

PATENT SPECIFICATION

DRAWINGS ATTACHED

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Magnetic head unit.

COMPLETE SPECIFICATION

We, AKAI ELECTRIC CO., LIMITED, a Japanese Corporation, of No. 883, 3-chome, Kohjiya-cho, Ohta-ku, Tokyo, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention relates to improvements in and relating to a magnetic head unit for a magnetic tape recording and reproducing machine, hereinafter briefly called "the tape recorder" or still more briefly the "machine".

It has been already proposed to separate the conventionally employed combined audio-signal and H.F. biasing head into two respective head units so as to obtain optimum magnetic operating conditions for the both. It is further known to arrange these two separated head units in opposed, but slightly separated, relation.

With use of such conventional separated and opposed head arrangements, considerable troubles have been encountered because the audio-signal recording head is maintained in a residually energised condition upon completion of a recording operation. This disadvantageous residual energisation also occurs in a combined recording and biasing head, and, when accumulated, leads to the production of a considerable noise level during play-back. In order to erase magnetically such residual magnetization of the recording head or play-back head, so-called "head erasers" in the form of portable units have been produced. However, it is necessary for an operator of the tape recorder to keep at least one such unit to hand to carry out the erasure in the above-mentioned sense, as and when it becomes necessary. Such an additional and troublesome procedure is also highly disadvantageous.

As an alternative measure for erasing residual magnetization, it has been proposed to

provide an additional circuit employing an earthed condenser for the erasing of residual head magnetization upon completion of each recording operation. Provision of such an additional circuit complicates the electronic circuit arrangement of the machine, as well as increasing the production costs thereof.

It is therefore the main object of the invention to provide an improved magnetic head arrangement for the tape recorder, wherein the biasing head serves as a residual magnetization eraser, operating in a substantially similar manner to the erasing magnetic head.

According to the present invention there is provided a magnetic head unit for a tape recorder, comprising a deck panel, an erasing head rigidly mounted thereon, an audio-current head rigidly mounted on said panel, and a separate high frequency biasing head mounted on said panel and adapted to control said mechanical means, and switching means operatively connected with said slide for maintaining said biasing head electromagnetically energised for a predetermined period after the start of pivotal movement of said biasing head from its operative to non-operative position.

Fig. 1 is a top plan view, partially in section of essential parts of tape recorder head unit according to the present invention wherein all magnetic heads are shown in their respective non-operative positions.

Fig. 2 is a similar view to that of Fig. 1 wherein, however, the heads are shown in their respective operative positions;

Fig. 3 is a vertical sectional view of pivotal supporting means for the biasing head;

Figs. 4 to 6 are side elevational views of a mechanism for selectively stepping the vertical position of the erasing and biasing heads;

Figs. 7 to 8 are perspective views of stationary control tape guide posts;

Fig. 9 is a side elevational view of a rotary switch and its mechanically related parts which are adapted to effect switching opera-

cooperate the aforesaid heads, mechanical means mounted on said deck panel for selectively and pivotally positioning said biasing head between its non-operative position and its operative position with respect to said audio-current head, a tape drive control slide mounted on said panel and adapted to cooperate with said tape drive control

tions on various electronic and electrical means such as amplifiers, oscillators, magnetic head units and the like, in unison with the stepping mechanism of Figs. 4 to 6; and

- 5 Fig. 10A and 10B are schematic views of a slider type time delay switch which can be used in the arrangement of the invention to provide a time delay before the de-energisation of the biasing head so as to enable the
10 latter to erase accumulated residual magnetization, if any, in the audio-signal head cooperating with the biasing head.

- It is to be noted that, in the following description, the audio-signal head will be referred to as the recording head though
15 this need not be so. Now referring to the accompanying drawings, especially Figs. 1 and 2 thereof, an upper deck panel 10 of a chassis of a tape recorder is shown only in
20 part for simplification of the drawing. A conventional recording head 11 is rigidly mounted on the panel 10 which is also provided with a conventional capstan 12 and a tape guide post 13 at properly selected
25 distances from the recording head 11 along the path of a magnetic tape 40 which is shown schematically by a chain-dotted line. The capstan 12 is mounted on a vertical shaft for rotation by an electric motor suspended from the bottom surface of the deck
30 panel 10. Such drive mechanism is however well known to those skilled in the art and thus it has been omitted from the drawings.

- A high frequency biasing head 14 is provided substantially in opposition to the recording head 11. This head is pivotally movable in the plane of the panel 10, as well as movable at right angles thereto for purposes that will be described hereinafter.

- 40 An elongate strip 15 is attached fixedly to one side of the biasing head and passes freely therefrom through an opening 10a formed in the panel 10. The strip 15 is formed, at its lowermost end, with a turned flange 15a which is pivotally mounted on a support
45 plate 18 by means of a pin 16 and a sleeve 17, as shown clearly in Fig. 3. Although not shown, the sleeve 17 is integral with the plate 18, and the plate 18 is adjustably attached to a carrier 19 by means of two attaching
50 screws. The carrier 19 can be selectively stepped to occupy a position parallel to and beneath the panel 10 as will be described in greater detail hereinafter.

- 55 An erasing head 21 is fixedly attached by one side surface thereof to a strip 22 similar to strip 15. The strip 22 passes freely through a further opening 10b formed in panel 10, and is provided at one end with a turned flange which is fixedly attached to carrier 19
60 by means of a plurality of fixing screws 23, only one of the latter being shown in Fig. 4. Several pin-and-slot type sliding guide means are provided for steppingly controlling the
65 position of carrier 19, of which means, how-

ever, only a pin 24 is shown (in Figs. 4 to 6), representative of said sliding guide means, to avoid possible confusion of the drawings.

An operating member 25 made in the form of a slide which is slidably guided in openings 26a and 27a formed in vertical walls 26 and 27 of a small frame detachably mounted on panel 10. The slide 25 is shiftable from its non-operative position (as shown in Fig. 1), to its operative position (as shown in Fig. 2) upon manual actuation of a control means such as playing—or recording push button. Such control means are highly conventional so that these have been omitted from the drawings. Upon the control means being released, the slide 25 will return automatically to its initial position (as shown in Fig. 1) under the action of a spring 28.

A lever 29 is pivotally mounted on panel 10 by means of a pin 30 studded thereto. A conventional pressure roller 31 adapted to cooperate with the capstan 12, is rotatably mounted on the lever 29. The free end 29a of the lever 29 is maintained in pressure contact with a stop 33 formed integrally on the slide 25, under the influence of a spring 32 so as to maintain the pressure roller 31 separated from the capstan 12. When the slide 25 is advanced in the *aforementioned* way, the lever 29 is rotated under the spring action so as to bring the pressure roller 31 into contact with the capstan 12 (as shown in Fig. 2). At one end of slide 25, there is provided a tape guide pin 36 studded to the slide 25. A further lever 34 is pivotally mounted at 35 on panel 10 and an angle member 37 is rigidly attached to the lever 34 by means of set screws. A spring strip 38 is resiliently mounted on the angle member 37 and carries a fixedly mounted pressure and wiper pad 39 for urging resiliently the tape 40 against the erasing head 21 when the lever 34 is brought into its operative position (as shown in Fig. 2). A tape guide pin 41 similar to that denoted 36 is fixedly mounted on the lever 34. At a corner of the lever 34, there is provided a slot 42 which receives a pin 43 fixedly attached to the free end of an arm 44 extending laterally from the slide 25. Arm 44 is fixedly attached to a spring strip 45 provided with a stop 46 fixedly mounted thereon. This stop 46 is adapted to cooperate with the side edge of a plate 49 which is fixedly attached on the side surface of the biasing head 14 remote from the attached strip 15.

When the slide 25 is caused to move to its operating position (as shown in Fig. 2), the spring strip 45 advances correspondingly, and thus motion is transmitted therefrom through the engagement between stop 46 and plate 47 to the head 14 which is thereby caused to pivot in the clockwise direction (as seen in Fig. 1), into its operative position in opposition to, yet separated a small distance



aforementioned

from, the recording head 11 (as shown in Fig. 2). The desired relative operative position between the both heads 11 and 14 is positively determined by the engagement of plate 47 with a stationary, yet adjustable stop 52. For this purpose, the stop is attached to a stationary tape guide post 51 studded onto the panel 10. A set screw 53 is screwed through a slot 51a formed in the post into the stop 52 which is thus adjustably positioned about a pivot screw 100, (as shown in Fig. 7).

When the slide 25 returns by spring action, in the aforementioned way, a return spring 48 mounted around sleeve 17 (Fig. 3) acts to urge the biasing head 14 to swivel in the clockwise direction (as seen from Fig. 2), thereby bringing the head resiliently into its non-operative position (as shown in Fig. 1). This non-operative position is positively maintained by the engagement of plate 47 with stop 46.

A tape guide post 49 is studded onto the panel 10 so as to guide the tape 40 at a leading position along the travel thereof. This post 49 is so positioned that, when seen in the direction of the tape travel, it occupies substantially an opposed position to the final tape guide post 13, and at the same time an outward position being separated from erasing head 21. An intermediate tape guide post 50 has a general configuration as shown in Fig. 8 and is mounted on panel 10 close to the recording head 11 and to the leading side thereof in the direction of the tape travel passage. The post 50 and the post 51 are symmetrically located with respect to the recording head 11.

A knob 54, (schematically shown in Figs. 4 and 5), is provided for positioning both heads 14 and 21 in a stepwise selected vertical position so as to carry out a multi-track recording or play-back operation, as the case may be. Under the term "multi-track operation" employed herein, the stereophonic recording or reproducing operation is also included, as commonly known to those skilled in the art. The said knob 54 is rigidly attached to a vertical shaft 55 at its uppermost end, the shaft 55 extending vertically downwardly from the knob 54. It passes rotatably through panel 10 and is provided with a segmental gear 56 and an integral three stepped-face cam 57 rigidly mounted thereon. A guide sleeve 58 is rigidly mounted on panel 10 and slidably receives a pin 59 which also passes slidably through a panel 10. A spring 60 is tensioned between pin 59 and panel 10 so as to urge the pin 59 to move towards any selected step on the cam 57. For obtaining a smooth engagement with the cam 57, the pin 59 is formed, at its free end, with a spherical contact surface. The carrier 19 is fixedly attached to the slide pin in the neighbour-

hood of the lowermost end thereof.

When the knob 54 is turned manually so as to bring the free end of pin 59 into pressure contact with operating step face 57a of the cam 57, the heads 14 and 21 are moved into their upper operating positions. In a similar way, when the knob 57 is manipulated to bring the pin 59 into engagement with cam step face 57b both heads 14, 21, are moved into their intermediate operating positions (Fig. 5). Finally, when the knob 54 is manipulated so that the follower pin 59 is brought into engagement with cam step face 57c (Fig. 6), both heads are moved into their lower operating positions.

Upon manual turning of the knob 54, shaft 55 and its segmental gear 56 will be rotated so as to turn a meshing segmental gear 61 correspondingly. A shaft 62 (shown in Figs. 5, 6 and 9), is fixed to the segmental gear 61 and thus rotates in unison therewith. A multiple rotary switch 63 has its movable parts rigidly connected with the shaft 62 at one end thereof, while the stationary switching elements are suspended from the panel 10 by means of a supporting arm 101 (Fig. 9). Thus, upon rotation of shaft 62, the switch 63 is switched to a properly selected stage so as to control the electronic elements in the tape recorder. It is however, commonly known to any skilled person in the art to provide such rotary switching means, and since such means do not constitute any part of the invention, the details of the switch have been omitted from the drawings.

When the tape recorder operates, the tape 40 is caused to travel from left to right (as seen in Figs. 1 and 2).

In the preparatory stage, the tape 40 is inserted into a mouth 51b formed in the intermediate guide post 51 and the correspondingly separated zones of the tape are passed round the guide posts 13 and 49. It will be clear from the foregoing that the necessary tape-threading operation is thus highly simple and trouble-free. Thereafter, the tape 40 occupies a somewhat wavy position slightly deviated from the schematic representation shown by the chain-dotted line 40 in Fig. 1.

When the tape drive control means such as a playing and/or recording control push button is manipulated to advance the slide 25 to its forward position, pressure roller 31 and biasing head 14 are brought into their operating position, as was described hereinbefore, and simultaneously, tape guide posts 36 and 41 are also caused to advance to their operating position. In addition, pad 39 is brought into pressure engagement with the operative surface of erasing head 21, through the intermediary of tape 40, under the action of spring 38.

Under such preparatory conditions, when current is fed to the machine from a suitable

power source, not shown, upon switching a main switch means to "on", a recording or reproducing operation may be initiated. It is noted, however, that in the case of the reproducing operation of the machine the biasing head is electrically de-energised by means of a further switching means, not shown, in a conventional manner.

In the above-mentioned preparatory step, tape 40 is caused to advance to the bottom wall 51c of the guide post 51 and maintained in slidable contact therewith. In this way, unintentional disengagement of the tape 4 from the guide post 51 can be positively prevented and in addition an accurate and desired positioning of the tape 40 may be assured. As most clearly seen from Fig. 1, the tape has been threaded in an undulating manner, and a correct back tension may be provided to the running tape when the machine operates.

When the slide 25 is released and caused to return to its retired, non-operative position automatically by means of spring 28 and the related parts, except those to be operated upon by knob 54, are caused to go back to their initial position shown in Fig. 1, the biasing magnetic fluxes emanating from the head 14 will act upon the recording head 11, which may be a combined recording and play-back head while the biasing head is caused, in this case, to recede from the recording head, as if the high frequency field were being gradually weakened away, although the energising current is in practice not diminished. This phenomenon may be compared definitely with the conventional function of an eraser head for erasing recorded information on a magnetic tape. Thus, possible accumulation of residual magnetization in the recording or play-back, or combined head, may be effectively erased without using a separate conventional portable erasing unit.

It is thus clear that, with use of the present unique and novel magnetic head arrangement, the next recording play-back operation can be initiated using an optimum magnetic condition of the recording or play-back head, or the combined head, as the case may be.

For the realization of the above-mentioned mechanoelectric erasing action, it is preferable, as shown schematically and by way of example in Figs. 10A and 10B, to provide stationary contacts 71 and 72 in an electric circuit connecting the biasing head 14 and a conventional oscillator 70 of the tape recorder, and a movable contact 73 adapted to cooperate therewith. The contact 73 is so arranged that it is movable in unison with conventional tape drive control means such as operating slide 25 or any suitable member operatively connected therewith. Fig. 10A shows an operating condition corresponding

to the working condition of the both heads 11 and 14, wherein the both are brought into their opposed operative relative positions. In this case, head 14 is also energised by a high frequency current fed from oscillator 70. Now assumed that slide 25 is released and thus recedes, movable contact 73 is caused thereby to move from right to left, as seen in the Figure, to an intermediate point of its movement, as shown in Fig. 10B, so as to break the contacts 71 and 72. Thus, the break incorporates a properly selected time lag counted from the initiation of return movement of slide 25. In this way, the aforementioned erasing effect can be positively obtained. Instead of the slide switch above described, a rotary switch may be employed with equal results. Or instead, a conventional limit switch, a time lag relay or the like may be employed so as to obtain the same results in an electrical way. Although not shown, it is natural that at the commencement of return movement of the biasing head, the recording head 14 is electrically shut off by means of a conventional switch.

Although only one embodiment of the invention has been illustrated in the accompanying drawings and described in the foregoing specification, it is to be expressly understood that the invention is not limited thereto in any way. Various changes may also be made in the design and arrangement of the parts without departing from the scope of the invention as defined in the appended claims.

WHAT WE CLAIM IS:

1. A magnetic head unit for a tape recorder, comprising a deck panel, an erasing head rigidly mounted thereon, an audio-current head rigidly mounted on said panel, and a separate high frequency biasing head mounted on said panel and adapted to cooperate the aforesaid heads, mechanical means mounted on said deck panel for selectively and pivotally positioning said biasing head between its non-operative position and its operative position with respect to said audio-current head, a tape drive control slide mounted on said panel and adapted to control said mechanical means, and switching means operatively connected with said slide for maintaining said biasing head electromagnetically energised for a predetermined period after the start of pivotal movement of said biasing head from its operative to non-operative position.

2. A magnetic head unit as claimed in claim 1, wherein shiftable tape guide means are provided which are rigidly mounted on said mechanical means for cooperation with a plurality of stationary tape guide means rigidly mounted on said panel for defining a non-linear path for a magnetic tape in the arrangement.

power source, not shown, upon switching a main switch means to "on", a recording or reproducing operation may be initiated. It is noted, however, that in the case of the reproducing operation of the machine the biasing head is electrically de-energised by means of a further switching means, not shown, in a conventional manner.

In the above-mentioned preparatory step, tape 40 is caused to advance to the bottom wall 51c of the guide post 51 and maintained in slidable contact therewith. In this way, unintentional disengagement of the tape 4 from the guide post 51 can be positively prevented and in addition an accurate and desired positioning of the tape 40 may be assured. As most clearly seen from Fig. 1, the tape has been threaded in an undulating manner, and a correct back tension may be provided to the running tape when the machine operates.

When the slide 25 is released and caused to return to its retired, non-operative position automatically by means of spring 28 and the related parts, except those to be operated upon by knob 54, are caused to go back to their initial position shown in Fig. 1, the biasing magnetic fluxes emanating from the head 14 will act upon the recording head 11, which may be a combined recording and play-back head while the biasing head is caused, in this case, to recede from the recording head, as if the high frequency field were being gradually weakened away, although the energising current is in practice not diminished. This phenomenon may be compared definitely with the conventional function of an eraser head for erasing recorded information on a magnetic tape. Thus, possible accumulation of residual magnetization in the recording or play-back, or combined head, may be effectively erased without using a separate conventional portable erasing unit.

It is thus clear that, with use of the present unique and novel magnetic head arrangement, the next recording play-back operation can be initiated using an optimum magnetic condition of the recording or play-back head, or the combined head, as the case may be.

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to the working condition of the both heads 11 and 14, wherein the both are brought into their opposed operative relative positions. In this case, head 14 is also energised by a high frequency current fed from oscillator 70. Now assumed that slide 25 is released and thus recedes, movable contact 73 is caused thereby to move from right to left, as seen in the Figure, to an intermediate point of its movement, as shown in Fig. 10B, so as to break the contacts 71 and 72. Thus, the break incorporates a properly selected time lag counted from the initiation of return movement of slide 25. In this way, the aforementioned erasing effect can be positively obtained. Instead of the slide switch above described, a rotary switch may be employed with equal results. Or instead, a conventional limit switch, a time lag relay or the like may be employed so as to obtain the same results in an electrical way. Although not shown, it is natural that at the commencement of return movement of the biasing head, the recording head 14 is electrically shut off by means of a conventional switch.

Although only one embodiment of the invention has been illustrated in the accompanying drawings and described in the foregoing specification, it is to be expressly understood that the invention is not limited thereto in any way. Various changes may also be made in the design and arrangement of the parts without departing from the scope of the invention as defined in the appended claims.

WHAT WE CLAIM IS:

1. A magnetic head unit for a tape recorder, comprising a deck panel, an erasing head rigidly mounted thereon, an audio-current head rigidly mounted on said panel, and a separate high frequency biasing head mounted on said panel and adapted to cooperate the aforesaid heads, mechanical means mounted on said deck panel for selectively and pivotally positioning said biasing head between its non-operative position and its operative position with respect to said audio-current head, a tape drive control slide mounted on said panel and adapted to control said mechanical means, and switching means operatively connected with said slide for maintaining said biasing head electromagnetically energised for a predetermined period after the start of pivotal movement of said biasing head from its operative to non-operative position.

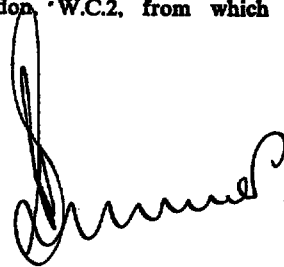
2. A magnetic head unit as claimed in claim 1, wherein shiftable tape guide means are provided which are rigidly mounted on said mechanical means for cooperation with a plurality of stationary tape guide means rigidly mounted on said panel for defining a non-linear path for a magnetic tape in the arrangement.



3. A magnetic head unit as claimed in Claim 2, wherein said shiftable tape guide means comprise guide posts adapted to move in unison with said biasing head.
- 5 4. A magnetic head unit as claimed in any preceding claim, wherein a pad is mounted shiftable on said panel, said pad being shiftable in unison with movement of said biasing head to move between a non-
10 operative position and an operative position with respect to said erasing head.
5. A magnetic head unit as claimed in any preceding claim, including a manual knob, a shaft attached fixedly thereto and
15 mounted turnably on said panel, a stepped cam fixedly connected to said knob shaft, a follower pin slidably mounted on said panel and maintained in engagement with stepped cam surfaces on said cam, said follower pin
20 being operatively connected with said mechanical means for selectively relatively positioning said erasing head and said biasing head.
6. A magnetic head unit as claimed in
25 claim 5, wherein switching means are mounted on said knob shaft for switching conventional electronic components in said tape recorder in unison with movement of said biasing head.
- 30 7. A magnetic head unit as claimed in any preceding claim, including a rotatable capstan and a pressure roller, adapted to co-operate therewith, said roller being pivotally mounted on said panel and arranged to move
35 in unison with said biasing head.
8. A magnetic tape recorder including a magnetic head unit as claimed in any preceding claim.
9. A magnetic head unit for a magnetic tape recorder constructed substantially as described hereinbefore with reference to and as illustrated in the accompanying drawings.
10. A magnetic tape recorder constructed substantially as described hereinbefore with reference to and as illustrated in the accom- 45
panying drawings.

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