Complete Specification for the invention entitled:

"AN AUTOMATIC RECORDING, REPRODUCTION AND TRANSLATION DEVICE AND A CORRESPONDING SUPPORT"

The following statement is a full description of this invention, including the best method of performing it known to me.
The invention relates to magnetic recorders in which the recording medium comprises cards having a magnetic coating on their backs. Such a magnetic recorder and card is disclosed in French Patent Specification No. 1,591,591.

In such apparatus, use is made of rectangular magnetic cards each bearing successive lines of writing on the front of the card, the lines of writing being visible from above the apparatus, in operation of the latter and being readable from left to right in the normal way, and each card bearing a magnetic coating on its back for recording and reproducing sound along successive parallel tracks scanned by a magnetic head moving alternately from left to right and from right to left, the direction of motion being reversed at each end of line, accompanied by a jump to the next line, usually by moving the card in its plane perpendicular to the directions of the lines. The sound recorded or reproduced can correspond, e.g. to the pronunciation of the corresponding written line or to a translation thereof into another language.

A device of this kind, however, has relatively limited possibilities of use, which restrict its possible applications.

An object of the invention is to increase the variety of possible uses while making only a very slight increase in technological complexity.

According to the invention, two sound recording tracks, i.e. a top track and a bottom track, are recorded on the back of the card and correspond to each line of writing on the front, the bottom track being always travelled along in the opposite direction from the top track, and the device being actuated so as to operate, when required, in accordance
with four different methods of scanning, the first consisting in reading all the top tracks alternately from left to right and from right to left, the second consisting in reading all the bottom tracks alternately from right to left and from left to right, the third consisting in alternately reading a top track of an odd line, a bottom track of the same line, a bottom track of the next even line, a top track of the same even line and so on, and the fourth consisting in successively reading a top track and a bottom track of the same line, then moving in an inoperative manner, i.e. in silence, to the other end and then scanning a top track followed by a bottom track of the next line, and so on.

More particularly, the aforementioned scanning can be brought about according to the invention by using a double magnetic head, the two parts of which correspond to the two tracks of a same line and are switchable from one to the other, whereas the jump in scanning from one line to the next is obtained mechanically, usually by moving the card upwards. Accordingly, the first two methods of scanning are obtained by bringing about the normal mechanical jump at each end of line without changing the switching, whereas the third method is obtained by bringing about the mechanical jump at the left end of each line and switching at the right end of each line, and the fourth method is brought about by the following operations in alternation, at each sequence of three ends of a line: switching alone, a jump and switching and stopping the sound, and restoration of the sound alone.

In each method of scanning, the recording or sound reproduction means can be operated as required. Preferably, each card has two slotted regions co-operating with two probes.
which lock the transition from reproduction to recording for the top and bottom tracks separately, so as to prevent recorded tracks of the respective series from being erased when the corresponding slot is present.

Preferably, the card also has two V-shaped slots on two opposite horizontal edges, cooperating with similarly-shaped lugs on the device in order to position the card correctly.

According to another aspect of the invention, there is provided a magnetic card, for use in the apparatus, in which the magnetic coating is deposited on a thin sheet of polyester or similar material secured by a flexible layer of foam to the back of the rigid support of the card.

An embodiment of the invention is described below by way of example with reference to accompanying drawings, in which:

Figure 1 is a diagram of the arrangement of the tracks on a magnetic card;

Figures 2, 3, 4 and 5 are smaller-scale diagrams showing respectively first, second, third and fourth methods of operation of an apparatus embodying the invention;

Figure 6 is a view of part of an apparatus embodying the invention and showing the card and the method of centering it, and

Figure 7 is a large-scale view of a cross-section through the card and the magnetic head, the section being in a plane extending in the direction of a recorded track.

A magnetic card embodying the invention, denoted by 1 in Figure 6, preferably has 26 parallel lines of text (not shown) on its front surface 2 (shown in Figure 7), so that
the lines can be denoted by the 26 letters of the alphabet from A to Z. In addition to the 26 marked lines, there are two additional lines at the beginning and end, as explained hereafter. The back surface 3 of the card has twice the number (i.e. 52) of parallel magnetic tracks represented by horizontal arrows in Figure 1, so that each line of writing on the front of the card corresponds to a pair of magnetic tracks on the back of the card, each pair comprising an upper track nearer an upper edge 4 of the card and a lower track nearer a lower edge 5 of the card. For the purposes of the description, the upper tracks will be considered referenced by respective capital letters and the lower tracks by respective lower case letters, successive pairs of tracks being accorded alphabetically successive letters. Thus the upper tracks, represented in thick lines on Figure 1, may be considered referenced A to Z, whereas the lower tracks, represented by thin lines on Figure 1, may be considered referenced a to z.

In operation of the recording and reproducing apparatus, each lower track a, b, etc., is scanned in the opposite direction from the corresponding upper track A, B, etc. Furthermore successive upper tracks are scanned alternately from left to right and from right to left and successive lower tracks are also scanned alternately from left to right and from right to left. One arrangement having the above noted characteristics is shown in Figure 1, in which inter alia two successive tracks such as a and B, or b and C, or c and D and so on are scanned in the same direction as each other in the same manner.

This arrangement can easily be adapted for the
following four methods of scanning:

The first method, shown in Figure 2, consists in scanning A, B, C, D, etc. in succession.

The second method, shown in Figure 3, consists in scanning a, b, c, d, etc. in succession.

The third method, shown in Figure 4, consists in successively scanning A, a, b, B, C, c, d, D and so on.

The fourth method of scanning, shown in Figure 5, consists in scanning A and a in succession, then moving from left to right in an inoperative manner, then scanning B and b in succession and moving from right to left in an inoperative manner, then scanning C and c in succession and so on.

The first method of scanning can be used e.g. for reproducing from or recording on the tracks indicated by capital letters, the pronunciation corresponding to the text of the corresponding written line on the front of the card, whereas the second method can be used for reproducing from or recording, on the tracks indicated by lower case letters, a translation of the same text. The third method is for continuously reproducing from or recording on the 52 recording tracks in order to use the maximum sound-recording capacity without distinction between the tracks. The fourth method is used for successively listening to or recording the text and translation or a question and answer, separately and successively for each line of writing.

These various methods of scanning are related to the arrangement of tracks on the cards and can be obtained by all desired combinations of card movements relative to the magnetic head.

More particularly it is preferred to use a double,
i.e. two-track magnetic head denoted by 6 in Figures 1 and 7, comprising two parts each with an air gap and a winding, i.e. an upper part 7 and a lower part 8. Of course, the parts are as close as possible and, at each movement of the magnetic head 6, their positions correspond to the scanning of an upper track and a lower track respectively. It is thus possible to use a mechanism for jumping from line to line, either by moving the head downwards or, more generally, by moving the card upwards, so that each mechanical jump corresponds exactly to the spacing between lines of writing on the front and results in the upper part 7 being moved from an upper track of a pair to the upper track of an adjacent pair and in the lower part 8 being moved from the lower part of the former pair to the lower part of said adjacent pair. Of course, no change is made in the mechanism for reversing the direction of motion of the head at each end of line.

In the present case, the first method of scanning shown in Figure 2 is obtained simply by operating the jump mechanism at the end of each scanning movement, both at the right and at the left, the upper part 7 of the magnetic head being operative and the lower part 8 being inoperative throughout scanning of the entire card. Similarly, the method of scanning in Figure 3 is obtained by effecting a mechanical jump at the end of each scanning movement, the lower part 8 of the head being operative and the upper part 7 inoperative throughout scanning of the entire card.

The third method of scanning, shown in Figure 4, is obtained in a very simple manner by the arrangement shown, by bringing about a mechanical jump at the end of each scanning movement to the left and by switching over from
part 7 to part 8 or vice versa to render part 7 inoperative and part 8 operative, or vice versa respectively, at the left end of each scanning movement to the right.

Finally, the fourth method of scanning, shown in Figure 5 is obtained by starting with the upper part 7 operative then switching over from part 7 to part 8 at the end of the first scanning movement to the right, then effecting a scanning movement to the left without effecting a mechanical jump, then effecting a mechanical jump at the end of the scanning movement to the left, rendering both parts 7 and 8 inoperative whilst effecting a return movement to the right, rendering the top part 7 operative and the bottom part 8 inoperative and effecting a scanning movement to the left after effecting a further mechanical jump, switching from part 7 to part 8 without any mechanical jump for the subsequent scanning movement to the left, and so on.

Note, however, that the second method of scanning begins at the top right of the card, whereas the first, third and fourth methods begin at the top left.

To overcome difficulties arising from this fact, two additional lines are provided, i.e. a zero or beginning line at the top of the card and an end line, below the line corresponding to tracks Z, z. These two lines are not used for recording sound but may or may not have a label such as title or reference on the front face of the card. Before each scanning operation, the magnetic head is systematically stopped at the centre of the beginning line at the place marked Mm in Figure 1, i.e. each scanning operation begins with an inoperative half-line, since the zero line, whether written or not, corresponds at the back to an imaginary, unrecorded upper track having a middle M and an imaginary, unrecorded lower
track having a middle m, the scanning direction of the imaginary upper track being that of the tracks B, D, F, etc., and the scanning direction of the imaginary lower track being that of tracks, b, d, f, etc. The first method of scanning, therefore, is obtained by switching to render the part 7 of the head disposed at M operative and by following the corresponding scanning direction. The half line M is scanned towards the left and in silence since nothing has been recorded, after which there is a jump at the end of the line so that scanning of line A can begin at the left. The second method of scanning is obtained by rendering the part 8 of the head, disposed at m, operative and by following the corresponding scanning direction, so that the half-line m is scanned towards the right in order to begin scanning of the line a from the right. For simplification, these inoperative movements, which are shown in broken lines on Figure 1, are not shown in Figures 2 - 5.

Similarly, when the head reaches the end of line Z, z after a mechanical jump it travels silently and in the opposite direction along half of the end line and stops at the middle thereof (not shown in the drawings) and is ready for renewed scanning by any one of the four methods.

In the previously-mentioned French Patent Specification No. 1,591,591 a marking index was provided and moved along the line of writing, always from left to right. In the present invention, the mechanically moved index is replaced by an electric sliding contact which moves over a row of contacts successively lighting a set of stationary electric bulbs constituting a light index. The contact at the middle of the row is also used to stop the head at the centre of the
As can be seen, all these methods of scanning can be obtained in an extremely simple manner under the action of a single control assembly, preferably electronic, provided only that the jump mechanism is electrically triggered.

As an additional improvement, according to the invention, two slot positions (not shown) are formed at a place on the edges of the card, or truncated regions are formed in two corners of the card as shown at 9 and 10 on Figure 6 and the apparatus comprises two probes, one for each of these corners, each probe having associated switches, which are operated by the probe, if a card fitted in the apparatus has the respective corner portion 9 or 10 still present, to prevent recording upon the upper or the lower tracks respectively, i.e. recording of fresh signals on top of, or in place, of those already recorded on these tracks, even if the controls of the apparatus are set for such recording.

If the respective corner portion 9 or 10 is removed however, the switches associated with the respective probe allow such recording on the upper or lower tracks respectively upon appropriate setting of the controls of the apparatus. Thus a card having portion 9 and 10 intact cannot be recorded on but can only be played back thus preventing accidental loss of the recording on the card. Portion 9 may prevent over-recording and erasure of the upper tracks, whereas truncated portion 10 produces the same result for the bottom tracks. Thus a card having only portion 9 removed can be erased and re-recorded only on the upper tracks while a card having only portion 10 removed can be erased and re-recorded
only on the lower tracks, whilst if the two truncated portions or slots 9 and 10 are both intact the card cannot be erased and is used for reproduction only.

It will be appreciated that it is also possible for the probes to be arranged so as to allow the respective tracks to be erased and re-recorded if the corner portions 9 and 10 are intact and so as to prevent erasure and re-recording of the respective tracks if the corner portions 9 and 10 are removed, so that a recording can be made on a card using the apparatus and can subsequently be preserved against accidental destruction by removing the respective corner portions 9 or 10.

These above noted safety features are, of course, applicable to all the methods of scanning described, but are particularly useful with the fourth method, since in this method the two tracks in each line are used separately and successively. In this case, all the required switching operations are made automatically, without intervention or using any supplementary means. For example, if a slot or truncated portion has been formed so as to prevent erasure and recording of the upper tracks but not the lower tracks and if the key or key combination producing the fourth mode of scanning is actuated together with the recording key, recording is stopped and automatically replaced by reproduction alone during the first scanning of track A, after which the device automatically changes over to recording and travels along track a, after which the conventional red light indicating recording goes out during the silent return from left to right and track B is reproduced, followed by an automatic return to recording when track b is scanned, and
so on.

For example, the device can read a sentence in a foreign language, then record the pupil pronouncing the same sentence, before moving on to the next. Alternatively it can ask a question and automatically record the reply, or any other desired combination. As can be seen the novel system is extremely rich in possible uses.

With regard to the manual control of the four methods of operation, four separate keys can be used or two keys only, one for scanning A to Z and the other for a to z, the two keys being pressed so as to reproduce the 26 lines in the third method of operation and the release of the two keys corresponding, by convention, to the fourth mode of operation.

Advantageously, in order accurately to centre the magnetic card while leaving its edges free for the previously-mentioned slots 9, 10 two additional V-shaped notches 11 and 12 are formed in the upper and lower edges 4, 5 of the card as shown in Figure 6. These supplementary notches co-operate with two centering lugs 13, 14 having a corresponding cross-section and secured to a component 15 in the form of a gripper having slightly resilient arms for taking up any clearance and exactly centering card 1 with regard both to its position and its orientation. Component 15 also slides on a rail 16 and thus acts as a slide for moving the card. Component 15 may also bear the previously-mentioned probes, which are not shown in the drawing.

Whilst, in the foregoing description, for the sake of simplicity, the scanning operations have been described as if the head moved whilst the card remained stationary, in practice it is preferred to keep the head stationary and move
the card in such a way that the relative motion of the head with respect to the card is as described in the foregoing. Alternatively, the head may move relative to the rest of the apparatus for scanning movements whilst the card moves relative to the head and the rest of the apparatus for said mechanical jumps, or the card may move for scanning movements with the head moving for said mechanical jumps.

Furthermore whilst the terms upper and lower have been used to refer to the tracks and terms such as upper, lower, top, bottom, front, back and have been used to refer to the card generally, as if the latter were disposed in a vertical plane with the tracks and lines of text extending horizontally, it will be appreciated that the card, when mounted in the apparatus, may have any convenient orientation and indeed the card preferably lies in a horizontal plane, with its front surface, i.e. the surface bearing the written text facing upwardly and the face with the magnetic coating facing downwardly, the head being disposed beneath the card.

The component 15, as in the previously-mentioned French Patent Specification No. 1,591,591 can be used for sliding the card (in scanning movements and mechanical jumps) over a stationary plate (not shown) provided only with a horizontal scanning window for the magnetic head. Advantageously also, the card when mounted in the operative position in the apparatus is covered by a transparent plate or the like. In one construction, the magnetic head 6 is mounted on a spring so that it can be resiliently pressed against the back 3 of the magnetic card, which is this raised and pressed against the underside of the transparent plate or the like. However, owing to the non-negligible weight
and inertial mass of the magnetic head, it is necessary for the force exerted by the spring to press the head against the card to be fairly high in order to maintain good contact of the head with the card, but the use of a high biasing force leads to a high rate of wear of the magnetic coating so that in practice it is necessary to adopt a compromise in which the head exerts considerable pressure on the card, which results in appreciable wear of the magnetic coating, but is still liable to be jarred away from the card by impacts to which the apparatus is subjected.

To avoid this drawback, the magnetic head is advantageously mounted with little or no resilience and the magnetic card is made intrinsically resilient in the direction perpendicular to its plane. For this purpose, the magnetic coating is disposed on the under-surface 3 of a thin polyester sheet 17 shown in Figure 7 and secured to a rigid card support 18, e.g. of cardboard, via thin compressible layer 19 of foamed plastics or of another resiliently compressible product.

Owing to this feature, the pressure of the magnetic layer 3 on the head is kept at a low value by the relatively flexible layer 19, and the inertia of the thus-moved part of the sheet is practically negligible. Consequently, the device is completely insensitive to impacts, which is very important for a portable device, and the foam 19 also absorbs all kinds of longitudinal or transverse mechanical vibrations capable of propagating in the magnetic layer as a result of the motion of head 6.
The claims defining the invention are as follows:

1. An automatic recording, reproduction and translation device of the kind using rectangular magnetic cards bearing horizontal lines of writing readable from left to right on the top and visible from above, and a magnetic coating on the back serving as a support for magnetic tracks which are scanned alternatively from left to right and from right to left by a movable magnetic head, a jump mechanism producing relative motion for the transition from a line to the next, the device being characterised in that each line of writing on the front corresponds to two recording tracks (a top track and a bottom track) on the back, each top track in a line is scanned in the opposite direction from the top track in the preceding line, and each bottom track is scanned in the opposite direction from the top track of the corresponding line, the device being actuated so as to provide a choice between four different methods of operation, the first corresponding to alternate scanning of the top tracks, the second to alternate scanning of the bottom tracks, the third to alternate scanning of a top track of one line, the bottom track of the same line, the bottom track of the next line, the top track of the aforementioned next line and so on, and the fourth corresponding to scanning a top track of a line, a bottom track of the same line, followed by an operative return to the other end of travel in order to scan the top track of the next line, the bottom track of the aforementioned next line and so on.

2. A device according to claim 1, characterised in that it
comprises a double magnetic head, the two parts of which correspond to the top tracks and the bottom tracks respectively, the jump mechanism having a pitch corresponding to a line of writing, i.e. to two tracks and being electrically actuated, the device also comprising an automatic, preferably electronic control circuit provided with a manual selection means for bringing about the first method of scanning by permanently switching the magnetic head at the top part and bringing about the mechanical jump at each end of travel by using suitable end-of-travel probes, the second method of scanning being obtained by switching in the same manner but using the bottom part of the head, the third method of scanning being obtained by bringing about the mechanical jump at each end of travel at the left and switching over from one part of the magnetic head to the other at each end of travel at the right and the fourth method of scanning being obtained by the following operation in succession, for each sequence of three ends of travel: switching alone at the first end of travel, a mechanical jump, switching and stopping the wound at the second end of travel, and restoration of sound without switching and without a jump at the third end of travel.

3. A device according to claim 2, characterised in that the lines of track are preceded by an additional line at the beginning and followed by an additional line at the end, each additional line having an imaginary top and bottom track, and the magnetic head is systematically stopped by an automatic stopping device at the centre of the additional lines at the beginning and end of each
scanning operation.

4. A device according to claim 3, characterised in that the motion of the magnetic head mechanically drives a sliding contact or a set of sliding contacts which always move in the same direction along a row of electric contacts supplying a row of electric bulbs forming a luminous marking index along the scanned line, and the contact at the middle of the two is also the detection means of the device for automatically stopping the head at the centre.

5. A device according to any of the preceding claims, of the kind comprising a probe detecting the presence, if any, of a slot or truncated portion on the edges or corners of the card for the purpose of electronic locking and inactivating the switch-over from reproduction to recording even when the manual selector is actuated, the device being characterised in that it comprises two probes adapted to co-operate with two slotted or truncated regions and separately and respectively acting on the top and bottom tracks in order to replace recording by reproduction, so as to ensure automatic alternation between the reproduction and recording phases during the third and fourth methods of scanning.

6. A device according to any one of the preceding claims, characterised in that each of the two opposite horizontal edges of the card has a substantially V-shaped centring and positioning slot co-operating with correspondingly-shaped lugs borne by substantially gripper-shaped component forming a slide for moving the card.

7. A magnetic card used as a writing, recording and
reproduction support for a device according to any one of claims 1 to 6, having a front bearing lines or positions for lines of writing readable from left to right, and a back bearing magnetic tracks or positions thereof readable alternately from left to right and from right to left, characterised in that each line of writing on the front corresponds to two magnetic tracks (a top track and a bottom track) on the back, the bottom track of each line is adapted to be travelled along in the opposite direction from the top track of the corresponding line, and the top track of each line is adapted to be travelled along in the opposite direction from the top track of the preceding line.

8. A magnetic card according to claim 7, characterised in that it is formed with at least two locking slots or truncated portions adapted to co-operate with probes for locking the two sets of tracks according to claim 3.

9. A magnetic card according to claim 7 or claim 8, characterised in that it comprises two substantially V-shaped centring slots on its top and bottom edge respectively.

10. A magnetic card according to any one of claims 7 to 9, wherein the magnetic coating is deposited on the bottom surface of a thin strong sheet secured below the rigid card support via a layer of compressible material, characterised in that the compressible material is a thin layer of expanded plastics.

11. An automatic recording and reproduction device, substantially as hereinbefore described with reference to the accompanying drawings.
12. A magnetic card substantially as hereinbefore described with reference to and as shown in Figure 7 of the accompanying drawings.

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