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(54) MAGNETIC-TAPE RECORDING AND/OR PLAYBACK APPARATUS

(71) We, N.V. PHILIPS' GLOEIL-
AMPENFABRIEKEN, 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 in and by the
following statement:—

The invention relates to an automatic
interruption mechanism for an apparatus
for recording and/or playing back signals on
a moving magnetic tape, which apparatus,
for transporting the magnetic tape at an
accurately defined speed, is provided with a
capstan which is rotatable about a first axis
of rotation and drives the magnetic tape,
and with a pressure roller which co-operates
with said capstan and is rotatable about a
second axis of rotation which is parallel to
the first axis of rotation, and which
apparatus is further provided with means
for driving the capstan, the interruption
mechanism being operable automatically to
interrupt the drive of the magnetic tape
upon at least local stoppage of the tape, and
comprising a first rotatably driven
component which rotates during operation
of the recording and/or playback apparatus
and continues rotating after stoppage of the
magnetic tape, least during the time which
is necessary to bring the interruption
mechanism into operation, a second
rotatable component which rotates during
operation of the apparatus but only during
transport of the magnetic tape and whose
stoppage provides a signal for the
interruption mechanism to indicate that the
magnetic tape has stopped, a differential
mechanism comprising a slip coupling with
primary and secondary coupling sections
which are rotatable relative to each other
and which are constituted by, rigidly

connected to, or rotatable with certain
transmission ratios by, the first and second
rotatable components respectively, the
differential mechanism further comprising a
zero member which is movable in first and
second directions of movement and which
can be loaded in both directions, these
directions of movement being dependent on
the difference in speed of rotation (the slip)
between the primary and secondary
coupling sections, and each of the coupling
sections being so driven and the zero
members being so loaded that during
transport of the magnetic tape the zero
member is continuously loaded in its first
direction of movement and upon stoppage
of the magnetic tape is loaded in its second
direction of movement, stop means being
provided to limit the movement of the zero
member in its first direction of movement,
and the interruption mechanism further
comprising a switching system which co-
operates with the zero member for
interrupting the drive of the magnetic tape
after the zero member has moved in its
second direction of movement.

There is a growing interest on the part of
the consumer in the presence of an
automatically operating mechanism which
interrupts or switches off the apparatus
when the end of the magnetic tape is
reached, in particular in the case of
magnetic-tape cassette equipment. In
cassette equipment which is suitable for
playing back in both directions the drive
means may be changed over automatically
after the interruption, so that automatically
a further playback of a recording on the
tape in a cassette is possible. In equipment
which is not suitable for automatic change-
over of the direction of movement, the
interest in an automatic stop feature for the
apparatus mainly arises from the wish to
prevent unnecessary wear and possible
damage to the magnetic tape and, in the

case of a battery-powered apparatus, unnecessary drainage of the electrical power stored in the batteries.

5 In the known automatic interruption mechanisms of the type described in the opening paragraph, the first rotatable component, which rotates during operation of the apparatus and continues rotating after the local stoppage of the tape, generally consists of a spindle, such as a capstan, which is directly driven by a drive motor. The second rotatable component, which rotates only during tape transport and whose stoppage constitutes a signal for the interruption mechanism that the tape has stopped, at least locally, is generally constituted by a reel disc or a pressure roller.

20 In the first case the switching mechanism thus responds to stoppage of the rotation of a reel disc. This need not necessarily mean that the magnetic tape at the location of the magnetic heads has stopped at the same time. Stoppage of the reel disc may be the result of jamming of a take-up reel. If in that event the magnetic-tape transport at the location of the capstan continues, loops are formed in the magnetic tape in the cassette, so that the magnetic tape and the cassette may be damaged.

30 In the second case the switching mechanism responds to stoppage of the magnetic tape at the location of the capstan. In switching mechanisms of this type the pressure roller should have an axial dimension which is smaller or not much greater than the width of the magnetic tape, because otherwise the pressure roller is also likely to be driven by the capstan when the magnetic tape has stopped.

40 An interruption mechanism of the first type is known from German Patent Specification DT-PS 1,286,776. In this known interruption mechanism two central gear wheels of a planetary gear arrangement are journaled on a spindle. The zero member consists of a pivotable lever, which at one of its ends is journaled so as to be pivotable about said spindle and at its free end carries two planet wheels. One of the two central gear wheels is driven by a capstan via a gear-wheel transmission, the other central gear wheel by a reel disc which in its turn is driven by a drive motor by means of a friction coupling. The two central wheels are mounted on a pivotable toggle lever. The transmission ratio of the planet wheels is such that even at the lowest speed of the reel disc the central gear wheel which is driven thereby pushes the lever against a stop in its first direction of movement, which is accompanied by slip in the friction coupling. When the speed of the reel disc becomes zero owing to the end of the magnetic tape being reached, the zero

member is moved in its second direction of movement and thus opens a contact, so that the current supply to the drive motor is interrupted.

70 An interruption mechanism of the second type is known from German Patent Specification 2,332,475. In this mechanism the primary coupling section consists of a spindle which is parallel to the capstan, which spindle is resiliently pressed against the pressure roller at its circumference. The pressure roller then serves as secondary coupling section, the slip between the coupling sections occurring between the circumferential surface of the pressure roller and the circumferential surface of the primary coupling section. The primary coupling section is journaled in a U-shaped bracket which near the end of its limbs is rotatable about an axis which is in a line with the axis of rotation of the pressure roller and which constitutes the zero member of the interruption mechanism. On the capstan a gear pinion is located which via an idler wheel drives a gear wheel mounted on the primary coupling section with a 1:1 transmission ratio. The diameter of the primary coupling section is such that during transport of the tape the primary coupling section has a slightly lower circumferential speed than the pressure roller. The slip between these two components results in a frictional force which presses the said U-shaped bracket, the zero member, against the stop. As soon as the magnetic tape stops, the pressure roller also stops. The capstan, however, rotates further so that the primary coupling section also continues to be driven. As a result of this it performs a rolling movement on the circumference of the pressure roller, so that the zero member is moved in its second direction of movement and moves a catch which, as a result of the movement, comes within range of a cam which is mounted on a flywheel which is coupled to the capstan. The cam exerts an impact force on the catch, so that a latching slide is unlatched and a drive motor is switched off.

115 In these and similar interruption mechanisms the zero member is pressed against a first stop during transport of the tape by a frictional force in the slip coupling. In practice, frictional forces which act between two components which are movable relative to each other are never constant, but exhibit fluctuations. Owing to the mutual coupling of the components of the differential mechanism and the drive motor the fluctuations in friction result in speed variations which are eventually transmitted to the magnetic tape. This may give rise to undesired variations in the frequency of the signal which is played back or recorded. The force with which the zero

member is moved in its second direction upon termination of the transport of the magnetic tape in order to actuate stop or change-over elements is determined by the friction in the friction coupling. This force is always small, because during the transport of the magnetic tape a small frictional force is desirable in order to avoid unnecessary loss of energy and also to avoid unnecessary variations in friction of unacceptable magnitude. The force available for switching over and/or switching off the apparatus is consequently small.

According to the invention, in an automatic interruption mechanism of the type described in the opening paragraph, the slip coupling is a unidirectional coupling which allows slip between the primary and secondary coupling sections in one direction only and which is provided with at least one blocking component which during a movement of the zero member in its second direction of movement co-operates with the primary and secondary coupling sections and prevents slip between these sections. Unidirectional couplings can readily be designed so that in the case of a relative movement of the coupling sections in the one direction of movement virtually no frictional force is exerted (apart from inevitable parasitic frictional forces), whilst a relative movement in the other direction of movement is blocked completely so that a greater force can be produced.

In recording and/or playback equipment it is of importance to avoid the use of unidirectional couplings which produce undesired rattling or grinding noises. In an embodiment of the invention which is very favourable in this respect the blocking component of the unidirectional coupling comprises a catch which is journaled on the primary coupling section so as to be capable of rotational movement relative thereto, and the secondary coupling section is provided with a cam which co-operates with the catch. It is easily ensured that the speed of the cam relative to the catch is very low during transport of the magnetic tape, so that these two components only move very slowly relative to each other, as a result of which very little noise is produced. In an embodiment which may be used to advantage the catch has a concave side face with the form of part of a surface of an imaginary cylinder, the catch is journaled on the primary coupling section for rotational movement relative thereto about a bearing axis which is parallel to the axis of the imaginary cylinder and passes through the centre of mass of the catch, the cam has a convex cam surface which co-operates with the concave side face of the catch so as to impart to the catch an oscillating movement about its bearing axis during

transport of the magnetic tape, and a stop surface of the cam co-operates with a stop portion of the catch upon stoppage of the magnetic tape, so as to prevent slip between the two coupling sections. By journaled the catch at the location of its centre of mass the likelihood of undesired noises being produced is minimized due to the fact that the catch is always balanced and has no tendency to strike other components under the influence of gravity. Therefore, this embodiment is extremely suitable for use in portable recording and/or playback equipment, for example portable cassette equipment.

In the previously discussed second type of interruption mechanism, known from German Patent Specification 2,322,475, the primary coupling section is urged against the pressure roller with the aid of a spring. As a result of this the pressure roller bearing and the bearing of the primary coupling section are subjected to a load, so that undesired additional frictional losses as well as fluctuations in the frictional forces may arise. In an embodiment of the invention which can also yield an improvement in this respect, the first rotatable component consists of the capstan and the second rotatable component consists of the pressure roller, the capstan cooperates with said differential mechanism *via* a gear-wheel transmission and for this purpose is rigidly connected to a primary gear wheel, and the pressure roller also co-operates with the differential mechanism *via* a gear-wheel transmission and for this purpose is rigidly connected to a secondary gear wheel. By the use of a gear-wheel transmission instead of a friction transmission a substantial reduction of the pressure forces acting on the bearing arrangement of the pressure roller and the primary coupling section is possible.

Favourable results have been obtained with an embodiment of the invention wherein the secondary coupling section of the unidirectional coupling comprises a third gear wheel which is rotatable about a third axis of rotation parallel to and spaced from the axis of rotation of the pressure roller, which third gear wheel meshes with said secondary gear wheel, wherein the primary coupling section of the unidirectional coupling comprises a fourth gear wheel which is journaled on the secondary coupling section so as to be rotatable about said third axis of rotation, wherein the zero member comprises a lever which to a limited extent is pivotable about a fourth axis of rotation parallel to and spaced from the third axis of rotation of the secondary coupling section, and wherein on the lever a fifth and a sixth gear wheel are mounted, which two gear wheels are

coaxially and rigidly connected to each other and are rotatable about a fifth axis of rotation parallel to and spaced from said fourth axis of rotation, whilst at least during operation of the recording and/or playback apparatus the fifth gear wheel continuously meshes with the fourth gear wheel and the sixth gear wheel with the first gear wheel.

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

Fig. 1 is a perspective view of an interruption mechanism in accordance with the invention,

Fig. 2, in order to illustrate the operation of the interruption mechanism of Fig. 1, is a sectional side view of the principal components which co-operate with each other,

Fig. 3 is a plan view showing the relative positions of some of the components of Fig. 2 during operation,

Fig. 4 is another plan view showing the components of Fig. 3 in relative positions in which the current supply to a motor is interrupted,

Fig. 5 illustrates schematically the co-operation of a catch and a cam of the interruption mechanism during operation, and

Fig. 6 illustrates the co-operation of the catch and the cam of Fig. 5 when the magnetic-tape transport ceases.

The interruption mechanism shown in the drawings is of the type which is based on the change in movements of a capstan 1 and a pressure roller 2 relative to each other after transport of a magnetic tape 3 in a recording and/or playback apparatus has ceased. The capstan 1 is rotatable about an axis of rotation 4 and is connected to a flywheel 5 which by means of a belt 6 can be driven by a drive motor, not shown. During operation the capstan rotates in the direction of arrow 7, and after the magnetic tape has stopped at the location of the capstan, it keeps rotating for the time which is necessary to allow the interruption mechanism to be activated. The pressure roller 2 is rotatable in the direction of arrow 9 about an axis of rotation 8 which is parallel to the axis of rotation 4 of the capstan. The pressure roller 2, as is common practice in magnetic-tape equipment, is not driven directly but is pressed against the magnetic tape 3 so as to be rotated by the tape. In Figure 1 a part of a compression spring 11 is visible which bears against a pressure roller lever 12 in a direction 13. The pressure-roller lever 12 is pivotable about an axis 14 which is also parallel to the axis of rotation 4 of the capstan. The axial dimension of the pressure roller 2 corresponds to the width of the magnetic tape 3. When the magnetic tape 3 stops the pressure roller 2 therefore

also stops. The pressure roller is consequently a component which during operation only performs a rotary movement as long as the magnetic tape is moving and whose stoppage may constitute a signal for the interruption mechanism that the transport of the magnetic tape has locally ceased.

The capstan 1 and the pressure roller 2 are coupled to each other via a differential mechanism which in Figs. 1 and 2 bears the general reference numeral 15. It comprises a slip coupling 16 and a so-called zero-member 17. The coupling comprises primary and secondary coupling sections 18 and 19 which are rotatable relative to each other. The primary coupling section 18 is driven by the capstan 1 via a gear-wheel transmission and the secondary coupling section 19 by the pressure roller 2 via a gear-wheel transmission. The zero member 17 is movable about a shaft 52 in two directions, namely, in a first direction of movement which is designated I and a second direction of movement which is designated II. The primary coupling section 18 rotates in the direction of arrow 20 and the secondary coupling section 19 in the direction of arrow 21. As will be explained in more detail later herein, the zero member 17 is urged against a fixed stop 23 by a tension spring 22 during transport of the magnetic tape 3 and is thus subjected to a driving force in the direction I. Upon stoppage of the magnetic tape the zero member moves in the direction II. The stop 23 limits movements in the direction I. When the zero member 17 moves in the direction II a switching system 24 is energized. This system comprises a metal switching plate 25 and a metal switching spring 26 which during operation contact each other and are included in a circuit. Interruption of the contact between these two components 25 and 26 results in an interruption of the motor drive of the capstan 1. A switching lever 27 is pivotably mounted on the switching plate 25 by means of a pin 28.

The slip coupling 16 is a unidirectional coupling which allows slip between the primary and secondary coupling sections 18 and 19 in one direction only and which is provided with a blocking component 29 which during the movement of the zero member 17 in its second direction of movement II co-operates with the primary and secondary coupling sections and prevents slip between these sections. This blocking component consists of a catch which is journaled on the primary coupling section 18 so as to be capable of rotational movement relative thereto. The secondary coupling section 19 is provided with a cam 30 which co-operates with the catch.

For driving the differential mechanism 15

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a primary gear wheel 31 is rigidly mounted on the capstan 4 and a secondary gear wheel 32 on the pressure roller 2.

5 The secondary coupling section 19 of the unidirectional coupling 16 comprises a third gear wheel 33 which is rotatable about a third axis of rotation 34 parallel to and spaced from the axis of rotation 8 of the pressure roller 2, which third gear wheel meshes with said secondary gear wheel 32. 10 The primary coupling section 18 comprises a fourth gear wheel 35 which is journaled on the secondary coupling section 19 so as to be rotatable about said third axis of rotation 34. The zero member 17 comprises a lever which to a limited extent is pivotable about a fourth axis of rotation 36 parallel to and spaced from the third axis of rotation 34 of the secondary coupling section 19. On 20 the lever 17 a fifth and a sixth gear wheel 37 and 38 respectively are mounted, which two gear wheels are coaxially and rigidly connected to each other. These two gear wheels are rotatable about a fifth axis of rotation 39 parallel to and spaced from said fourth axis of rotation 36. The fifth gear wheel 37 continuously meshes with the fourth gear wheel 35 and the sixth gear wheel 38 with the first gear wheel 31, at least during operation of the recording and/or playback apparatus. 30

Practically all components of the interruption mechanism are made of a plastics. The gear wheel 32 is integral with a plastics hub and a plastics bearing pin (not shown), which together with a rubber ring fitted on the hub form the pressure roller. The secondary coupling section 19 is integrally manufactured from a plastics and comprises the gear wheel 33, a spindle 40, a flange 41 and the cam 30. The gear wheel 35 is also made of a plastic and is journaled on the spindle 40. The plastics catch 29 is journaled in the hub 43 of the gear wheel 35 by means of a bearing pin 42. The upper end of the spindle 40 is journaled in the pressure-roller lever 12. The lower end may be journaled in a part of a head slide (not shown) on which the magnetic heads of the recording and/or playback apparatus are mounted and on which the pressure-roller lever 12 is also journaled. As the pressure roller lever 12 must be capable of a slight pivotal movement, of the order of 1 mm, relative to the head slide, the lower end of the spindle 40 should be journaled so as to be slightly tiltable. In practice this presents no problems. The lever 17 is also integrally manufactured from a plastic. The lever is pivotably mounted on a pin 52 which is rigidly connected to a stationary part of the recording and/or playback apparatus. Furthermore, the lever 17 is provided with a journal 44 (see Fig. 2) on which plastics gear wheels 37 and 38, which are integral with 65

each other, are mounted for free rotation. The tension spring 22 is connected to a pin 45 on the lever 17. At one side the lever is furthermore provided with a projection 46 for co-operation with an arm 47 of the switching lever 27.

As is clearly shown in Figs. 5 and 6, the catch 29 is crescent-shaped and has a concave side face 48 with the form of part of a surface of an imaginary cylinder. By means of the bearing pin 42 the catch is journaled on the primary coupling section 18 so as to be rotatable relative thereto about a bearing axis which is parallel to the axis of said imaginary cylinder and which passes through the centre of mass Z of the catch. The cam 30 has a convex cam surface 49 which cooperates with the concave side face 48 of the catch 29 during transport of the magnetic tape 3. As will be explained, this cooperation imparts an oscillating movement to the catch 29 about its bearing axis. The cam 30 comprises a stop surface 50 which, upon stoppage of the magnetic tape, cooperates with a stop portion 51 of the catch. As a result slip between the two coupling sections 18 and 19 is prevented upon stoppage of the magnetic tape. As can be seen from Figs. 5 and 6, the stop surface 50 of the cam 30 consists of a flat surface at the back of the cam surface 49, and the stop portion 51 of the catch 29 is formed by one of the horns of the crescent-shaped catch.

The operation of the interruption mechanism is as follows:—

A. Transport of the magnetic tape.

The capstan 1 is driven by a motor *via* the belt 6. The magnetic tape 3 is advanced by the capstan 1 due to it's being pressed against the capstan by the pressure roller 2 under the influence of the pressure spring 11. The gear wheel 35 moves in the direction 20 and the cam 30 in the direction 21. The different gear-wheels transmissions are so selected that the speed of the rotation of the cam 30 is slightly greater than that of the rotation of the catch 29. As can be seen from Fig. 5, this means that the curved cam surface 49 of the cam 30 is entirely clear of the catch 29 during some of the time and slides slowly across the concave side face 48 of the catch 29 during another part of the time. As a result, the catch 29 is given a slow oscillating movement, for example one oscillation per thirty seconds. Since the frictional forces prevailing between the primary and secondary coupling sections 18 and 19 are very small, hardly any force will be exerted on the circumference of the gear wheel 37. The tension spring 22 is capable of holding the lever 17 against the stop 23. Between the projection 46 on lever 17 and the arm 47 of switching lever 27 there is a

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slight clearance and the switching spring 26 makes contact with the switching plate 25. The switching spring 26 has a self-resilient action and is mounted around a pin 53 on a stationary part of the frame of the recording and/or playback apparatus and is anchored at one end in an opening 54, in such a way that the spring is always loaded in the direction of the switching plate 25.

B. Standstill of the magnetic tape.

When the magnetic tape stops, the pressure roller 2 also stops. This means that the secondary coupling section 19 is no longer driven, so that the cam 30 also stops. However, the rotation of the catch 29 continues because the drive of the capstan 1 has not yet been disengaged. After some time the catch 29 will be in the position relative to the cam 30 shown in Fig. 6 and the stop portion 51 of the catch will engage with the stop surface, 50 of the cam. This prevents further rotation of the gear wheel 35. As the gear wheel 37 is still being driven and is in mesh with the gear wheel 35, the gear wheel 37 rolls on the circumference of the gear wheel 35. Although this rolling movement is effected about the axis of rotation 36 of the lever 17, the teeth of the gear wheels 35 and 37 remain in mesh with each other. Consequently, on the circumference of the gear wheel 37 a force is exerted which pivots the lever 17 in the direction II. The projection 46 on lever 17 consequently comes into engagement with the arm 47 of the switching lever 27, so that the switching lever 27 is pivoted in a direction 55 (see Fig. 4). The switching spring 26 is pressed away from the switching plate 25, so that the current supply to the drive motor is interrupted and the capstan stops.

Obviously, it is also possible for the projection 46, or another component connected to the lever 17, to be arranged to actuate a stop catch for unlatching a latching slide in a manner similar to that described in the previously discussed German Patent Specification 2,332,475. Thus, it is possible to switch off the recording and/or playback apparatus whilst the head slide is withdrawn simultaneously and, if necessary, any depressed actuating buttons are reset. Instead of switching off a drive motor it is alternatively possible to actuate a change-over system so that the direction of rotation of the capstan 1 is reversed and transport of the magnetic tape 3 is obtained in a direction opposite to the direction of transport 10 indicated in Fig. 1. Of course, it is also possible to initiate other switching actions.

WHAT WE CLAIM IS:—

1. An automatic interruption mechanism

for an apparatus for recording and/or playing back signals on a moving magnetic tape, which apparatus, for transporting the magnetic tape at an accurately defined speed, is provided with a capstan which is rotatable about a first axis of rotation and drives the magnetic tape, and with a pressure roller which cooperates with said capstan and is rotatable about a second axis of rotation parallel to the first axis of rotation, and which apparatus is further provided with means for driving the capstan, the interruption mechanism being operable automatically to interrupt the drive of the magnetic tape upon at least local stoppage of the tape, and comprising a first rotatably driven component which rotates during operation of the recording and/or playback apparatus and continues rotating after stoppage of the magnetic tape, at least during the time which is necessary to bring the interruption mechanism into operation, a second rotatable component which rotates during operation of the apparatus but only during transport of the magnetic tape and whose stoppage provides a signal for the interruption mechanism to indicate that the magnetic tape has stopped, a differential mechanism comprising a slip coupling with primary and secondary coupling sections which are rotatable relative to each other and which are constituted by, rigidly connected to, or rotatable with certain transmission ratios by, the first and second rotatable components respectively, the differential mechanism further comprising a zero member which is movable in first and second directions of movement and which can be loaded in both directions, these directions of movement being dependent on the difference in speed of rotation (the slip) between the primary and secondary coupling sections, and each of the coupling sections being so driven and the zero member being so loaded that during transport of the magnetic tape, the zero member is continuously loaded in its first direction of movement and upon stoppage of the magnetic tape is loaded in its second direction of movement, stop means being provided to limit the movement of the zero member in its first direction of movement, and the interruption mechanism further comprising a switching system which co-operates with the zero member for interrupting the drive of the magnetic tape when the zero member has moved in its second direction of movement wherein the slip coupling is a unidirectional coupling which allows slip between the primary and secondary coupling sections in one direction only and which is provided with at least one blocking component which during a movement of the zero member in its

slight clearance and the switching spring 26 makes contact with the switching plate 25. The switching spring 26 has a self-resilient action and is mounted around a pin 53 on a stationary part of the frame of the recording and/or playback apparatus and is anchored at one end in an opening 54, in such a way that the spring is always loaded in the direction of the switching plate 25.

B. Standstill of the magnetic tape.

When the magnetic tape stops, the pressure roller 2 also stops. This means that the secondary coupling section 19 is no longer driven, so that the cam 30 also stops. However, the rotation of the catch 29 continues because the drive of the capstan 1 has not yet been disengaged. After some time the catch 29 will be in the position relative to the cam 30 shown in Fig. 6 and the stop portion 51 of the catch will engage with the stop surface, 50 of the cam. This prevents further rotation of the gear wheel 35. As the gear wheel 37 is still being driven and is in mesh with the gear wheel 35, the gear wheel 37 rolls on the circumference of the gear wheel 35. Although this rolling movement is effected about the axis of rotation 36 of the lever 17, the teeth of the gear wheels 35 and 37 remain in mesh with each other. Consequently, on the circumference of the gear wheel 37 a force is exerted which pivots the lever 17 in the direction II. The projection 46 on lever 17 consequently comes into engagement with the arm 47 of the switching lever 27, so that the switching lever 27 is pivoted in a direction 55 (see Fig. 4). The switching spring 26 is pressed away from the switching plate 25, so that the current supply to the drive motor is interrupted and the capstan stops.

Obviously, it is also possible for the projection 46, or another component connected to the lever 17, to be arranged to actuate a stop catch for unlatching a latching slide in a manner similar to that described in the previously discussed German Patent Specification 2,332,475. Thus, it is possible to switch off the recording and/or playback apparatus whilst the head slide is withdrawn simultaneously and, if necessary, any depressed actuating buttons are reset. Instead of switching off a drive motor it is alternatively possible to actuate a change-over system so that the direction of rotation of the capstan 1 is reversed and transport of the magnetic tape 3 is obtained in a direction opposite to the direction of transport 10 indicated in Fig. 1. Of course, it is also possible to initiate other switching actions.

WHAT WE CLAIM IS:—

1. An automatic interruption mechanism

for an apparatus for recording and/or playing back signals on a moving magnetic tape, which apparatus, for transporting the magnetic tape at an accurately defined speed, is provided with a capstan which is rotatable about a first axis of rotation and drives the magnetic tape, and with a pressure roller which cooperates with said capstan and is rotatable about a second axis of rotation parallel to the first axis of rotation, and which apparatus is further provided with means for driving the capstan, the interruption mechanism being operable automatically to interrupt the drive of the magnetic tape upon at least local stoppage of the tape, and comprising a first rotatably driven component which rotates during operation of the recording and/or playback apparatus and continues rotating after stoppage of the magnetic tape, at least during the time which is necessary to bring the interruption mechanism into operation, a second rotatable component which rotates during operation of the apparatus but only during transport of the magnetic tape and whose stoppage provides a signal for the interruption mechanism to indicate that the magnetic tape has stopped, a differential mechanism comprising a slip coupling with primary and secondary coupling sections which are rotatable relative to each other and which are constituted by, rigidly connected to, or rotatable with certain transmission ratios by, the first and second rotatable components respectively, the differential mechanism further comprising a zero member which is movable in first and second directions of movement and which can be loaded in both directions, these directions of movement being dependent on the difference in speed of rotation (the slip) between the primary and secondary coupling sections, and each of the coupling sections being so driven and the zero member being so loaded that during transport of the magnetic tape, the zero member is continuously loaded in its first direction of movement and upon stoppage of the magnetic tape is loaded in its second direction of movement, stop means being provided to limit the movement of the zero member in its first direction of movement, and the interruption mechanism further comprising a switching system which co-operates with the zero member for interrupting the drive of the magnetic tape when the zero member has moved in its second direction of movement wherein the slip coupling is a unidirectional coupling which allows slip between the primary and secondary coupling sections in one direction only and which is provided with at least one blocking component which during a movement of the zero member in its



second direction of movement co-operates with the primary and secondary coupling sections and prevents slip between these sections.

5 2. An interruption mechanism as claimed in Claim 1, wherein the blocking component of the unidirectional coupling comprises a catch which is journalled on the primary coupling section so as to be capable of rotational movement relative thereto, and the secondary coupling section is provided with a cam which co-operates with the catch.

10 3. An interruption mechanism as claimed in Claim 2, wherein the catch has a concave side face with the form of part of a surface of an imaginary cylinder, wherein the catch is journalled on the primary coupling section for rotational movement relative thereto about a bearing axis which is parallel to the axis of the imaginary cylinder and passes through the centre of mass of the catch, wherein the cam has a convex cam surface which cooperates with the concave side face of the catch so as to impart to the catch an oscillating movement about its bearing axis during transport of the magnetic tape, and wherein a stop surface of the cam co-operates with a stop portion of the catch upon stoppage of the magnetic tape, so as to prevent slip between the two coupling sections.

15 4. An interruption mechanism as claimed in Claim 1, wherein the first rotatable component consists of the capstan and the second rotatable component consists of the pressure roller, wherein the capstan cooperates with said differential mechanism via a gear-wheel transmission and for this purpose is rigidly connected to a primary gear wheel, and wherein the pressure roller also co-operates with the differential mechanism via a gear-wheel transmission

and for this purpose is rigidly connected to a secondary gear wheel.

5. An interruption mechanism as claimed in Claims 2 and 4, wherein the secondary coupling section of the unidirectional coupling comprises a third gear wheel which is rotatable about a third axis of rotation parallel to and spaced from the axis of rotation of the pressure roller, which third gear wheel meshes with said secondary gear wheel, wherein the primary coupling section of the unidirectional coupling comprises a fourth gear wheel which is journalled on the secondary section so as to be rotatable about said third axis of rotation, wherein the zero member comprises a lever which to a limited extent is pivotable about a fourth axis of rotation parallel to and spaced from the third axis of rotation of the secondary coupling section, and wherein a fifth and a sixth gear wheel are mounted on the lever, said fifth and sixth gear wheels being coaxially and rigidly connected to each other and being rotatable about a fifth axis of rotation parallel to and spaced from said fourth axis of rotation, whilst at least during operation of the recording and/or playback apparatus the fifth gear wheel continuously meshes with the fourth gear wheel and the sixth gear wheel with the first gear wheel.

6. An automatic interruption mechanism for a magnetic-tape recording and/or playback apparatus, substantially as herein described with reference to the accompanying drawings.

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