of the transverse wall of the cover at 39 at an angle between 60° and 90° and is tangent at 40 to a portion or a flat wall 40[a] of the wall 36 situated in the joint plane M—M. This raised portion 38 is provided for guiding the upper part of the loop 2 in combination with a cylindrical portion 37[a] of the lateral wall 37 and a cylindrical wall 41 (see notably FIG. 10) defining the portion 40[a] adapted to be super-imposed on the portion 26[a] of the body B.

The wall 36 comprises a recess 42 centered on the axis IV—IV in vertical alignment with the recess 28 of the base 21, and a central boss 43 located at a lower level and at the centre of which is disposed a swivel ball 44 adapted to form the second bearing of the hub D.

Further, in radial directions and preferably in line with the rollers 33 of the case body B, the cover C also comprises rollers 45 which are disposed under plates 46 and are adapted to avoid friction between the wall 36 and the upper coil 1[a] of the helical band A.

At the left end (as viewed in FIG. 10), that is, in the region of the case diametrally opposed to the guide channel for the loop 2, the wall 36 of the cover C comprises a rectangular window 47 provided for recording the band A or reproducing the recordings on the latter.

The intermediate plate E spanning the window has a generally C-shape, its outer contour 48 corresponding to the inner contour of the left portion of the lateral wall 37 of the cover C. Toward the right this plate E terminates substantially in line with the axis IV—IV its right edge comprising two radially extending edges 49 connected by an inner circular edge 50 which has a greater diameter than that of the hub D.

In line with the window 47 the plate E comprises an aperture 52 adapted to be filled with felt.

This plate is maintained a certain distance above the lateral wall 25 of the case body B by studs 54 (FIG. 9) which are integral with or attached to the base 21 and the plate is fixed on these studs at the same time as the cover C by means of screws 54[a] screwed in tapped holes 55 formed in the upper end of the studs. The widths of the lateral walls 25 and 37 are such that after assemblage, these walls are in exactly adjoining relation in the plane M—M in a similar manner to their walls 26[a] and 40[a] (FIG. 10) which can be connected by connecting means comprising a screw 54[b] and a nut 54[c].

It will be observed that the case body B comprises on its longitudinal edges two outer longitudinal projections or ribs 56 adapted to support the magazine unit in a recording or reproducing apparatus.

The hub D for driving the band A (FIGS. 9 and 10) comprises a shaft 57 around which is moulded a cylindrical body 58 preferably of plastic material preferably provided with openings 59 and at its periphery with semi-circular ribs 60 adapted to drive the band A by their engagement in the notches 5 formed in the superimposed coils of this band.

These ribs have in the whole of their part adapted to be located below the plate E such cross-sectional shape that they extend through the notches 5 with clearance, but at their upper ends, that is, above the plate E, these ribs are enlarged at 60[a], the cross-sectional shape of these portions 60[a], being substantially identical to that of the notches 5, so that these portions permit positively driving the upper coils engaged at 1[a] on the plate E, whereas the other superimposed coils are allowed to float to a certain extent on the remaining part of the ribs.

Fixed on either end of the shaft 57 outside the case B is a notched disc 61 or any other device whereby to drive the hub D in the direction of arrow f^1 (FIGS. 8 and 10).

The magazine operates in the following manner:

The cover C and the plate E having been removed, and the hub D being in position, the superimposed coils of the band A are mounted on this hub so that the notches in the coils are engaged on the ribs 60 of the hub.

The lower end of the loop 2 is placed in the lower part 22 of the base of the case then, before engaging the last upper coil 1[a] on the hub D, the plate E is mounted on the hub and this last coil 1[a] is disposed flat against this plate and the cover C is placed in position taking care to engage the upper part of the loop 2 in the raised part 38 of this cover. The latter is then held in position by the screws 54 and the magazine is ready for use.

When the hub D is rotated in the opposite direction to arrow f^1, the upper coil 1[a] driven positively without play by the portions 60[a] of the hub ribs, progressively furnishes the loop 2 which in turn feeds the bottom of the stack of coils, this loop forming at each instant a new lower coil 1[b]. The coils therefore progressively rise (without being retarded by the ribs 60 owing to the slight clearance provided between the latter and the notches 5 beyond the portions 60[a] from the continuously renewed lower coil toward the continuously renewed upper coil 1[a] located between the plate E and the wall 36 of the cover C. Thus the band is continuously moved before the recording or reproduction window 47 in the region of its upper coil 1[a] which is continuously renewed before it forms the loop 2 which moves freely in the lateral channel formed by the walls 22, 38 and the cylindrical faces 25[a], 35[a] and 26, 41.

In view of the fact that the reproduction occurs in the mid-part of the plate E, at a point diametrally opposed to the floating guiding of the loop 2, that is, at a point where the driving of the coil 1[a] is positive owing to the fact that the portions 60[a] of the ribs 60 have no play in the notches 5, experience has shown that the recording and reproduction are absolutely perfect.

The connecting loop 2, which is taken from the lower coil 1[b] through a bent portion 1[c] of short developed length and is taken up in the upper coil 1[a] through another bent portion 1[d] (FIG. 9), is very rapidly returned to the close vicinity of the plane M—M (FIG. 10), which represents the advantage of considerably reducing the thickness of the magazine.

As the channel is separated by the walls 26[a], 40[a] from the generally cylindrical chamber in which the driving hub D and the superimposed coils of the band A rotate, rotation of the latter is in no way hindered by the loop

2. Experience has shown that the band is uncoiled from and coiled onto itself, as mentioned hereinbefore, without the least jerkiness in a particularly smooth effortless manner.

IV. *Magazine for the Support Shown in FIG. 4*

Referring now to FIGS. 12 and 13, showing a modification of the magazine more particularly provided for the band A^1 shown in FIG. 4, that is, a support in which the portion interconnecting the upper coil 1^a to the lower coil 1^b extends inside the helical band in forming a secondary helicoid 2^a.

In this case, the helical band cannot be driven in rotation at the centre and must be driven by the periphery by notches or recesses 5^a provided on the outer edges of the coils.

As in the first embodiment, the magazine comprises in combination a case consisting of a case body B^1 and a cover C^1, driving means D^1 in the form of a ring co-operating with the periphery of the helical band, and a plate E^1 adapted to maintain the upper coil in front of the recording or reproduction window 47^a provided in the cover C^1.

In the presently-described embodiment, the case body B^1 has a circular shape. Its base 21^a is provided with a recessed part 22^a which is adapted to receive the end of the auxiliary helicoid 2^a and is connected in the region of a wall 61 to a central cylindrical well 62 which constitutes a part of an axial cylindrical housing having an axis V—V for the helical portion 2^a interconnecting the two end coils of the band A^1. This axial housing occupies the full height of the magazine and includes a cylindrical tube or hub 63 whose lower part is recessed at 64 and the upper part at 65 to allow free passage of the helical portion 2^a. The case body B^1 also comprises two diametrally opposed rectilinear outer projections or ribs 55^a which are adapted to hold the magazine in position in the recording or reproducing apparatus in combination with similar projections 56^a on the cover.

Further, the base body B^1 carries in an aperture 66 in its lateral wall 25^a a roller 67 which protrudes into the case and is provided for driving the ring D^1, and a number of freely rotative rollers 68 disposed in apertures 69 in the wall 25^a and adapted to act as guides for this ring.

As in the first embodiment described hereinbefore, the base 21^a is provided with a number of rollers 45^a to prevent the bottom-coil of the support A^1 from rubbing against this base.

The cover C^1 also has a circular shape and its upper transverse wall 36^a also includes a raised part 38^a provided to allow free movement of the upper part of the connecting portion 2^a interconnecting the two end coils of the band A^1. This part 38^a merges into a cylindrical portion 70 which forms the upper part of the axial tubular housing containing the auxiliary connecting helicoid 2^a.

The wall 36^a of the cover is also provided with rollers 45^a and the lateral wall 37^a carries freely rotative rollers 68^a for guiding the driving ring D^1.

The plate E^1 for supporting the top coil of the band A^1 extends round the hub 63 and carries a number of rollers 53^a.

The driving ring D^1 is provided with a smooth outer face 71 adapted to be disposed within the guide rollers 68 and 68^a which center this ring on the axis V—V. The ring is driven from outside the case by the roller 67 which is driven by any suitable means, for example by a disc frictionally engaging this roller 67.

The ring D^1 is provided interiorly with semi-circular ribs 72 provided for driving the endless band A^1 by engagement in the notches 5^a in this band (FIG. 4).

When the ring D^1 is rotated in the direction of arrow f^2 (FIG. 12), the band A^1 is uncoiled by its top coil which moves in the direction of arrow f^3 into the raised part 38^a of the cover C^1, the portion 2^a descending in the form of a helicoid in the axial housing and moving into the lower part 22^a of the base of the case body B^1 so as to form the bottom coil of the band A^1. If the ring D^1 is rotated in the direction opposite to arrow f^2, the band A^1 is of course moved in the opposite direction.

The top coil 1^a moves between the wall 36^a of the cover C^1 and the plate E^1 past the recording or reproducing window 47^a.

V. *Recording or Reproducing Apparatus*

FIG. 14 shows such an apparatus which receives the magazine shown in FIGS. 8–11.

This magazine is held in position by its two pairs of ribs 55 and 56 in two slideways 73 provided in the lateral walls 74 of a large case comprising a body F, a cover H and a removable lateral wall G permitting loading the magazine.

The shaft 57 of the hub of the magazine is driven in rotation by an electric motor 75 whose output shaft is operatively connected by a set of rollers 76 to a disc 77 which is freely rotative on the end of the shaft 57 and drives the latter through the medium of two lugs or pins 78 located on either side of the notched disc or bar 61.

Assuming that the apparatus is arranged for reproduction, the reproducing head 79 is disposed in alignment with the reproducing window 47, the head being connected in the known manner to an amplifier 80 connected to a loud-speaker 81.

The apparatus is arranged to permit reproduction from any one of a plurality of parallel tracks, such as the tracks P shown in FIG. 2. To this end, the head 79 is carried by a bar 82 which is guided by rollers 83 and 84 and is provided with a rack 85 meshing with a gear 86. This gear is rotatable in either direction by means of two push-buttons 87, 88 each of which is upwardly biased by a spring 89, 90 and acts, through the medium of a pawl 91, 92 on either of two ratchet wheels 93, 94 keyed on a shaft 95 rigid with the gear 86, the pawls being ordinarily held away from the ratchet wheels a sufficient distance to permit free rotation thereof.

The unit is maintained in the adjusted desired position by the co-operation of a third gear wheel 96 (fixed on the shaft 95) with locking means formed by a resilient strip 97.

When one of the push-buttons 87 or 88 is depressed the corresponding ratchet wheel 93 or 94 is rotated, the two ratchet wheels rotating in opposite directions owing to the positions of the push-buttons. The shaft 95 and gear 96 are therefore driven in either direction, the resilient locking strip 97 being pushed back by the crests of the teeth of the gear 96.

The device just described is very simple and is given merely by way of example.

It will be understood that if the band A had a single helical track, such as the track P^1 shown in FIG. 3, the reproducing head 79 would have to be moved in synchronism with the rotation of the recorded band A, which necessitates a connection between the support bar 82 of the head 79 and one of the elements 76 or 77 connecting the motor 75 to the shaft 57, or a direct connection with the shaft of the motor 75.

It is clear that the apparatus also permits recordings to be made on a virgin support, and in this case the reproducing head 79 is replaced by a magnetic recording head connected to a magnetophone instead of to the loud-speaker 81.

The type of recording or reproducing device depends of course on the type of the support A.

For the purpose of demonstrating that the invention has a general application, there has been shown in a diagrammatic manner in FIG. 15 an arrangement for the reproduction of a sound track by means of a photoelectric cell. This figure shows the case body B, the cover C and the support plate E supporting the first coil 1^a of the helical band through which coil passes the light

beam 98 issuing from a light source 99 having a constant light flux. This light beam, which is modulated by the track on the helical band, impinges on a prism or mirror 100 which directs the beam onto a photoelectric cell 101. This cell, the prism 100, and the light source 99 are carried by a support 82^a similar to the support bar 82 shown in FIG. 14.

In the case of a mechanical, embossed or cut track recordings, the usual pickup head is used.

It will be understood that owing to the fact that it is easy to drive the support A or A^1 in either direction, it is possible to return to a previously recorded part of the track for reproducing this track and if desired modifying the recording (possible notably in the case of a magnetic recording).

FIG. 16 relates to the case where the recorded support band A comprises in side by side relation a number of independent recordings P each of which commences at 6 and terminates at 7, this figure illustrating diagrammatically one manner of automatically shifting the reproducing head 69 at the end of each reproduction of a recording to permit reproducing the next recording. For this purpose, the head 79 is rigid with a rack 102 which is biased toward the left, as viewed in FIG. 16, by a spring 103. The movements of the head are controlled by a pivotable anchor member 104 urged in one direction by a spring 105 and in the other direction by an electromagnet 106 whose circuit is connected to an electric source 107 by a switch I. The latter comprises two brushes 108 which are for example fixed in an insulated manner to the base of the case body B so as to rub against an electrically conductive area 109 provided on the unrecorded side of the band A at such position in this band that this area is on the bottom coil 16 and passes over the brushes 108 at the precise moment when the reproducing head 79 is located in the small gap between the start 6 and the end 7 of recordings P.

Although specific embodiments of the invention have been described, many modifications and changes may be made therein without departing from the scope of the invention as defined in the appended claims.

In the embodiment shown in FIGS. 8–11, the hub D of the magazine only permits driving the support A in the direction of arrow f^1, but it is possible to drive the support A in either direction on condition that the ribs 60 of the hub are provided at both ends with portions having a cross-sectional shape corresponding to that of the notches 5 in the support A and these portions are progressively merged or run into the remainder of these rubs so as to avoid any projection or ledge capable of hindering the coils in their upward or downward travel along the hub.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:

1. Magazine for a recording support having a coiled portion constituted by a band coiled in the form of a helicoid, the ends of said coiled portion being interconnected by a closing portion, said magazine comprising a substantially flat-shaped case which includes a case body and a cover in which is journalled a rotatable cylindrical member for driving the helicoid in rotation, said case body and cover defining a guiding passageway for guiding said closing portion separating said closing portion from and preventing it from rubbing against the helicoid.

2. Apparatus permitting selectively the recording and reproduction on a support constituted by a flexible band coiled in the form of a helicoid having superimposed coils and rendered endless by a closing portion, said apparatus comprising in combination, a large case; a fixed support inside said case, a magazine carried by said fixed support and a substantially flat-shaped case which includes a case body and a cover in which is journalled a rotatable cylindrical member engaging substantially all the coils of the helicoid for driving said helicoid in rotation and a guiding passageway for guiding said closing portion, separate said closing portion from and prevent it from rubbing against the helicoid; a movable recording or reproducing head in said large case; a motor adapted to drive said rotative driving member of said magazine in rotation and carrying and shifting means for shifting said head in a radial direction relative to the helicoid and in synchronism with the rotation of the latter for recording or reproduction of the band successively at points situated at different distances from the two longitudinal inner and outer edges of the band.

3. Recording unit comprising in combination: a very thin flexible endless recording band extending about an axis in the form of superimposed coils which ordinarily rest against one another but are capable of separating from one another in a direction parallel with said axis owing to the flexibility of the band, the latter including a band portion forming a loop which interconnects the two end coils of the band, recesses formed along the entire length of one of the peripheral edges of the band said recesses forming grooves and ribs on one of the cylindrical surfaces of said helicoid, a magazine case for the band including a guiding passageway for guiding said loop, whereby rotation of said coils relative to said case about said axis causes the band to move through said guiding passageway, and band driving means rotatably mounted in said case and capable of being rotated from outside said case, said driving means having projections adapted to engage said grooves along substantially the whole length of said grooves so that rotation of the driving means causes rotation of said helicoid about said axis.

4. Recording unit as claimed in claim 3, wherein said guiding passageway encloses said loop, an aperture being provided in said case so as to render said band accessible from outside the case for recording or reproduction purposes.

5. Recording support constituted by a very thin flexible band coiled upon itself in the form of a helicoid whose coils are capable of subsiding so that they bear against one another due to the flexibility of the band, the overall thickness being substantially equal to the sum of the thicknesses of the coils and the two end coils being interconnected by a short portion forming a closing loop which renders the band endless, equal curved notches being uniformly provided along the entire length of one of the inner and outer edges of the band the number of notches formed on each coil being an integer, whereby the notches of two adjacent coils coincide and all the notches of the pack formed by the superimposed coils formed on the cylindrical surface formed by said one edge of said flexible band ribs and grooves for the purpose of driving said pack in rotation.

6. Recording support constituted by a very thin flexible band coiled upon itself in the form of a helicoid whose coils are capable of subsiding so that they bear against one another due to the flexibility of the band, the overall thickness being substantially equal to the sum of the thicknesses of the coils, and the two end coils being interconnected by a short portion forming a closing loop which renders the band endless, the two ends of said band being connected with one another along a line which is oblique relative to the curved edges of the helicoid, equal curved notches being uniformly provided along the entire length of one of the inner and outer edges of the band, the number of notches formed on each coil being an integer, whereby the notches of two adjacent coils coincide and all the notches of the pack formed by the superimposed coils form on the cylindrical surface formed by said one edge of said flexible band ribs and grooves for the purpose of driving said pack in rotation.

7. Method of producing an endless recording support wherein a helicoid band having separate ends is produced and these ends are interconnected along a line which is oblique relative to the curved edges of the helicoid.

8. Method of producing an endless recording support,

wherein a series of annular discs are cut, each disc being cut along two rectilinear cutting lines extending from the periphery to the central aperture of the annular disc, each of said cutting lines being at an angle with the radii extending from the disc centre to the end points of said cutting line, each of said disc being put in the form of a helical coil which subtends an angle at the centre of slightly less than 360°, and the discs cut in said manner are assembled in such manner that in respect of each disc each edge of the cut is connected to one of the edges of the cut in one of the adjacent two discs between which said disc is located, the joint lines being thus offset, the two ends of the two end coils being also interconnected, in the same manner.

9. Method of producing an endless recording support wherein a band having a rectangular cross-sectional shape is continuously rolled between two rolls having convergent axes so as to impart to the band a slightly trapezoidal cross-sectional shape which automatically causes the band to assume the shape of a helicoid, and the two ends of said helicoid are interconnected along a line which is oblique relative to the curved edges of the helicoid.

10. Method of producing an endless recording support wherein a band having a rectangular cros-section is drawn over a cone which causes the band to assume the shape of a helicoid, and the two ends of said helicoid are interconnected along a line which is oblique relative to the curved edges of the helicoid.

11. Magazine for a recording support having a coiled portion constituted by a band coiled in the form of a helicoid, the ends of said coiled portion being interconnected by a closing portion, said magazine comprising a substantially flat shaped case which includes a case body and a cover in which is journalled a rotatable cylindrical member for driving the helicoid in rotation, said case body and cover comprising transverse walls having outwardly offset portions adapted to guide said closing portion of the support in combination with at least one cylindrical guide wall.

12. Magazine for a recording support constituted by a flexible band having a coiled portion coiled in the form of a helicoid and rendered endless by a loop formed outside said coiled portion, said magazine comprising a substantially flat-shaped case which includes a case body and a cover in which is journalled a rotatable cylindrical member for driving the helicoid in rotation, said body and cover being assembled in an assembly plane and defining a guiding passageway for guiding said outer loop; said body and cover and said guiding passageway, and consequently said loop, being substantially symmetrical relative to a longitudinal line passing through said assembly plane.

13. Magazine for a recording support constituted by a flexible band having a coiled portion coiled in the form of a helicoid and rendered endless by a loop formed outside said coiled portion, said magazine comprising a substantially flat-shaped case which includes a case body and a cover in which is journalled a rotatable cylindrical member for driving the helicoid in rotation, said case body and said cover comprising two transverse walls having two flat facing portions which form with conjugate portions of the lateral walls a housing for the helicoid and the means driving the latter in rotation, and two inclined faces connected to said flat portions of said transverse walls and forming with cylindrical walls a lateral guide channel for said loop of the band, said inclined faces which constitute the transverse walls of the channel being connected at one of their ends at an angle between substantially 60 and 90° to said flat portions of said transverse walls whereas at their other ends they are tangent to the plane of the assembly joint between the body and the cover.

14. Magazine for a recording support having a coiled portion constituted by a band coiled in the form of a helicoid, the ends of said coiled portion being interconnected by a closing portion, said magazine comprising a substantially flat-shaped case which includes a case body and a cover in which is journalled a rotatable cylindrical member for driving the helicoid in rotation, said case body and cover defining a guiding passageway for guiding said closing portion, separating said closing portion from and preventing it from rubbing against the helicoid, said cover comprising a window substantially diametrically opposed to said guiding passageway whereby the recording or reproduction is effected on a part of the band engaged with said driving member.

15. Magazine for a recording support having a coiled portion constituted by a band coiled in the form of a helicoid, the ends of said coiled portion being interconnected by a closing portion, said magazine comprising a substantially flat-shaped case which includes a case body and a cover in which is journalled a rotatable cylindrical member for driving the helicoid in rotation, said case body and cover defining a guiding passageway for guiding said closing portion, separating said closing portion from and preventing it from rubbing against the helicoid, said driving member being adapted to positively drive a portion of the helicoid on which the recording or reproduction is effected, and to drive the other portions of the helicoid with play.

16. Magazine for a recording support having a coiled portion constituted by a band coiled in the form of a helicoid, the ends of said coiled portion being interconnected by a closing portion formed outside said helicoid, said support being provided along the entire length of its inner edge with curved notches for driving the helicoid in rotation about the axis of the helicoid, said magazine comprising a flat-shaped case which includes a case body and a cover in which is journalled a rotatable cylindrical central hub provided on its outer face with ribs adapted to co-operate with said notches on the inner edge of said band; and said case body and cover defining a guiding passageway for guiding said closing portion, separating said closing portion from and preventing it from rubbing against the helicoid.

17. Magazine as claimed in claim 16, wherein the hub is mounted in the case through the medium of two swivel bearings.

18. Magazine for a recording support having a coiled portion constituted by a band coiled in the form of a helicoid, the ends of said coiled portion being interconnected by a closing portion formed outside said helicoid, said support being provided along the entire length of its inner edge with curved notches for driving the helicoid in rotation about the axis of the helicoid, said magazine comprising a flat-shaped case which includes a case body and a cover in which is journalled a rotatable cylindrical central hub provided on its outer face with ribs; each of said rib having a short end portion for positively driving the coil of the band on which the recording or reproduction is effected and having a cross-sectional size which exactly corresponds to that of said notches, the adjacent portion of said rib having a cross-sectional size less than the cross-sectional size of said notches.

19. Magazine for a recording support having a main helicoid portion constituted by a flexible band which is coiled in the form of a helicoid having superimposed coils, the two end coils of the band being interconnected by an auxiliary helicoid extending through the helicoid formed by said main portion, said band comprising along the entire length of its outer edge driving notches, said magazine comprising a substantially flat-shaped case which includes a case body and a cover in which is journalled a rotatable driving ring which surrounds said main helicoid portion and comprises inner ribs which co-operate with said notches; and said case body and cover defining a guiding passageway for guiding said auxiliary helicoid, separating it from and preventing it from rubbing against the helicoid.

20. Magazine for a recording support having a coiled portion constituted by a band coiled in the form of a helicoid, the ends of said coiled portion being intercon-

nected by a closing portion, said magazine comprising a substantially flat-shaped case which includes a case body and a cover in which is journalled a rotatable cylindrical member for driving the helicoid in rotation, said case body and cover defining a guiding passageway for guiding said closing-portion, separating said closing portion from and preventing it from rubbing against the helicoid, and the case and cover having transverse walls and freely rotative rollers mounted on said walls to reduce friction against the two end coils of the helicoid.

21. Magazine for a recording support having a coiled portion constituted by a band coiled in the form of a helicoid, the ends of said coiled portion being interconnected by a closing portion, said magazine comprising a substantially flat-shaped case which includes a case body and a cover in which is journalled a rotatable cylindrical member for driving the helicoid in rotation, said cover having an upper transverse wall, said case body and cover defining a guiding passageway for guiding said closing portion, separating said closing portion from and preventing it from rubbing against the helicoid; said cover comprising a window substantially diametrically opposed to said guiding passageway whereby the recording or reproduction is effected on a part of the band engaged with said driving member, and a plate being fixed under said window parallel with said upper transverse wall of the cover from which it is spaced a slight distance to permit passage between the plate and the cover of the first coil of the helicoid in course of recording or reproduction.

22. Apparatus as claimed in claim 2 and adapted to receive a support comprising a number of independent recording tracks and having on its face opposed to the tracks a short transverse conductive portion; said apparatus comprising a longitudinally movable head-carrying rack, a spring urging said rack in one direction, an escapement anchor means controlling the movements of said rack, an electromagnet for actuating said anchor, said electromagnet being fed through an electric circuit comprising said conductive portion and a fixed contact, said circuit being closed each time said conductive portion passes over said fixed contact, whereby said electromagnet pivots said anchor and said spring shifts said rack, and said head thereby a distance corresponding to the distance between said tracks.

23. In an apparatus of the character described, the combination of an endless recording tape in the form of a helix comprising a plurality of superimposed substantially flat and parallel circular turns of said tape and a loop extending between the end turns of said helix, drive means for rotating said helix about its axis, and guide means for guiding one end turn of said helix into said loop and for guiding said loop into the other end turn of said helix.

24. The invention as defined in claim 23, further characterized by recording or reproducing means co-operatively associated with a section of an end turn of said helix.

25. The invention as defined in claim 24, further characterized by support means arranged to be engaged between the section of said end turn in co-operative relation with said recording or reproducing means and the next adjacent turn of said helix.

26. The invention as defined in claim 24, further characterized by means for imparting movement to said recording or reproducing means transversely of the section of tape in co-operative relation therewith.

27. The invention as defined in claim 23, further characterized by an annular support engaged with an end turn of said helix and having an opening through which said tape moves between said loop and said helix.

28. The invention as defined in claim 23, further characterized by an arcuate inclined trackway over which said loop is guided as it moves from one end turn to the other end turn.

29. The invention as defined in claim 23, further characterized by guide rollers between which said loop is guided as it moves from one end turn to the other end turn.

30. The invention as defined in claim 23, wherein said drive means includes cog means connecting said drive means to said helix.

31. The invention as defined in claim 30, wherein said cog means comprises a plurality of circumferentially spaced posts carried by said drive means arranged parallel to the axis of said helix engaged in correspondingly arranged grooves in the outer periphery of said helix.

32. An endless recording tape comprising: a plurality of superimposed, substantially flat and parallel, circular turns of said tape which form a helix, the ends of which extend in opposite circumferential directions; a loop of said tape connecting the ends of the helix, said loop comprising a portion of said tape that extends from one of the ends of the helix around a side of the helix to the other end of the helix; and junctures between the ends of said loop and said ends of the helix, each of said junctures comprising a portion of said tape that reversely extends back over itself; said loop between said junctures being curved, inclined relative to the helix and free of twists.

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