United States Patent [19]

Dimitracopoulos

[11] **3,717,407**

[45] **Feb. 20, 1973**

[54] AUDIOVISUAL SLIDES AND DATA-RECORD CARDS

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[22] Filed: **March 2, 1970**

[21] Appl. No.: **15,738**

[52] **U.S. Cl.**.....**353/120,** 274/13 A, 353/19
[51] **Int. Cl.**...**G03b 21/00,** G03b 31/06, G11b 17/06
[58] **Field of Search** .....353/19, 120; 274/134; 340/174.1 B

[56] **References Cited**

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3,282,154	11/1966	Dimitracopoulos et al.	353/120
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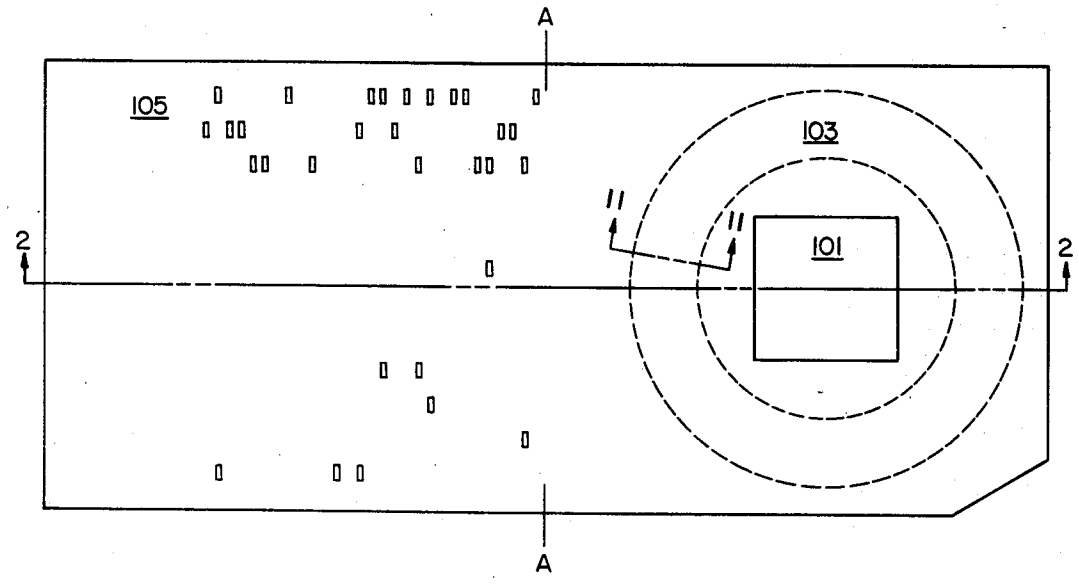
709,022	1954	Great Britain	274/4 H

Primary Examiner—Leonard Forman
Assistant Examiner—Steven L. Stephan

[57] **ABSTRACT**

Audiovisual Slides and Audiovisual Data-Record Cards carrying on their surface a stationary spiral sound track surrounding a window receiving a projectable transparency, the spiral sound track being recorded on one surface of the slides or cards, while a spiral groove, formed on the same or the opposite surface of these slides or cards, is used in the special recording and reproduction apparatus for the guidance of the recording and reproduction transducer. An alternative transducer-guidance means, on the slides and cards, is one or more auxilliary tracks coaxial to the sound track.

3 Claims, 20 Drawing Figures



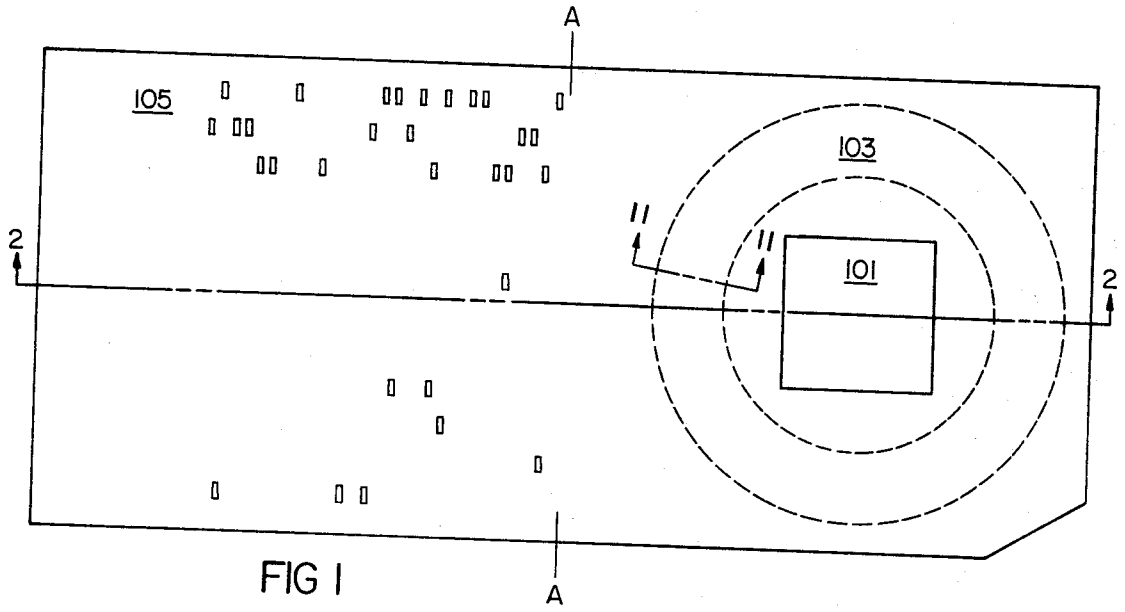


FIG 1

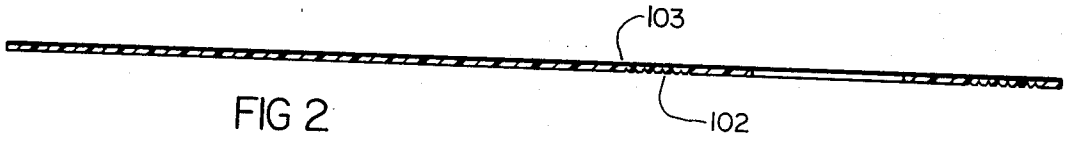


FIG 2

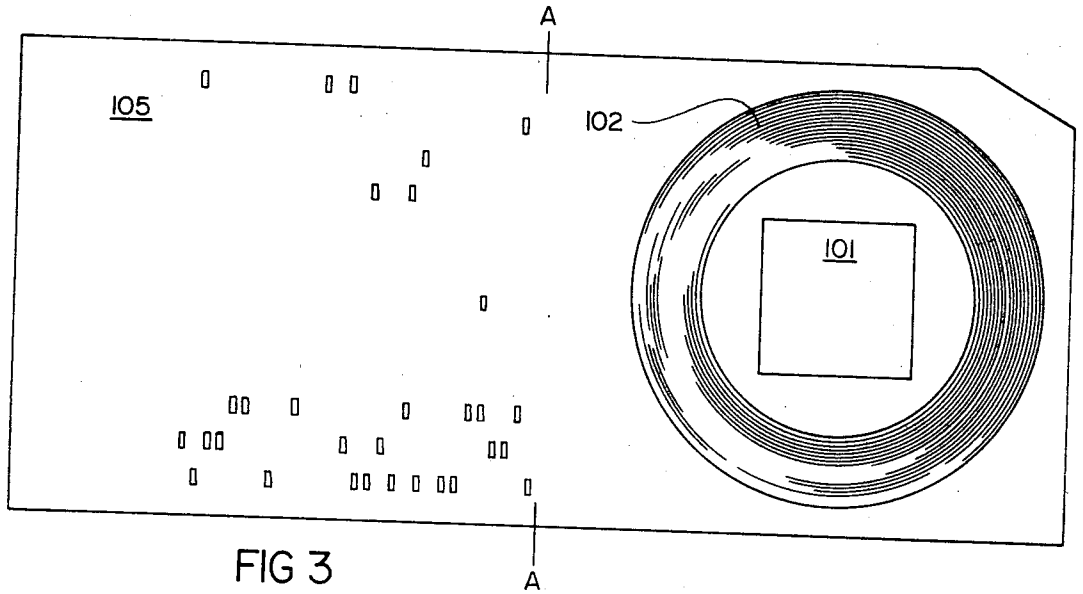


FIG 3

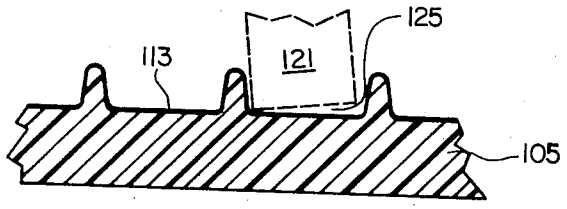


FIG 4 (PRIOR ART)

INVENTOR

P. C. DIMITRACOPOULOS

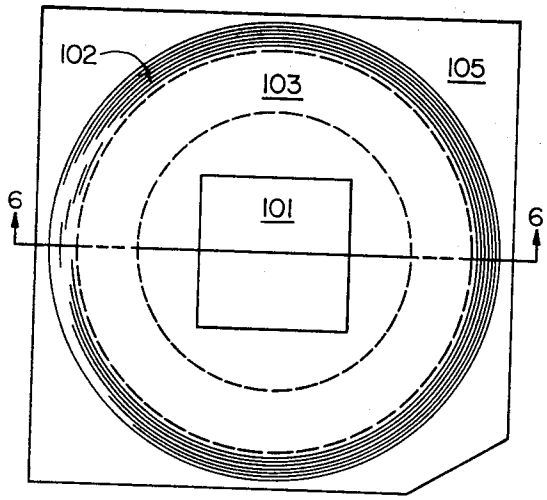


FIG 5

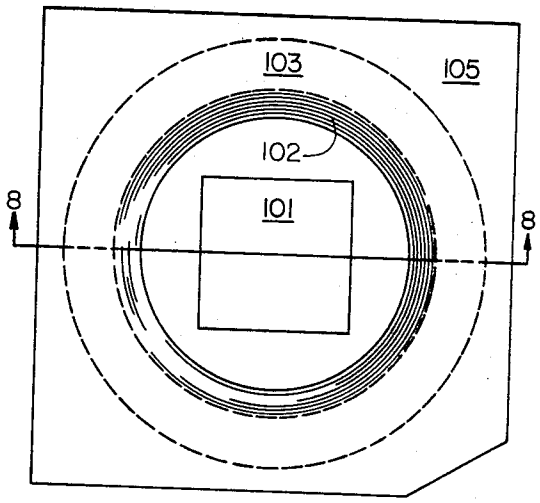


FIG 7

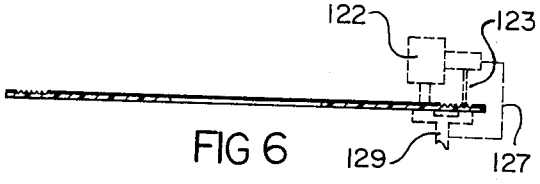


FIG 6

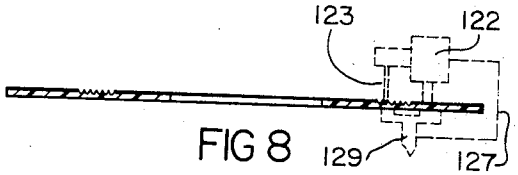


FIG 8

FIG 13

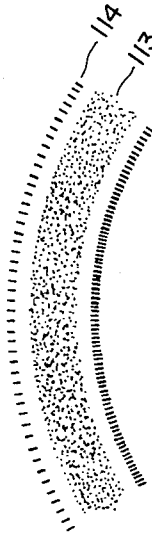


FIG 10

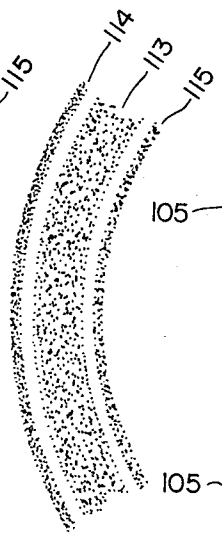


FIG 9

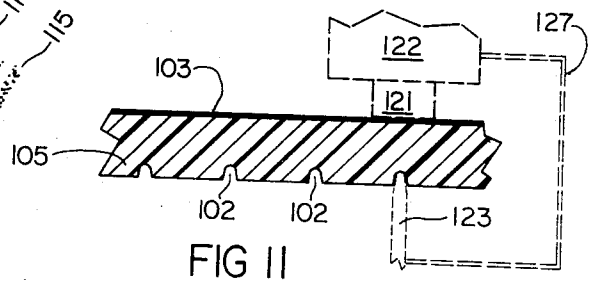


FIG 11

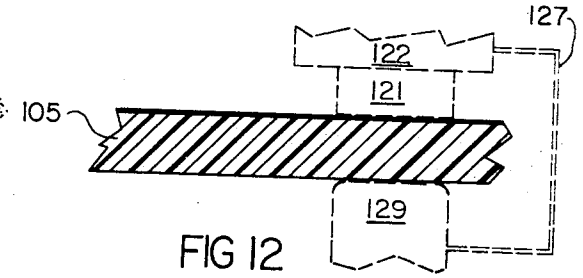


FIG 12

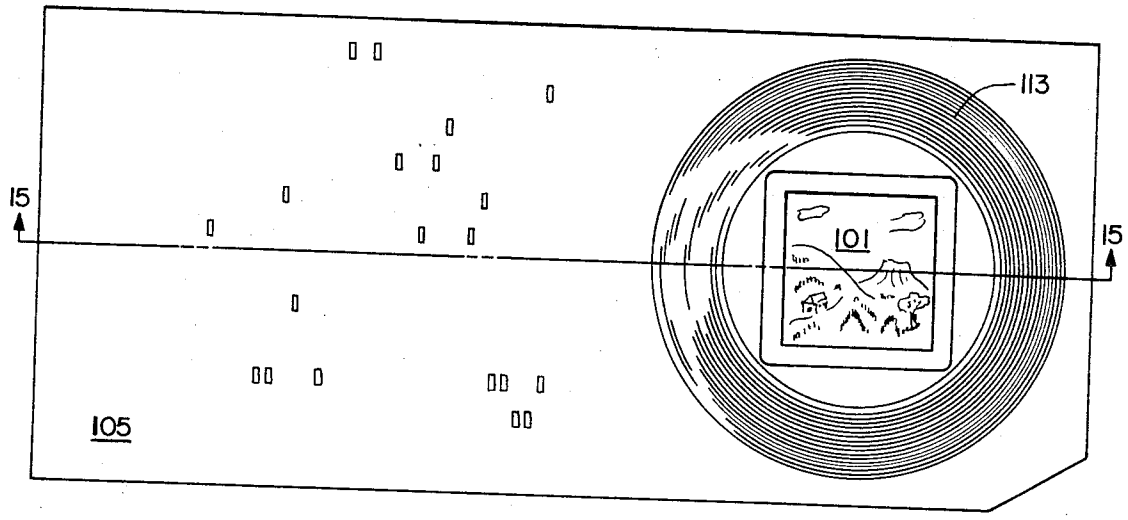


FIG 14

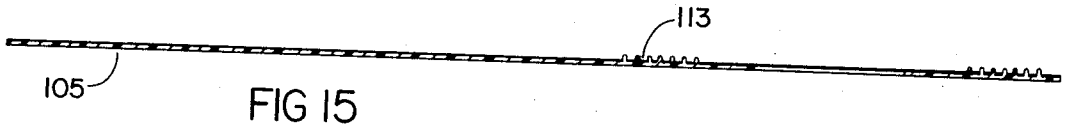


FIG 15

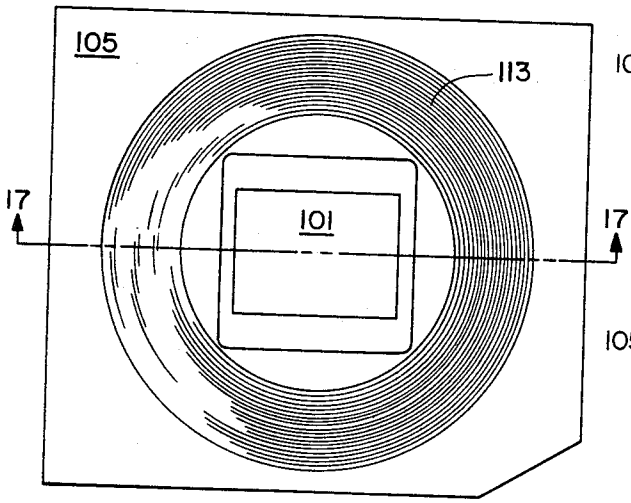


FIG 16

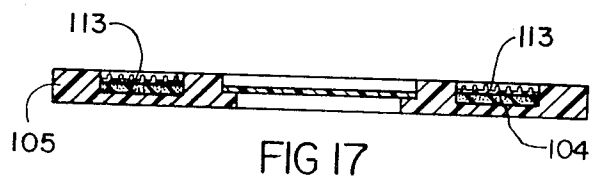


FIG 17

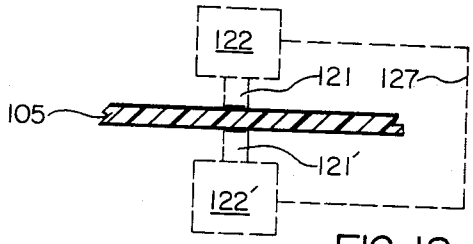


FIG 18

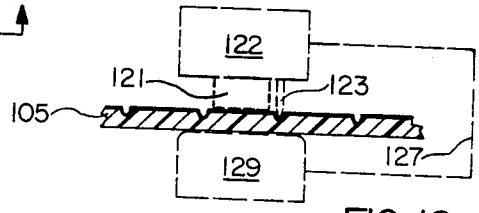


FIG 19

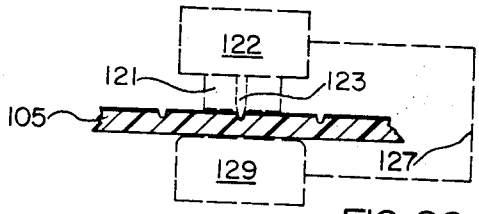


FIG 20

AUDIOVISUAL SLIDES AND DATA-RECORD CARDS

FIELD OF INVENTION

This invention relates to Audiovisual Slides and Audiovisual Data Record Cards, and also to guiding means, on the slides and cards, for guiding the sound transducer of the recording and reproduction apparatus while it scans the surface of the slides and cards along a desired spiral path.

DESCRIPTION OF PRIOR ART

While picture and sound synchronization was successfully achieved a long time ago in the movie industry, a practical method for obtaining the same result was not available, until a few years ago, in the photographic slides or transparencies field.

In his U.S. Pat. Nos. 3,302,520, 3,282,154 and 3,644,032 the inventor of the present invention taught a method of complete synchronization which consisted of directly and permanently associating a generous length of recorded sound (audio) information with each visually-projectable image or visual slide unit, in such a way that a properly designed projector, as described in his U.S. Pat. Nos. 3,122,053, 3,122,054 and 3,480,356, can simultaneously reproduce both audio and visual records of an audiovisual slide unit, individually or sequentially, without any special requirement as to synchronization, the latter following inevitably from the fact of integration of the two kinds of records upon a single audiovisual slide unit.

In the abovementioned patents the inventor of the present invention taught a form of audiovisual slides consisting of a projectable transparency, such as a projection diapositive, positive film, or the like, carried directly upon, or forming part of, a sound record of the spiral type, preferably, but not necessarily of the magnetic or phonographic type, adapted for ready reproduction by a special form of rotating transducer (for example, but not exclusively, a magnetic or phonographic pick up head). The audiovisual slides are employed with a special audiovisual apparatus that permits the audiovisual slides to be held stationary, while the pick up head is rotated around the optical projection beam, follows the spiral sound track, and thus senses and reproduces the sound information contained therein.

Audiovisual Slides and Audiovisual Apparatuses according to the teachings of the abovementioned patents are now the objects of commercial manufacture. But when magnetic sound tracks are employed, it is imperative that the best possible contact be made between the surface of the magnetic track and the pole-tip or shoe of the magnetic transducer, and the inventor of the present invention has taught methods of improving such surface-to-pole tip contact in his U.S. Pat. Nos. 3,644,032 and 3,627,330. Nevertheless, there are some forms of audiovisual slides, especially when they are thin or very thin, for example data-record cards, which by their very nature, present substantial difficulties in this surface-to-pole-tip contact.

OBJECTS OF THE INVENTION

It is therefore the object of this invention to provide means for guiding the electromagnetic transducer, along the desired spiral paths on the audiovisual slide, with a greatly improved surface-to-pole-tip contact.

It is a further object to provide such contact by using guiding means on special audiovisual slides that do not have the guiding raised walls heretofore employed, which walls proved objectionable in certain cases, as for example in the case of the audiovisual data-record cards.

It is a further object to provide special combinations of guiding phonographic grooves and magnetic sound tracks on such audiovisual slides.

It is a further object to provide audiovisual slides of improved sound recording and reproduction quality.

It is a further object to provide such audiovisual slides of thin or very thin thickness, which have particular importance and significance when they take the form of, and are employed as, audiovisual data-record cards.

Other objects of the invention will become evident from the ensuing description, illustrations and claims.

SUMMARY

Audiovisual slides and data-record cards having in one region of their surface a spiral sound track, surrounding a projectable image, and

1. a spiral transducer-guiding groove on their other surface, directly beneath, and coaxial to, the sound track, or

2. a spiral transducer-guiding groove, coaxially within, or coaxially outside, the sound track, and on the same side of the sound track, or

3. auxilliary transducer-guiding tracks, coaxial to the sound track.

BRIEF DESCRIPTION OF THE FIGURES:

FIG. 1 is a plan view of a typical embodiment of audiovisual slide according to the invention, having the form of an audiovisual data-record card.

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1.

FIG. 3 is the same audiovisual slide of FIG. 1 seen from the opposite surface, i.e. its other side.

FIG. 4 illustrates a segment of an enlarged cross-section of the sound track portion of an audiovisual slide according to the prior art.

FIG. 5 is a plan view of another typical audiovisual slide according to the invention.

FIG. 6 is a sectional view taken along line 6—6 of FIG. 5.

FIG. 7 is a plan view of still another typical audiovisual slide according to the invention.

FIG. 8 is a sectional view taken along line 8—8 of FIG. 7.

FIG. 9 is a greatly enlarged plan view of a portion of a sound track according to the invention.

FIG. 10 is a greatly enlarged plan view of a portion of an alternative form of sound track according to the invention.

FIG. 11 illustrates a segment of an enlarged cross-section taken along line 11—11 of FIG. 1.

FIG. 12 illustrates a segment of an enlarged cross-section of an audiovisual slide according to the invention, having sound tracks of the types illustrated in FIGS. 9 and 10, and 13.

FIG. 13 illustrates a greatly enlarged plan view of a portion of still another form of sound track according to the invention.

FIG. 14 is a plan view of a typical audiovisual slide, according to prior art, as taught by the same inventor.

FIG. 15 is a sectional view taken along line 15—15 of FIG. 14.

FIG. 16 is a plan view of another form of audiovisual slide, according to prior art, as also taught by the same inventor.

FIG. 17 is a sectional view taken along line 17—17 of FIG. 16.

FIGS. 18, 19 and 20 illustrate segments of enlarged cross-sections of alternative forms of audiovisual slides according to the invention, the cross-sections taken along lines corresponding to line 11—11 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS:

In the abovementioned U.S. patents by the same inventor, the sound tracks were of the phonographic, magnetic, optical etc. types. In the case of phonographic sound tracks the usual spiral phonographic groove was employed for guiding the point or needle of the phonographic transducer along the desired spiral path surrounding the transparency. When magnetic sound tracks were employed, the guidance of the electromagnetic transducer along this desired spiral path had to be obtained either from external to the audiovisual slide means, or by special pre-grooved magnetic sound tracks, for example, similar to those illustrated in FIGS. 4, 15 and 17. It is evident that when external means were employed, the centering of an audiovisual slide on the recording and reproduction apparatus was an extremely difficult problem, since the slightest misalignment would cause unacceptable sound deterioration. On the other hand, the type of pre-grooved magnetic tracks, such as those illustrated in FIGS. 4 and 15, and described at some length in the abovementioned patents by the same inventor, had solved in a very elegant way the tracking problem. As it is also explained in U.S. Pat. No. 3,644,032 by the same inventor, a perfect contact is imperative between the surface of the sound track and the pole-tip, or shoe, of the electromagnetic transducer. In order to obtain this perfect contact it was found very useful to back-up the magnetic oxide layer with a resilient material, so that differential areas or segments of the sound track may "float" under the pressure of the transducer's shoe. FIGS. 16 and 17 illustrate such audiovisual slides, in which the pre-grooved magnetizable layer 113 is backed-up by a resilient (for example rubber-foam) layer 104. As long as the audiovisual slides are of a fairly thick cross-section, the use of such resilient backing is possible. However, when very thin slides are employed such as audiovisual data-record cards, the interposition of such a backing is very difficult or impossible, and one must rely on the flexibility of the card itself to ensure a perfect sound track to pole-tip contact. In addition, in pre-grooved magnetic tracks according to the prior art, as taught by the same inventor, and illustrated in FIGS. 14 and 15, the wall separating adjoining sound tracks has a substantial height, and this adds up thickness at one portion of the card, and may cause problems in automatic sorting machines. FIG. 4 illustrates in a somewhat exaggerated fashion what happens when the pole-shoe 121 of a magnetic transducer does not make a perfect contact with the surface of the sound track 113. In this FIG. 4, only the left corner of the shoe 121 touches the sound track 113, and thus an unacceptable void, here designated by numeral 125, remains between the sound track and the shoe of the transducer. It must be understood that even if the shoe of the transducer is properly aligned, it is almost certain that unevenesses will exist in various points along the sound track 113. It might be suggested that a gimbal suspension of the transducer might solve the problem, but this is not so in view of the very small size and geometry of the shoe of the transducer

The three principal areas in which this invention makes substantial contributions are:

a. The provision of dependable, economical and practical transducer guiding means, on each and every audiovisual slide and data-record card.

b. The elimination of the additional height of the spiral guiding wall in the magnetic tracks, thus ensuring uniform thickness throughout the audiovisual slide or audiovisual data-record card.

c. The provision of means for ensuring positive transducer-shoe to sound-track contact.

The above three principal contributions and some important secondary ones, are made possible in more than one way, as will be described below by reference to a few presently preferred typical embodiments of the invention, with regard to the construction of the audiovisual slides and data-record cards, as well as to a few forms of sound tracks. The embodiments described below are to be construed as examples only, since the principles of the invention can be carried out by specifically different physical devices.

EMBODIMENT I

Sound track on one side and guiding groove on another side

This preferred slide will be described by referring specifically to FIGS. 1, 2, 3 and 11.

FIG. 1 illustrates an audiovisual slide, in this case a typical data-record card, generally designated by numeral 105, having space provided on its surface for the usual perforations, indentations, optical, magnetic and/or other markings, etc. This card carries an image 101, or is formed with a window 101 carrying, or adapted to carry, a projectable image. The card contains, is coated with, or is covered with, a layer of magnetizable material, for example, magnetic oxide or the like. Alternatively, a portion of the surface of the card, say the area on the right of line A—A, or an annular ring 103 around the image or window 101, carries the abovementioned magnetizable substance.

On its opposite surface, i.e. the surface illustrated in FIG. 3, and surrounding the image 101, the card is formed (for example is embossed) with a spiral groove 102, somewhat resembling that of a phonographic record, but without any modulation. The depth and width of this groove need only be of the order of a thousand of an inch or even less, and its spirals may be spaced further apart than those usually employed in the phonographic art.

FIG. 11, is a greatly enlarged cross-sectional segment of the slide or card, taken along line 11—11 of FIG. 1

and it illustrates the card **105**, carrying or covered with the magnetizable layer **103** on one surface, and formed with the abovedescribed spiral groove **102** on its other surface. This arrangement permits a very interesting configuration of sound-track scanning mechanism, which is described in co-pending U.S. patent application Ser. No. 15,739 by the same inventor,filed concurrently herewith, but will be also briefly explained here for the better understanding of this invention. The pole-tip or shoe **121** of the electromagnetic transducer **122** makes contact magnetizable layer **103**, under the guidance of a tracking needle **123**, which rides in the above-described groove **102**. An arm of bracket, for example, of substantially U-shaped form, carries the transducer **122** and the tracking needle **123**, one each, at opposite ends of its U-shaped member. This arm or bracket diagrammatically illustrated in dotted lines and designated by numeral **127**, urges the pole-tip **121** and the needle **123** against one another, and thus literally "-sandwiches," or presses, in pincers-like fashion, the slide or card **105**, while the needle rides in groove **102**. The arm or bracket **127** revolves around the optical projection beam of the apparatus, in the fashion taught by the abovementioned patents and more specifically by the abovementioned pending patent application by the same inventor, and in this way, the pole-tip **121** is forced to follow the desired spiral path, guided by the needle **123**. It is evident that if the slide or card **105** is thin and flexible enough, as is the case of the usual data-record cards, the pincers-like arrangement of the arm assures positive tip to magnetic-surface contact, and voids, such as void **125** of FIG. **4**, are virtually impossible. The sound quality is thereby greatly improved, and this constitutes a very important feature of this invention.

EMBODIMENT II

Sound track and guiding groove on same side

While the abovedescribed arrangement offers many advantages, and experimentally it appears to be very effective, there are two more alternatives which while generally inferior to the above, offer nevertheless certain advantages in special circumstances. Namely, the guiding groove and the sound track can be on the same surface or side of the audiovisual slide or card, and, as illustrated in FIGS. **5**, **6**, **7** and **8**, the groove **102** may be between the sound track **103** and the image **101**, or vice versa.

Even in these two alternatives, it is possible to utilize in the apparatus the "pincers-like" effect described in I above, by employing a small pad **129** (see FIGS. **6** and **8**), supporting the opposite side or surface of the slide or card. This small pad **129** is affixed at the tip of the U-shaped arm and therefore revolves with the transducer **122**, in the above-described fashion, i.e. around the optical projection beam of the apparatus.

While certain advantages may exist in this arrangement, the principal disadvantages are:

There is less available room for the sound track.

Since it is easier to cover the entire surface with magnetizable material, the groove may contain oxide particles, which are abrasive and may wear the needle **123**.

The pincers-like effect between the needle **123** and the shoe **121** of Embodiment I, as illustrated in FIG. **11**, is exerted along the centerline, or axis, of the two principal elements and therefore is superior to the pincers-like arrangement of FIGS. **6** and **8** of this Embodiment II.

Nevertheless, only a relatively small area of the surface need be wasted by the groove **102**, since the spacing of the groove spirals **102**, may be much closer than the spiral trace of the sound track, and the needle **123** and transducer **122** need not be directly attached to one another, as illustrated for simplicity in FIGS. **6** and **8**, but may be mounted at different distances from their common pivot, thus achieving leverage effects of desired magnitude.

EMBODIMENT III

Sound track and auxillary guiding tracks

Referring to FIG. **9**, **113** designates a segment of a typical spiral sound track, which is flanked by two other tracks, **114** and **115**. Each of the latter may contain a different, distinct, frequency, so that when an electromagnetic transducer, mounted at the end of an arm, drifts inwards or outwards, it picks one or the other of these two frequencies, which are then fed, after proper separation and amplification, to a servo-mechanism providing the necessary guidance correction. Actually, only one frequency track is necessary, and the arm may be permanently urged or biased by spring means (or even by the "skating force" of the arm) towards that track, this bias being nicely counterbalanced by the opposing action of a servo-mechanism, fed or triggered by that frequency.

EMBODIMENT IV

Embossed frequency tracks

This arrangement is illustrated in FIG. **10**, and is essentially similar to that described in III above, except that instead of magnetically recording the guiding tracks **114** and **115**, these two tracks consist of a series of small depressions below the surface of the slide or card. These depressions may take the form of small parallel lines, or points, embossed, formed or depressed below the record surface, so that the scanning electromagnetic transducer will "read" them as frequencies, which can be utilized by the transducer guidance system in the fashion explained in III above. It is evident, as it was explained above, that only one track, rather than two, suffices to provide the guidance, and that instead of depressions, the markings of the tracks may consist of a series of protrusions above the surface of the record.

EMBODIMENT V

Magnetic Guiding track within the sound track itself

A frequency guiding track may be recorded on the surface of the slide or card and the sound track recorded right over it as shown in FIG. **13**. Actually, the recording of this guiding track may be obtained by essentially printing methods, for example, by etching away or removing a spiral groove from the face of a magnetically permeable plate, so that the remaining flat surface corresponds to the width and other geometric parameters of the spiral sound track. The surface of the spiral track on the plate may be further engraved or etched with striations, points, lines, or markings corresponding to the desired frequency or frequencies (at

the given transducer speed). When this plate is now backed up by a magnet or electromagnet and brought in contact with the magnetic surface of the slide or card (for example by using a press) it will record on it the desired guiding track. The same result could be obtained by engraving or etching directly on the face of a magnet or electromagnet, i.e. without the interposition of the magnetically permeable plate, although this method does not seem very practical.

Remarks and Comments

It can be seen that the abovedescribed arrangements, provide substantial improvements over the prior art taught by the same inventor, namely:

By providing very positive, simple and practical spiral guiding means, on each and every slide and card, a misalignment of the center of the spiral sound track will have no audible effect, since the recording and reproduction paths will be exactly the same and any linear speed variations caused by such misalignment will be the same in both the recording and reproduction modes, and therefore inaudible.

By the elimination of the guiding walls used in pregrooved magnetic tracks of the prior art, the slides, and what is particularly important, the data-record cards, have the same thickness throughout, a feature particularly important in automatic stacking, sorting and handling of these cards.

By ensuring a positive, yet very simple and economical, pole-tip to magnetic-surface contact, it is possible to obtain excellent scanning of the track, at relatively low transducer pressures (less wear of the track and the transducer tip), even if the pole-tip and the surface of the record are not exactly parallel to one another.

FIG. **12** illustrates how a pad **129** and the "pincers-like" arrangement of Embodiment I can equally well be employed in the Embodiments III, IV and V.

While a data-record card was described in Embodiment I, this was only done as an example and for illustrative purposes only, and the arrangement of Embodiment I is equally well applicable to any other shape or format of audiovisual slides, within the spirit of the invention, for example, a shape as that illustrated in FIGS. **5** or **7**, or any other shape, whether rectangular, circular or a strip comprising more than one audiovisual area, etc.

Similarly, while FIGS. **5, 6, 7** and **8** were employed in the description of Embodiment II, the arrangement of this Embodiment II, or for that matter of any other Embodiment, is equally well applicable to any desired format of audiovisual slides according to the invention, including but not limited to, data-record cards, discs, strips, etc.

It has been stated that the records, or their surface, may contain, or may be coated with, magnetic oxide, since magnetic oxides are the most commonly employed substances today. But the term "magnetic oxide" is intended to include any magnetic or magnetizable element, material, substance or composition that may be used in magnetic records of the type abovedescribed.

While it may appear more practical to make the abovecited magnetic records with a uniform coating or layer of magnetizable substance, or this magnetizable substance may be contained within the material of the record, the arrangement of the present invention is intended to include records having a magnetic or magnetizable substance in, or on, parts only of the record, or record surface, for example on the magnetic track itself only, or on desired portions thereof.

The tracks of FIGS. **9, 10** and **13** have been shown by a series of dots, but this was only done for illustrative purposes, since on a magnetizable surface, the actual trace of a magnetic track is usually invisible or indistinguishable from the remaining surface. On the other hand, there are instances where it would be very advantageous to have a magnetizable substance ONLY on the desired spiral path, in which case, under magnification, the tracks may appear approximately as the illustrations of the FIGS. **9, 10** and **13**.

The embodiments III, IV and V and the FIGS. **9, 10** and **13** imply that the sound track and the guiding tracks are on the same side of the slide or card, but again, it is quite possible, and sometimes very advantageous to have the sound track on one surface of the slide or card and the guiding track, or tracks, on the opposite surface. In this case, the pad **129** of FIG. **12** will be the shoe or pole-tip of a second transducer scanning and "reading" the guiding track or tracks, as specifically illustrated in FIG. **18** where two transducers **122** and **122'** are utilized in the recording and reproduction apparatus, this arrangement more fully described in the abovementioned co-pending patent application. This arrangement offers distinct advantages, including economy of space, and the possibility of utilizing guiding tracks of somewhat larger width (for example the same width of the sound track itself) which has definite practical significance since the spiral tracks may be printed, if desired, with magnetic ink and the transducers may be somewhat larger and therefore less expensive.

In embodiment II, two alternative locations of the guiding grooves were described, namely those illustrated in FIGS. **5, 6** and **7, 8**. But it is evident that the guiding groove **102** need not occupy a separate and distinct area on the surface of the audiovisual slide or card, but the spiral guiding groove may actually lie between the convolutions of the spiral sound track as illustrated in FIG. **19**. The spiral guiding groove may also lie substantially at the edge of, or substantially in the middle of, or within the width of, the sound track, as shown in FIG. **20**, which also illustrates in dotted lines the arrangement of the scanning element of the recording and reproduction apparatus.

Specific reference to magnetic tracks and magnetic or electromagnetic transducers has been made in the description, but other forms of tracks and transducers are evidently possible, within the spirit and teachings of the invention, for example electrostatic, etc. tracks, and therefore such other forms of tracks and transducers are clearly intended to be included in the present invention.

While a number of specific arrangements for audiovisual slides, audiovisual data-record cards and sound tracks and transducer guiding means and a number of specific embodiments of the invention have been disclosed, it will be understood that various modifications and variations within the spirit of the invention are possible, for example, while it has been stated that the image **101** of the audiovisual slides is a projectable transparency, it could equally well be an

image for epidiascopic projection. Also in the final analysis, other than purely optical images could be employed within the spirit of the invention.

What is claimed is:

1. A thin audiovisual slide comprising:

a. a thin, flat support having in one region thereof a projectable transparency image,

b. said support having on one of its surfaces a narrow, flat and substantially physically intangible magnetizable track, spirally disposed around said image, on which magnetizable track magnetic signals may be recorded by a magnetic transducer;

c. said support having on its other surface a second magnetizable spiral track, similar to, directly and allochirally below, the first-named track, said second track constituting a magnetic guiding track for said transducer;

d. at least one of said magnitizable tracks being constituted by magnetizable substance disposed only along its path on said support.

2. An audiovisual slide according to claim 1, in which said support is formed with a window receiving and fixedly holding said image.

3. An audiovisual slide according to claim 1, in which said support has an area outside said spiral track for the recording of encoded data in the manner of a data record card.

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