PATENT SPECIFICATION (11) 1 587 229

1 587 229

(21) Application No. 25429/77 (22) Filed 17 Jun 1977

(31) Convention Application No. 7606690 (32) Filed 21 Jun 1976 (19) in

(33) Netherlands (NL)

(44) Complete Specification Published 1 Apr 1981

(51) INT. CL.³ G11B 5/54 5/008 15/66 23/08

(52) Index at Acceptance
G5R B264 B345 B37Y B38Y B421 B435
B441 B443 B451 B474 B475 B476
B481 B483 B488 B512 B513 B682
B685 B83A KE

(54) APPARATUS FOR RECORDING AND/OR PLAYING BACK SIGNALS ON A MAGNETIC TAPE CONTAINED IN A CASSETTE

(71) We, N.V. PHILIPS' GLOEILAMPENFABRIEKEN, a limited liability Company, organised and established under the laws of the Kingdom of the Netherlands, of Emmasingel 29, Eindhoven, the Netherlands, 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 inand by the following statement:—

The invention relates to an apparatus for recording and/or playing back signals on a magnetic tape which is contained in a cassette, the apparatus comprising a housing, a magnetic-head unit which is movable relative to the housing and which comprises a magnetic recording and/or play back head mounted on a head support i.e. which is movable between an operating position in which the magnetic head can co-operate with a magnetic tape in a cassette supported in an operative position on the apparatus, and a retracted position in which a cassette can be placed on the apparatus or removed therefrom without being impeded by the magnetic head, and cassette-supporting means for defining the operative position of the cassette on the apparatus.

According to the present invention there is provided an apparatus for recording and/or playing back signals on a magnetic tape which is contained in a cassette, the apparatus comprising a housing, a magnetic head unit which is movable relative to the housing and which comprises a magnetic recording and/or play back head mounted on a head support which is movable in a first direction between an operating position in which the magnetic head can co-operate with a magnetic tape in a cassette supported in an operative position on the apparatus, and a retracted position in which a cassette can be placed on the apparatus or removed therefrom without being impeded by the magnetic head, and cassette-supporting means for defining the operative position of the cassette on the apparatus, the head support also being movable in the retracted position in a second direction extending transversely of the first direction into a locked position, locking means being provided for locking the head support in this locked retracted position, and unlocking means being provided for releasing the head support from its locked position, which unlocking means comprise a movable unlocking member which is arranged to be actuated by a cassette upon movement of the cassette into its operative position.

The cassette-supporting means may comprise movable supporting means whose position during operation is determined by the magnetic-head unit so that the operative position of a cassette on the apparatus is at least partly determined by the position of the magnetic-head unit.

The movable cassette-supporting means may be arranged to function also as the movable unlocking member.

As it is generally undesirable to subject the recording and/or play back head to a mechanical load, an embodiment of the invention is usually preferred in which the position of the movable cassette-supporting means is determined by the position of the head support. This component is better able, or can be made better able, to withstand external loads.

In order to avoid the use of additional components it is of advantage if the movable cassette-supporting means are disposed on the head support itself. This means that the movable cassette-supporting means also perform the movements of the head support towards the cassette and away from the cassette. For the sake of simplicity the movable cassette-supporting means are preferably rigidly connected to the head support.

All the cassette-supporting means can be made to move with the magnetic head unit. However, it is alternatively possible, and in many cases very probably adequate, to have at least a part of the cassette-supporting means stationary and another part movable. The

stationary cassette-supporting means may be located on a base plate of a deck mechanism or on the housing of the apparatus. In a preferred embodiment of the invention the movable cassette-supporting means are rigidly connected to the head support and consist of a single cassette-support in the immediate vicinity of the magnetic head. An accurate positioning of a cassette can be obtained if the stationary cassette-supporting means consist of two stationary cassette-supports, and if a cassette in its operative position rests on only the single movable cassette-support and the two stationary cassette-supports. During operation the cassette is consequently supported at three points. Two of these points are located on a stationary base plate or on the housing of the apparatus, whilst the third supporting point is rigidly connected to the head support, namely in the immediate vicinity of the recording and/or play back head. The principal parameter for a correct co-operation between this head and the magnetic tape, namely the mutual height position, is thus accurately defined during operation.

In cassette equipment in which in addition to movable also stationary cassette-supporting means are provided, further steps may be applied which serve to define the position of the magnetic head unit relative to the stationary cassette-supporting means, at least in the operating condition. In one embodiment of the invention stationary stop means may be provided with which the magnetic-head unit co-operates in the operating position so as to define the position of the magnetic-head and of the movable cassette-supporting means relative to the stationary cassette-supporting means during operation. The advantage of this embodiment over conventional deck mechanisms which constantly, *i.e.* also when inoperative, aim at an accurate positioning of the magnetic-head unit relative to fixed cassette-supporting means by means of an accurate guidance for the head support, resides in the fact that a comparatively simple and not very accurate guidance for the head support may be used. Only when the operating position is reached is a correct positioning effected by means of a number of stops. In view of the objections to subjecting the magnetic-head itself to a mechanical load, it is also preferred to have the stationary stop means co-operate with the head support in the operating position.

There is cassette equipment available which has no finger-actuated button or similar actuating element for rendering the equipment operative but which can be put into operation by exerting manual pressure on a cassette which has been placed on the apparatus. Such equipment is in particular made for use in the motor cars, where the operation should demand a minimum of manipulation by the driver. The known equipment comprises first resilient means which load the head support towards its operating position, actuating means for manually moving the head support against the action of the first resilient means from the operating position to the retracted position, locking means for locking the head support in its retracted position, and unlocking means for unlocking the head support from its locked position and comprising second resilient means and a movable unlocking member which is loaded thereby and which is adapted to co-operate with a cassette upon the exertion of manual pressure on the cassette. In the known cassette equipment of this type the locking means comprise a small pin which projects upwards through the base of the apparatus. When, after placing a cassette on the apparatus, pressure is exerted on the front of the cassette, *i.e.* on the side near the magnetic-heads, the head support is released from its locked position and moves to its operating position under the influence of the first resilient means. The apparatus is switched off by pressing with the hand on two interlocked push-buttons which are disposed one on each side of the apparatus, so that the head support is returned to its retracted position and at the same time the said pin moves upwards again and pushes the cassette upwards. In a preferred embodiment of the invention the movable cassette-supporting means are arranged to function also as the movable unlocking member. Thus, an entirely new class of cassette equipment is available, in which an accurate positioning of the cassette relative to the magnetic-head is guaranteed, even in the absence of an accurate guidance of the movements of the magnetic-head support, whilst furthermore the apparatus, as in the known cassette equipment designed for use in motor cars, can be switched on with the aid of the cassette itself by giving at least one of the cassette-supporting means a double function, so that this means, in addition to supporting the cassette, may also serve for unlocking the head support and bringing it into its operating position. Thus, a separate actuating member for switching-on the apparatus may be dispensed with.

In an embodiment of the invention which comprises first resilient means which load the head support towards its operating position, manually operable actuating means for moving the head support against the action of the first resilient means from the operating position to the retracted position, and second resilient means which load the head support towards its locked position, the locking means may comprise movable locking means which are connected to the head support and which are arranged to co-operate under the influence of the first and second resilient means with stationary locking means which are connected to the housing.

A pivot bearing arrangement with play may be provided for the head support, the pivot bearing arrangement enabling said support to pivot about a first axis between the operating position and the retracted position and in the latter position to pivot into and out of the

locked position about a second axis which extends transversely of the first axis. From the point of view of production it is simple to manufacture a bearing arrangement having play. Such bearing arrangements are generally regarded as bearing arrangements of poor quality. However, such a very simple bearing arrangement may be utilized successfully in an apparatus according to the invention.

In an embodiment of the invention in which the housing comprises a plurality of housing sections, both the stationary cassette-supporting means and the stationary stop means for the head support may be integral with one of the housing sections. The advantage of this is that the position of the said supporting means and the stop means relative to each other is determined by dimensional tolerances in one single part only which, if the housing is made of a plastic material, can be manufactured integrally by means of an injection-moulding process. This greatly improves the accuracy of the positioning of the supporting means and the stop means relative to each other without appreciably affecting the cost price. This is because injection moulds are manufactured with a high precision. The said housing section may comprise a cassette compartment with a bottom in which an opening is formed through which the movable cassette-supporting means project into the compartment, and the stationary stop means and the stationary cassette-supporting means may be located on opposite sides of the wall of said housing section. This will ensure that the stop means and the cassette-supporting means are suitably positioned relative to each other in the case of an apparatus with a plastic housing in which the cassette deck mechanism is located completely inside the housing and the cassette can be placed in a cassette compartment.

An embodiment of the invention will now be described in more detail with reference to the accompanying drawings, in which:—

Figure 1 is a perspective view of a small portable cassette recorder with an associated cassette and having a divided housing consisting of an upper section and a lower section,

Figure 2 is an exploded perspective view of the underside of the upper section of the housing of the cassette recorder of Figure 1,

Figure 3 is a view similar to Figure 2 but showing a recording switching member in a recording position,

Figure 4 is another view similar to Figure 2 but with some parts omitted, and

Figure 5 is a perspective view of a magnetic-head unit of the cassette recorder of Figure 1.

In the various Figures corresponding parts are denoted by corresponding reference numerals.

The cassette recorder shown in the drawings comprises a housing with two housing sections 1 and 2 which are each integrally formed from a plastics material. A magnetic-head unit 3 (see in particular Figure 5) is movable relative to this housing. This unit comprises a magnetic-head 4 for recording and play back an erase head 5 for erasing signals. The magnetic-heads are mounted on a head support 6 which is movable between an operating position in which the magnetic-heads 4 and 5 can co-operate with a magnetic tape in a magnetic tape cassette 7 and a retracted position in which the cassette 7 can be placed on the recorder or can be removed therefrom without being impeded by the magnetic-heads 4 and 5. Cassette-supporting means which during operation support the cassette 7 which has been placed on the apparatus for defining the position of the cassette relative to the magnetic-heads 4 and 5 are described in more detail hereinafter.

A part of the cassette-supporting means is formed by movable supporting means whose position during operation is determined by the magnetic-head unit 3, so that the position of the cassette 7 relative to the magentic-heads 4 and 5 during operation is at least partly determined by the position of the magnetic-head unit 3. The movable cassette-supporting means consist of a single movable cassette support 8 which is rigidly connected to the head support 6. This support is located in the immediate vicinity of the recording/play back head 4 which serves for playing back and recording signals. A stationary part of the cassette-supporting means comprises two stationary cassette supports 9. During operation the cassette 7 bears only on the movable cassette-support 8 and the two stationary cassette-supports 9.

In Figures 2 and 3 the magnetic-head unit 3 is shown in its operating position. In Figure 1 the magentic-head unit is shown in its retracted position. The head support 6 is continuously loaded towards its operating position by a compression spring 11, shown in Figure 4. This spring, which is not shown in the other Figures, bears against a wall of the housing section 1 with one end and against the rear of a pressure-roller lever 12 (see Figure 5) with its other end. The pressure-roller lever carries a pressure-roller 13 and is connected to the head support 6 by means of an integral hinge in the form of a flexible web 14, and an end portion 15 which is firmly pressed into a recess in a projection 16 of the head support 6. The pressure-roller lever 12 is entirely made of a plastics material and is provided with a tab 17 which, when the head support is moved out of its operating position, co-operates with a pin 18 on the head support 6. The pressure of the spring 11 is then transmitted to the head support *inter alia via* the lever 12 and the pin 18. The head support can manually be moved from its operating position to its retracted position by means of push-button 19 which is movable through an opening 20 in the housing section 2. The head support 6 together with the movable cassette support 8 and the button 19 is a part which is integrally manufactured from a plastics material. On thus unitary assembly only the pressure-roller lever 12 with its pressure-roller 13 and the two magnetic-heads

4 and 5 need be mounted as separate components.

In the retracted position, *i.e.* the position shown in Figure 1, the magentic-head support 6 is locked. For this purpose locking means are provided which consist of movable locking means 21 which are connected to the head support, and stationary locking means which co-operate therewith and which are connected to the housing section 1. These stationary locking means consist of an edge of the housing section, which edge bears the reference numeral 22 in Figure 4. The co-operation of these locking means will be further discussed hereinafter.

For loading the head support 6 towards its locked position resilient means in the form of a leaf-spring 23 are provided, which leaf spring is pressed into a mount 24 which is integral with the housing section 1. For unlocking purposes an unlocking member is provided which is adapted to co-operate with the cassette 7 upon exertion of manual pressure on the cassette; this unlocking member is formed by the movable cassette support 8, which has a dual function, namely as a cassette support and as an unlocking member.

In its retracted position the head support 6 is movable between an unlocked position and a locked position. The magnetic-head unit 3 is thus movable in two different directions: first between its operating position and its retracted position, and secondly, when in its retracted position, between an unlocked and a locked position. These movements can be performed by means of a pivot bearing arrangement which comprises a bearing pin 25 (see Figure 4) and a projection 27 of the head support 6, in which projection a corresponding bore 26 is formed. These are not visible in Figures 1, 2 and 3. The bore 26 is so large that there is play between the bearing pin 25 and the projection 27. By means of the push-button 19 the complete magnetic-head unit 3 is pivotable about the bearing pin 25 between its operating position shown in Figure 2 and 3 and the retracted position. In the latter position the magnetic-head unit, because of the play of the pivot bearing arrangement, is tiltable about an axis extending transversely of the axis of the bearing pin 25, locking being effected by the locking member 21 engaging behind the edge 22 under the influence of the leaf spring 23. This locking member 21 is formed by the free end of a projecting portion of the head support 6 which bears the reference numeral 28. In addition to the member 21 a second member 29 is located on this projection 28, which member is disposed at a slightly different level to the member 21 and projects slightly beyond this member, as well as a roller 30 which is rotatable in the projection 28. Owing to the difference in level between the members 21 and 29 the head support 6 in its retracted position is pressed slightly downwards (as viewed in Figures 2 and 3) by the leaf spring 23, so that the member 21 locks behind the edge 22.

The head support 6 is a two-armed, substantially L-shaped lever. One arm has the reference numeral 31, the other arm the reference numeral 32. On the arm 31 the magnetic-heads 4 and 5 are mounted, whilst the push-button 19 is located at the free end of the arm 32. The pivot bearing arrangement, comprising the bearing pin 25 and the projection 27 which is pivotable on said pin, is disposed near the junction between the two arms 31 and 32. Under the influence of the leaf spring 23 the arms 31 and 32 of the head support 6 co-operate with three stationary stops which have the reference numerals 33, 34 and 35 (see in particular Figure 4). The stationary stop 33 co-operates with the lever 6 near the free end of the arm 31 thereof when the lever 6 is in the unlocked position. The stationary stop 34 co-operates with the lever near the free end of the arm 32 and the stop 35 co-operates with the lever near the junction between the two arms 31 and 32, *i.e.* near the bearing pin 25. With the aid of these three stops an excellent guidance of the head support is assured. During movements between the operating position and the retracted position the locking member 21 slides over the stop 33, whilst the arm 32 slides over the stops 34 and 35 at its two ends. When the head support has arrived in its retracted position the locking member 21 slides over the edge 22 and is latched behind the edge 22. The arm 31 then bears on the stop 33 with the member 29. Unlatching, as previously stated, can be effected by pressing down with the cassette on the cassette support 8 (see Figure 1), so that the locking member 21 is released from the edge 22 and the head lever 6 can be returned to its operating position by the spring 11.

For the accurate positioning of the magentic-head unit 3 relative to the cassette 7 it is of importance that both the stationary cassette supports 9 and the stationary stops 33 to 35 for the head support are integral with the housing section 1. This housing section comprises a cassette compartment in the form of a well 36 (Figure 1) with a bottom 37 in which a slot 38 is formed for the movable cassette support 8. The stationary stops 33 to 35 for the head support 6 and the stationary cassette supports 9 are located on opposite sides of the bottom wall 37 of the cassette compartment 36.

In the operating position the position of the magnetic-heads 4 and 5 and the movable cassette support 8 relative to the stationary cassette supports 9 is exactly defined by stationary stop means. These means comprise the two stops 34 and 35 with which the arm 32 of the head support 6 always co-operates, the locking member 21 and the stop surface 33, as well as a member which forms part of the head support and bears the reference numeral 39, which member engages with a stop 40 of the housing section 1. The leaf spring 23 presses the head support 6 against the stops 33, 34 and 35, and also, as will

be explained hereinafter under "Playback", the member 39 against the stop 40.

The portable cassette recorder shown in the drawing is suitable for playing back from and recording on the tape of a Compact Cassettes. In the case of a pre-recorded cassette on which a programme has been recorded which should not be erased, erasure of the pre-recorded programme and recording a new programme is prevented automatically by the removal of break-out portions 92 from the rear wall of the cassette. The cassette recorder is equipped with a provision for fast rewinding of the magnetic tape and for temporarily stopping the tape transport during recording or playback. Furthermore, the recorder is equipped with a so-called "quick-repeat" facility. Such a facility is of particular interest for portable cassette recorders in order to enable the user to rapidly check whether during recording the signal is actually recorded on the tape. Larger cassette recorders generally feature a pointer instrument for this purpose, but this may be a drawback in the case of portable cassette recorders, in particular when these are cheap and small cassette recorders.

For these provisions, in addition to the previously described components, further components are provided which are now described.

For driving the winding hubs in the cassette the recorder comprises an electric motor 41 with a pulley 42 on its spindle. The winding hubs 43 and 44 of the cassette 7 can co-operate with two reel spindles 45 and 46 of the recorder. The reel spindle 45 is integral with a disc 47 (Figure 1) and a gear-wheel 48 and the reel spindle 46 with a disc 49 and a gear-wheel 50. In the bottom 37 of the cassette compartment 36 local cylindrical recesses or wells 51 and 52 are formed which accommodate the assembly consisting of the reel spindle 45, the disc 47 and the gear-wheel 48, and the assembly consisting of the reel spindle 46, the disc 49 and the gear-wheel 50, respectively (see Figure 2 to 4). These local recesses or wells will be referred to hereinafter as casings 51 and 52 for the gear-wheels 48 and 50. On the bottoms of these casings, which are integral with the plastics housing section 1, journals (not shown) are integrally formed, onto which journals the gear-wheels 48 and 50 with their associated discs and reel spindles are fitted and retained in a suitable manner. Through local openings in the cylindrical walls of the casings 51 and 52 the gear-wheels 48 and 50 can mesh with other gear-wheels at the side of the housing section 1, as shown in Figures 2 to 4. For transmitting the drive from the motor 41, three further gear-wheels are provided, namely a gear-wheel 53, a gear-wheel 54 and an intermediate gear-wheel 55. The gear-wheel 53 is integral with a pulley 56. The two gear-wheels 53 and 54 and the pulley 56 are rotatably journalled on a spindle 57 which is disposed on a movable bracket 58. This bracket is also completely made of a plastics material and the spindle 57 is integral with it. It is obvious that, if desired, the spindle may be made of metal and for example pressed into the bracket. The parts fitted on the spindle are axially retained by suitable means such as a retaining ring on a projecting portion of the spindle 57. This is not visible in the drawing.

Between the gear-wheel 54 and the assembly consisting of the gear-wheel 53 and the pulley 56 a friction coupling is disposed. This also is not visible in the drawing. Such couplings, however, are generally used in cassette recorders and are known in numerous versions. Usually the comprise a friction disc with a felt friction surface and a spring for pressing the friction surface against a surface which moves relative thereto. The purpose of the friction coupling is to produce a substantially speed-independent torque at the reel spindle 45 for winding the magnetic tape onto the hub 43 during recording or playback.

The bracket 58, together with the parts already mentioned and subsequently to be mentioned which are mounted on or are integral with it, constitutes a bodily movable drive unit, which bears the general reference numeral 59. At one of its ends the bracket 58 comprises a push-button 60 for the movement of the drive unit 59. This button is located next to the push-button 19 in the opening 20 in the housing section.

In the assembled condition the unit 59 contacts the housing section 1 at three points, namely at the location of a guide face 61, at the location of an edge 62 which is at the same level as the stop 34 for the head support 6, and finally at the location of the bottom wall 63 of the casing 52 of the gear-wheel 50, which wall faces the interior of the housing. On this wall a bridge 64 with an opening 65 is disposed, which bridge is integral with said wall. The bracket 58 has a guide pin 66 which fits the opening 65. In the assembled condition the guide pin 66 is partly disposed in the opening 65 and furthermore bears against the wall 63. The button 60 bears against the wall 62 and a guide portion 67 which is formed on the bracket 58 bears against the guide surface 61.

A guide member 68 which is integral with the housing section 1 projects at its free end through a slot 69 in the bracket 58. The guide member 68 comprises a projecting tab 70 for retaining the end of a U-shaped leaf spring 71 which is fitted behind the button 60. Owing to the deformation to which this leaf spring is subjected during mounting of the drive unit 59, the drive unit is loaded by the spring in such a way that the button 60, in the absence of an actuation force which is exerted by the user, is always in the position shown in Figure 1. Moreover, the entire drive unit is pressed by the spring 71 against the guide surfaces 61, 62 and 63.

The bracket 58 also comprises a retaining lug 72 which keeps the intermediate gear-wheel

55 in position on a pin 73 which is integral with the housing section 1 and on which the gear-wheel 55 can rotate.

The drive means also include a pulley 74 which is rotatable about a spindle 75 whose free end portion constitutes a capstan which co-operates with the pressure-roller 13 for driving the magnetic tape in the cassette 7. For journalling the capstan 75 a bush 76 is formed on the housing section 1, into which bush a metal bearing bush 77 is pressed. In the assembled condition the pulley 74 and the capstan 75 are retained in their axial position by an arm 78 of the bracket 58. A drive belt 79 runs round the pulleys 42 and 74 and also round a part of the circumference of the pulley 56.

For initiating recordings a recording switching member 80 is provided. It is made of a plastics material and consists of a one-piece elongate member. It is movable both longitudinally and rotationally relative to the housing section 1, being formed with a longitudinal slot 81 which fits with play round a pin 82 which is integral with the housing section 1. At one end the recording switching member 80 has a locking projection 83 which can co-operate with a locking projection 84 on the head support 6. At its other end the recording switching member 80 comprises a recording key 85, by means of which a user can actuate the recording switching member with a finger. The recording key is located in an opening 86 in the wall of the housing section 1. This opening adjoins a slot 87 in the bottom 37 of the cassette compartment 36, which slot can receive the member 80. A sensor 88 which is connected to the recording key 85 projects into the cassette compartment 36. A tension spring 89 is connected at one end to a pin 90 which is integral with the recording switching member 80. The spring 89 extends obliquely with respect to the recording switching member 80 so that this member is continuously loaded towards the head support 6 in the longitudinal direction and counter-clockwise, as viewed in Figures 2 and 3, in the rotational direction. A pulling rod 91 which is pivotally connected to the recording switching member operates a recording switch (not shown).

The operation of the apparatus is as follows:

1. PLAYBACK

For playing back, either cassettes may be used from which the break-out tabs 92 in the rear wall have been removed, *i.e.* pre-recorded cassettes, or cassettes whose rear wall is intact. For the description of the playback process it is assumed that a non-pre-recorded cassette is used. The situation in the case of pre-recorded cassettes will be discussed under "recording".

With the magnetic-head support 6 locked in its retracted position, the cassette 7 is placed in a slightly upwardly inclined position beneath portions 93 of the housing section 1, which portions are located at the top of the cassette compartment 36. The cassette is then moved down at its front into the compartment 36, the capstan 75 then entering the cassette through an opening 94 provided in the cassette for this purpose. Since the cassette can be reversed, two such openings are formed in each of the two major walls of the cassette. Other openings 95 co-operate with locating pins 96 which are integral with the housing section 1 and project upwards from the bottom 37 of the cassette compartment. The cassette then engages at its front the movable cassette support 8 which serves as an unlocking member. The cassette is subsequently pressed down at its front to bring it into its final position. As a result the head support 6 is slightly tilted against the action of the leaf spring 23 about an axis which passes through the stops 34 and 35, which tilting movement, as previously stated, is possible owing to the play between the opening 26 in the projection 27 of the head support and the pin 25. By thus tilting the head support the locking member 21 is disengaged from the edge 22 of the housing section 1 so that at a given instant the head support ceases to be retained in its retracted position by the locking member 21. The head support is now pivoted towards the operating position by the spring 11, acting through the pressure-roller lever 12 and the pin 18 on the head support. In this movement of the head support the locking member 21 slides over the stop surface 33 and is held against said surface by the leaf spring 23. It will be evident that during this pivoting movement the cassette support 8 makes a slides along the underside of the cassette 7. As the head support is pivoted further the pressure-roller 13 and the magnetic-heads 4 and 5 pass through the openings 97, 98 and 99 formed for this purpose in the cassette compartment 36. They then pass through the openings (not shown in the drawing) formed in the cassette for this purpose, until the pressure-roller 13 presses the magnetic tape in the cassette against the capstan 75. Further pivoting movement of the head support by the spring 11 is then no longer possible. This is assured by the oblique end 100 of the leaf spring 23, which towards the end of the movement of the head support to its operating position, rides over the roller 30 in the projection 28 of the head support and, acting on the roller in the manner of a cam, imparts a further slight pivoting movement to the head support to ensure that the pin 18 on the head support disengages from the tab 17 of the pressure-roller lever 12. This cam action of the oblique end 100 of the leaf spring 23 also presses the member 39 of the head support against the stop 40 on the housing section 1.

During the pivoting movement of the head support a switch (not shown) is actuated so that the motor 41 is started, whilst the electronic circuits necessary for playback are also switched on. Upon the actuation of the motor 41 the belt 79 is driven and through it the pulley 74 and the

capstan 75 as well as the pulley 56 and the gear-wheels 53 and 54. While the button 60 is not depressed the left-hand end of the slot 69, as viewed in Figures 2 and 3, remains pressed against the guide member 68 by the leaf spring 71. *Via* the friction coupling between the gear-wheels 53 and 54, the gear-wheel 54, the gear-wheel 48, which meshes with the gear-wheel 54 when the drive unit 59 is in the position shown in Figures 2 and 3, and the reel spindle 45 which is integral with the gear-wheel 48, the winding hub with a torque which is determined by the degree of friction in the friction coupling. Simultaneously, the capstan 75 feeds the tape on the supply hub 44 on the take-up hub 43. The rear spindle 46 which engages with the hub 44 can rotate freely.

2. RECORDING

Recording is possibly only with cassettes from which the break-out tabs 92 in the rear wall of the cassette have not been removed. When such a cassette is placed in the cassette compartment 37 the sensor 88 and thus the recording switching member 80 is moved outwards against the action of the tension spring 89, so that the recording key 85 projects from the housing section 1 of the apparatus. This key preferably has a conspicuous colour so that a distinct visual indication is obtained that a recording can be made. The recording key 85 is now moved with one finger (to the left in Figures 2 and 3) so that the switching members 80 pivots about the pin 82, against the action of the tension spring 89, and thus sets the recording switch which is coupled to the pulling rod 91 to the recording position. In this movement of the switching member 80 the sensor 88 slides over the rear wall of the cassette, against which it bears under the influence of spring pressure. The further procedure is now as described hereinbefore for playback. When the head support 6 has reached its operating position the recording key 85 can be released. The locking projections 83 and 84 of the recording switching member and the head support now co-operate with each other and the recording switching member remains in its recording position (Figure 3).

When the break-out tabs 92 have been removed from the rear wall of the cassette, in other words when a pre-recorded cassette is used, the sensor 88 projects into the respective opening in the rear wall of the cassette, so that the recording key 85 does not project from the housing section 1 but remains within the opening 86 and thus cannot readily be actuated by hand. However, actuation is positively prevented by the sensor, which is disposed in the opening in the cassette rear wall, so that the recording switching member 80 cannot be pivoted.

3. STOPPING

Both during playback and during recording, stopping is effected by pressing the button 19 with a finger. The button should be depressed so far that the head support 6 is moved fully to its retracted position, after which the head support is locked under the influence of the leaf spring 23. In the movement of the head support to its retracted position the movable cassette support 8 in the cassette compartment 36 together with the pressure-roller 13 and the magnet-heads 4 and 5 initially move back from the cassette compartment, after which, as the head support 6 springs upwards into its locked position, the cassette support 8 is slightly raised with respect to the bottom 37 of cassette compartment, so that the cassette is slightly tilted. In this position the cassette can be easily gripped to lift it out of the cassette compartment, which is facilitated by the presence of an opening 101 in a wall of the cassette compartment.

4. FAST REWINDING

Fast rewinding can be effected during play back by depressing the button 60. As a result of this the complete drive unit 59 is moved against the pressure of the leaf spring 71 until the gear-wheel 53 meshes with the gear-wheel 55. This gear-wheel is continuously in mesh with the gear-wheel 50. In the fully depressed position of the button 60 the gear-wheel 48 and thus the reel spindle 45 is freely rotatable. Simultaneously, *via* the pulley 56 and the gear-wheels 53, 55 and 50, the reel spindle 46 is rotated with increased speed in a direction opposite to the direction of rotation during playback. Obviously, it is desirable that during fast rewinding the pressure-roller 13 no longer presses the magnetic tape against the capstan 75. Therefore, means must be provided whereby the head support 6 is also actuated by depression of the button 60, so that it is pivoted back slightly, sufficiently to lift the pressure-roller 13 off the tape. For this purpose, a stop 102 is provided at a side of the push-button 60, which stop can co-operate with a laterally projecting tab 103 of the push-button 19 of the head support. When the magnetic tape has been rewound as far as is required, the rewind button 60 is released. The drive unit 59 is returned to its original position by the leaf spring 71, and the head support 6 also returns to its initial position, the member 39 of the head support again engaging the stop 40.

5. QUICK REPEAT

When the recording switching member 80 is in its recording position, as in Figure 3, fast rewinding is possible by depression of the rewind button 60. The process is now fully identical to that discussed under 4, except that the slight pivoting movement of the head support 6 during fast rewinding now interrupts the co-operation of the two locking projections 83 and 84, so that the recording switching member 80 springs back to its playback position. Thus, upon release of the rewind button 60 the apparatus will be in the playback mode. Consequently, the signal which has just been recorded on the rewound part of the magnetic tape is played back.

6. PAUSE

For temporarily interrupting playback or recording a pause button 104 is provided. This button is integral with a pause lever 105 which is rotatable about a pin 106 which is integral with the housing section 1 (Figure 4). The pause lever 105 is made of a plastics material and in addition to the pause button 104 it comprises a leaf spring 107 and a hook 108. The spring 107 bears against a stop pin 109 which is integral with the housing section 1, whilst the hook 108 slides over an edge 110 and an adjoining guide ridge 111 on the housing section 1.

In the casing 51 of the gear-wheel 48 an opening is formed at the side which faces the hook 108, through which opening the hook can co-operate with the teeth of the gear-wheel 48. The position of the pause lever 105 is continuously defined by three contact faces which are disposed at the same level, namely the edge 62 of the housing section 1, the surface at the underside of the cassette compartment 36, on which surface the pin 106 is located, and a surface formed by an edge of the recess in the casing 51 and the adjoining edge 110 and guide ridge 111.

By moving the pause button 104 with a finger the pause lever 105 can be pivoted against the action of the spring 107 until the hook 108 engages with the teeth of the gear-wheel 48. In this situation the gear-wheel 48 is prevented from being driven, which is also possible when the motor 41 is running because the gear-wheels 53 and 54 are coupled by means of a friction coupling. It is obvious that in this situation, in which the winding hub 43 is no longer driven and the magnetic tape is thus no longer wound onto the take-up hub, the transport of the magnetic tape by the capstan 75 should be interrupted. Interruption is achieved by co-operation of the pause lever 105 with the pressure-roller lever 12. For this purpose this last-mentioned lever is provided with a projection 112. The pause lever comprises a pin 113 at its underside (Figure 4). In the pause position this pin engages with the projection 112 of the pressure-roller lever 12 and pivots this lever slightly so that clearance is obtained between the pressure-roller, the magnetic tape and the capstan. Moreover, this projection 112 has a shape at its free end such that under the influence of the spring 11 the pause lever 105 is locked in its pause position. The pause lever can manually be moved out of its locked position, after which by means of the spring 107 the pause lever is again returned to its original neutral position. This last-mentioned position is defined by the engagement of an edge 114 with the outer edge of the projection 27 of the head support 6. The leaf spring 23 is so proportioned that in the pause position, in which the pressure-roller lever 12 is pivoted against the pressure of the spring 11, the head support 6 nevertheless remains in its operating position.

If during the time that the pause lever 105 is in its pause position the apparatus is switched off by depressing the push-button 19, the pause lever automatically returns to its neutral position. This is because the co-operation between the pin of the pause lever 105 and the projection 112 of the pressure-roller lever 12 is interrupted owing to the pivoting movement of the head support 6. The spring 107 can then return the pause lever 105 to its neutral position. The head support 6 can always pivot freely relative to the pause lever 105; these two parts move in different planes (see Figures 2 and 3).

Although in the foregoing the invention has been described with reference to a single example, this does not imply that the invention is limited to this example. On the contrary, many embodiments are possible within the scope of the invention. Thus, it is for example possible to use three movable cassette supports instead of a single movable cassette support 8. The stationary cassette supports 9 may then be dispensed with. Local openings may then be formed in the bottom 37 of the cassette compartment 36 through which movable cassette supports can move, which like the cassette support 8 may also be integral with the head support 6. However, the last-mentioned feature is not necessary. It is also conceivable that spring-loaded cassette supports are movably connected to the bottom 37, the height-position of the supports in the operating condition then being determined by the head support, in that this head support co-operates with the movable cassette supports by means of stop members. Neither is it necessary to use the movable cassette support 8 as the unlocking member for the head support. Moreover, the invention is also applicable to cassette equipment in which the head support is spring-loaded towards its retracted position and in which by means of a button a force must be exerted to move the head support to its locked operating position.

The presence of a fixed bottom in the cassette compartment is not essential. In some types of apparatus a cassette is inserted into the apparatus through a slot, so that there is in fact no cassette compartment. In such an apparatus it is possible to support the cassette on a plurality of movable cassette supports which are for example directly connected to a head support and which during the movement of the head support from its retracted position to its operating position all slide over the cassette. In the meantime the cassette is held in position by locating pins which extend into the cassette through the appropriate openings 95.

Apart from these alternative embodiments many other alternatives are conceivable within the scope of the invention to those skilled in the art. Finally, an alternative is mentioned which may be of practical importance. For a correct synchronization of the movements of the parts which are driven by the motor 41 it may be of importance that the push-button 60 is not

integral with the bracket 58 of the drive unit 59. By the use of a push-button which is movable relative to the bracket it is easy to ensure that between the two parts certain backlash exists during which the head support 6 is already moved by the co-operation of the push-button with the tab 103 of the stop-button 19, so that the pressure-roller 13 is lifted off the capstan 75 and furthermore the gear-wheel 48 is temporarily not driven by the motor 41 by interrupting the electric current to the motor 41, before fast rewinding takes place. It is not until after the backlash has been overcome, and the drive unit 59 has been moved back sufficiently and after the gear-wheel 53 has engaged with the gear-wheel 51, that the motor 41 is re-energized. This also prevents rattling noises being produced due to inaccurate meshing of the the teeth of the gear-wheels.

WHAT WE CLAIM IS:—

1. An apparatus for recording and/or playing back signals on a magnetic tape which is contained in a cassette, the apparatus comprising a housing, a magnetic-head unit which is movable relative to the housing and which comprises a magnetic recording and/or playback head mounted on a head support which is movable in a first direction between an operating position in which the magentic-head can co-operate with a magnetic tape in a cassette supported in an operative position on the apparatus, and a retracted position in which a cassette can be placed on the apparatus or removed therefrom without being impeded by the magnetic-head, and cassette-supporting means for defining the operative position of the cassette on the apparatus, the head support also being movable in the retracted position in a second direction extending transversely of the first direction into a locked position, locking means being provided for locking the head support in this locked retracted position, and unlocking means being provided for releasing the head support from its locked position, which unlocking means comprise a movable unlocking member which is arranged to be actuated by a cassette upon movement of the cassette into its operative position.

2. An apparatus as claimed in Claim 1, wherein the cassette-supporting means comprise movable supporting means whose position is determined by the magnetic-head unit so that the operative position of a cassette on the apparatus is at least partly determined by the position of the magnetic-head unit.

3. An apparatus as claimed in Claim 2, wherein the movable cassette-supporting means are arranged to function also as the movable unlocking member.

4. An apparatus as claimed in Claim 2 or 3, wherein the position of the movable cassette-supporting means is determined by the position of the head support.

5. An apparatus as claimed in Claim 4, wherein the movable cassette-supporting means are mounted on the head support.

6. An apparatus as claimed in Claim 5, wherein the movable cassette-supporting means are rigidly connected to the head support.

7. An apparatus as claimed in Claim 5, in which the cassette-supporting means comprise, in addition to the movable cassette-supporting means, stationary cassette-supporting means, and wherein the movable cassette-supporting means consist of a single movable cassette-support in the immediate vicinity of the magnetic head.

8. An apparatus as claimed in Claim 7, wherein the stationary cassette-supporting means comprise two stationary cassette-supports, and a cassette in its operative position rests on only the single movable cassette support and the two stationary cassette-supports.

9. An apparatus as claimed in any of Claims 2 to 6, in which the cassette-supporting means comprise, in addition to the movable cassette supporting means, stationary cassette-supporting means, and wherein stationary stop means are provided with which the magnetic-head unit co-operates in the operating position so as to define the position of the magnetic head and of the movable cassette-supporting means relative to the stationary cassette-supporting means during operation of the apparatus.

10. An apparatus as claimed in Claim 9, wherein the stationary stop means co-operate with the head support in the operating position.

11. An apparatus as claimed in any of Claims 1 to 10, comprising first resilient means which load the head support towards its operating position, manually operable actuating means for moving the head support against the action of the first resilient means from the operating position to the retracted position, and second resilient means which load the head support to its locked position.

12. An apparatus as claimed in Claim 11, wherein the locking means comprise movable locking means which are connected to the head support and which are arranged to co-operate under the influence of the first and second resilient means with stationary locking means which are connected to the housing.

13. An apparatus as claimed in any of the preceding claims, wherein a pivot bearing arrangement with play is provided for the head support to enable the head support to pivot about a first axis between the operating position and the retracted position and in the latter position to pivot into and out of the locked position about a second axis which extends transversely of the first axis.

14. An apparatus as claimed in Claim 11 or 12, wherein the actuating means for moving the head support from the operating position to the retracted position consist of an actuating member which is mounted on the head support and which is movable in an opening in a wall of the housing.

15. An apparatus as claimed in Claim 14,

integral with the bracket 58 of the drive unit 59. By the use of a push-button which is movable relative to the bracket it is easy to ensure that between the two parts certain backlash exists during which the head support 6 is already moved by the co-operation of the push-button with the tab 103 of the stop-button 19, so that the pressure-roller 13 is lifted off the capstan 75 and furthermore the gear-wheel 48 is temporarily not driven by the motor 41 by interrupting the electric current to the motor 41, before fast rewinding takes place. It is not until after the backlash has been overcome, and the drive unit 59 has been moved back sufficiently and after the gear-wheel 53 has engaged with the gear-wheel 51, that the motor 41 is re-energized. This also prevents rattling noises being produced due to inaccurate meshing of the the teeth of the gear-wheels.

WHAT WE CLAIM IS:—

1. An apparatus for recording and/or playing back signals on a magnetic tape which is contained in a cassette, the apparatus comprising a housing, a magnetic-head unit which is movable relative to the housing and which comprises a magnetic recording and/or playback head mounted on a head-support which is movable in a first direction between an operating position in which the magentic-head can co-operate with a magnetic tape in a cassette supported in an operative position on the apparatus, and a retracted position in which a cassette can be placed on the apparatus or removed therefrom without being impeded by the magnetic-head, and cassette-supporting means for defining the operative position of the cassette on the apparatus, the head support also being movable in the retracted position in a second direction extending transversely of the first direction into a locked position, locking means being provided for locking the head support in this locked retracted position, and unlocking means being provided for releasing the head support from its locked position, which unlocking means comprise a movable unlocking member which is arranged to be actuated by a cassette upon movement of the cassette into its operative position.

2. An apparatus as claimed in Claim 1, wherein the cassette-supporting means comprise movable supporting means whose position is determined by the magnetic-head unit so that the operative position of a cassette on the apparatus is at least partly determined by the position of the magnetic-head unit.

3. An apparatus as claimed in Claim 2, wherein the movable cassette-supporting means are arranged to function also as the movable unlocking member.

4. An apparatus as claimed in Claim 2 or 3, wherein the position of the movable cassette-supporting means is determined by the position of the head support.

5. An apparatus as claimed in Claim 4, wherein the movable cassette-supporting means are mounted on the head support.

6. An apparatus as claimed in Claim 5, wherein the movable cassette-supporting means are rigidly connected to the head support.

7. An apparatus as claimed in Claim 5, in which the cassette-supporting means comprise, in addition to the movable cassette-supporting means, stationary cassette-supporting means, and wherein the movable cassette-supporting means consist of a single movable cassette-support in the immediate vicinity of the magnetic head.

8. An apparatus as claimed in Claim 7, wherein the stationary cassette-supporting means comprise two stationary cassette-supports, and a cassette in its operative position rests on only the single movable cassette support and the two stationary cassette-supports.

9. An apparatus as claimed in any of Claims 2 to 6, in which the cassette-supporting means comprise, in addition to the movable cassette supporting means, stationary cassette-supporting means, and wherein stationary stop means are provided with which the magnetic-head unit co-operates in the operating position so as to define the position of the magnetic head and of the movable cassette-supporting means relative to the stationary cassette-supporting means during operation of the apparatus.

10. An apparatus as claimed in Claim 9, wherein the stationary stop means co-operate with the head support in the operating position.

11. An apparatus as claimed in any of Claims 1 to 10, comprising first resilient means which load the head support towards its operating position, manually operable actuating means for moving the head support against the action of the first resilient means from the operating position to the retracted position, and second resilient means which load the head support to its locked position.

12. An apparatus as claimed in Claim 11, wherein the locking means comprise movable locking means which are connected to the head support and which are arranged to co-operate under the influence of the first and second resilient means with stationary locking means which are connected to the housing.

13. An apparatus as claimed in any of the preceding claims, wherein a pivot bearing arrangement with play is provided for the head support to enable the head support to pivot about a first axis between the operating position and the retracted position and in the latter position to pivot into and out of the locked position about a second axis which extends transversely of the first axis.

14. An apparatus as claimed in Claim 11 or 12, wherein the actuating means for moving the head support from the operating position to the retracted position consist of an actuating member which is mounted on the head support and which is movable in an opening in a wall of the housing.

15. An apparatus as claimed in Claim 14,

* C L M S *

wherein the head support is manufactured integrally with the said actuating member from a plastics material.

16. An apparatus as claimed in Claim 11, 12, 14 or 15, wherein the second resilient means consist of a leaf spring which at one of its ends is rigidly connected to the housing and at its other end bears slidably on the head support.

17. An apparatus as claimed in Claims 13 and 14, wherein the head support comprises a substantially L-shaped two-armed lever of which a first arm carries the magnetic head and a second arm carries the said actuating member, the pivot bearing arrangement being disposed at or near the junction between the two arms.

18. An apparatus as claimed in Claims 10 and 17, wherein the stationary stop means comprise three stationary stops with which the two-armed lever co-operates under the influence of the second resilient means in the operating position of the head support and which comprise a first stationary stop co-operating with the lever near the free end of said first arm, a second stationary stop co-operating with the lever near the free end of said second arm, and a third stationary stop co-operating with the lever near the junction between the first and second arms.

19. An apparatus as claimed in Claim 10, wherein the housing comprises a plurality of housing sections and both the stationary cassette-supporting means and the stationary stop means for the head support are integral with one of the housing sections.

20. An apparatus as claimed in Claim 19 when read as appendant to Claim 5 or 6, wherein said housing section comprises a cassette compartment with a bottom in which an opening is formed through which the movable cassette-supporting means project into the compartment, and wherein the stationary stop means and the stationary cassette-supporting means are located on opposite sides of the wall of said housing section.

20. An apparatus for recording and/or playing back signals on a magnetic tape which is contained in a cassette, the apparatus being constructed and arranged to operate substantially as herein described with reference to the accompanying drawings.

R. J. BOXALL,
Chartered Patent Agent,
Mullard House,
Torrington Place,
London, WC1E 7HD.
Agent for the Applicants.

Printed for Her Majesty's Stationery Office by MULTIPLEX techniques ltd., St. Mary Cray, Kent. 1981. Published at the Patent Office, 25 Southampton Buildings, London WC2 1AY, from which copies may be obtained.

* C L M S *