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"MAGNETIC TAPE CASSETTE"

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5 The invention relates to a magnetic tape cassette for use in a recording system for recording signals on a magnetic tape. The cassette, which contains a specific length of magnetic tape, can be placed onto a recording apparatus comprising a timer for determining at least one start and one stop instant for an automatic recording which is preprogrammed in respect of time. The present application is a divisional application of Application Serial No. 2,030,755.

10 Such a known recording system is for example employed for automatically recording television signals, and is described in the magazine "Elektronikschau" 1977, Heft 5, pages 47 to 50. The timer enables a preprogrammed automatic recording to be made within a comparatively long period of time, for example four days. Furthermore, different types of cassettes are available, which
15 differ from each other in respect of the lengths of magnetic tape. When preprogramming a recording the user of such a recording system should ensure that a cassette is used which contains such a length of tape that it can actually accommodate the entire preprogrammed automatic recording.

20 In order to improve the ease of operation of the abovementioned type of recording system and to exclude incorrect operation, Application Serial No. 2,030,755 discloses a recording system for recording signals on a magnetic tape, which system comprises a recording apparatus and a cassette having a housing whose
25 overall size conforms to standard outer dimensions and containing sufficient magnetic tape to enable one of a plurality of predetermined recording times to be achieved, the cassette having indicia indicative of the length of the tape contained in the cassette, the cassette in use being placed onto said
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apparatus, wherein the recording apparatus comprises a timer for determining at least one start and one stop instant for an automatic recording which is preprogrammed in respect of time, at least one detection device for detecting said tape length indicia when a cassette is placed on the apparatus, a comparator device for receiving an output quantity from the detection device, which output quantity is a measure of the recording time attainable with the cassette, as well as a reference quantity which is derived from the timer and which is a measure of the total automatic recording time preprogrammed by means of said timer, and a warning device coupled to the comparator device, the warning device being actuated when the time needed for the preprogrammed automatic recording exceeds the recording time attainable with the cassette.

The recording system of Application 2,030,755 is thus able to warn automatically the user of the apparatus if a cassette is used which permits a recording period which is shorter than that preprogrammed by means of the timer. Thus erroneous operation is avoided, which is likely to happen especially if by means of the timer a plurality of successive automatic recordings are preprogrammed, because this may easily give rise to errors in adding the lengths of the individual automatic recordings.

There are several possibilities of realizing such a recording system in respect of the choice of the detection device to be used for detecting the recording period attainable with the cassette inserted in the recording apparatus, as an example, it is possible to employ optical or mechanical devices for detecting the available length of tape. It is found to be simple and advantageous if the detection device of the apparatus is provided with a sensing device for sensing at least one tape length mark provided on the cassette, which mark indicates the total length of magnetic tape contained in said cassette. This enables the maximum recording period of this cassette, which is

proportional to the total length of the magnetic tape in the cassette, to be determined in a simple manner. It is obvious that a user of the recording apparatus, if several successive automatic recordings are programmed, will use a cassette of which the total length of magnetic tape is still available for recording. In this case it suffices to compare the sum of the lengths of the preprogrammed automatic recordings with the maximum recording time of the cassette which is used. There are various possibilities of realizing a tape-length marking. As an example an optical mark may be used, which is then optically detected. Mechanical tape-length marks in the form of tabs or recesses on the cassette are also possible which are sensed by sensors.

Another possibility is that several marks together in the form of a binary code represent different lengths of magnetic tape.

It is found to be particularly advantageous if the detection device of the recording apparatus is adapted to detect the length of tape that is actually available for recording in a cassette placed on the recording apparatus. This ensures that incorrect operation is avoided because allowance is made for the fact that a certain length of magnetic tape in the cassette is no longer available for further recordings because of previously made recordings. This also enables preprogrammed automatic recordings to be made on cassettes in which already a specific length of magnetic tape is unwound from the supply reel and is consequently no longer available for further recordings. The detection device may again be realized in various manners and thus be adapted to specific requirements, for which it is possible to revert to the state of the art. As an example the detection device may comprise mechanical or optical means which detect the instantaneous length of magnetic tape contained on the supply reel of the cassette. However, it is also possible to provide marks on the magnetic tape itself, enabling the detection device to ascertain at which

point on the magnetic tape a new recording begins, so that it is then automatically detected how much magnetic tape is still available for recording.

As a detection device it is also possible to use a device described for example in German Offenlegungsschrift 27 30 134 for detecting the length of magnetic tape wound from a supply reel onto a take-up reel of a cassette, which uses the difference in speed of rotation of the supply reel and the take-up reel as detection criterion. Such detection devices should then allow for parameters, such as the total length of magnetic tape, the thickness of the magnetic tape and the diameter of the supply-reel and take-up reel hubs.

The recording apparatus may comprise a detection device comprising a combination of a first detection device, provided with a sensing device for at least one mark, provided on the cassette, which indicates the total length of magnetic tape contained in said cassette, and a second detection device which is adapted to detect the length of magnetic tape which is actually available for recording in a cassette placed on the apparatus, the output quantity of the first detection device serving as reference quantity for the second detection device.

In this way the total length of magnetic tape in a cassette may also be a variable parameter, which is advantageous in view of the frequently occurring practical situation that a recording system employs cassettes with different lengths of magnetic tape. The total length of magnetic tape is then automatically detected by the first detection device and allowance is made for this in determining the actual length of magnetic tape still available for recording.

Suitably, the detection device used in the recording apparatus is also adapted to determine whether or not a cassette has been inserted in the recording apparatus. When programming an automatic recording, a user of the recording apparatus is thus warned immediately if no cassette is inserted in the recording apparatus so that the apparatus is consequently not ready for operation.

In respect of a particularly simple construction it is found to be advantageous if the recording apparatus comprises a microprocessor, which at least serves to constitute the timer, the detection device and the comparator device. By means of such a microprocessor a simple compact construction is obtained and the operations required in this respect can be realized in a simple manner.

According to the present invention there is provided a magnetic tape cassette comprising a housing formed by two substantially rectangular major walls interconnected by side walls, magnetic tape supply and take-up means rotatably mounted within the housing, and a group of at least two tape length marks formed by one of the walls, wherein the group of marks are indicative of the length of the magnetic tape contained on the supply and take-up means and is in a form which is detectable by a recording apparatus when the cassette is placed thereon, and wherein the group of marks is fixedly positioned and is unalterable by normal handling of the cassette.

By means of the provision of a group of detectable tape-length marks an important parameter of the cassette, namely the maximum recording time attainable with said cassette, which time is proportional to the total length of the magnetic tape, can be determined in a simple manner by means of a sensing operating carried out in a recording apparatus.

The tape length marks may be detectable by mechanical or optical means.

The tape length marks may comprise a multi-bit binary code, each bit being constituted by a respective one of the marks, which may have one of two specific conditions. An important advantage of this is that by means of n marks in principle a total of 2^n types of cassettes provided with different amounts of magnetic tape can be distinguished from each other. Thus, it is for example possible that a recording system of a type described in Application Serial No. 2,020,755 can be used in conjunction with eight types of cassettes of different playing times by the use of a 3-bit coded tape length marking.

It is advantageous if the different types of cassettes, in spite of their different tape length markings and thus the different amounts of magnetic tape which they contain, can be

assembled from each time the same components. In an embodiment of the invention the cassette housing is provided with marking apertures which can be closed by removable wall portions and one of the two conditions of each mark is constituted
5 by the presence of the removable wall portion of a marking aperture and the other of the two conditions by the absence of the removable wall portion. In this embodiment all cassette housings may be assembled using identical components. In order to mark the amount of magnetic tape contained in the
10 cassette one or more of the removable wall portions are removed by means of a very simple tool, in conformity with the binary code used. In view of the space which is available within the cassette it is advantageous if the sub-markings are located near a corner in a major wall of the cassette housing. In this embodiment
15 the space which is available in the cassette between the major walls and the side walls which meet in said corner and the circular reel is used in an optimum manner. An additional advantage of this embodiment is that especially in recording equipment in which the cassette is inserted in a movable cassette holder which,
20 together with the cassette contained therein, is subsequently moved to an operating position the group of tape length marks is arranged at a location which is suitable to cooperate with the detection device of the recording apparatus. Moreover,
25 the manner in which the part of the cassette with the tape length marks is moved from and to the detection device by the cassette holder is favourable.

This last-mentioned advantage plays a part in an embodiment of a recording apparatus which has a detection device for
30 determining the amount of magnetic tape which is actually available for recording in a cassette placed on the recording apparatus. The detection device is provided with a number, corresponding to the number of bits of the binary code used for indicating the tape length, of detection switches, each provided with a spring-loaded movable
35 detection member for detecting the condition of a marks on

the cassette, which detection member in the absence of a removable wall portion is at least partly disposed in a marking aperture, the relevant detection switch then being in a first condition, and in the presence of the removable wall portion cooperates with said wall portion, the detection switch then being in a second condition. By moving the cassette holder from and towards its operating position the detection members, at least if locally a removable wall portion is present, is moved against the spring load. This can be realized without the use of additional motion-transmitting parts, if in accordance with a further embodiment the detection members of the detection switches comprise detection pins which are depressable in their longitudinal directions.

In yet another embodiment of the recording apparatus no special means are required in order to determine whether or not a cassette has been placed on the recording apparatus. In this embodiment, if all detection switches are in their first condition then it can be assumed that no cassette has been placed on the recording apparatus. In this embodiment it is obvious that one of the binary words of the binary tape length marking code should be reserved for other purposes. Thus, when a group of three marks are used this means that seven instead of eight types of cassettes of different playing time may be employed. However, in practice this does not necessarily present a drawback.

The invention is described in more detail, by way of example, with reference to the accompanying drawings, in which:

Figure 1, partly in cross-section, represents an embodiment of a recording system whose recording apparatus comprises a detection device for detecting the total length of the magnetic tape contained in a cassette having detectable tape-length marks on one side of the cassette housing,

Figure 2, partly in cross-section, shows another embodiment of a recording system whose recording apparatus comprises two detection devices of which one device detects the total length of the magnetic tape contained in a cassette having detectable

tape-length marks on opposite sides of the cassette housing and of which the second device detects the length of magnetic tape in this cassette which is actually available for recording, and

5 Figure 3 is a perspective view of a video cassette made in accordance with the invention.

Figure 1 shows those parts of the recording apparatus 2 which are essential for the understanding of the operation of the recording system 1. The recording apparatus 2 comprises
10 a cassette receptacle 3 for receiving a cassette 4, which depending on the type of cassette contains a different length of magnetic tape.

Figure 1 shows such a cassette 4 inserted in the receptacle 3 of the recording apparatus, the magnetic tape 5 accommodated
15 in said cassette being symbolically represented by dash-dot lines.

As can be seen in Figure 1, the cassette 4 is formed with three recesses 7, 8 and 9 in a major wall 6, in which recesses tabs are arranged which may be broken out and which constitute
20 detectable marks. In the present case two tabs 10 and 11 in the two recesses 7 and 9 are left in the cassette 4, whilst the tab corresponding to the recess 8 has been broken out or has not been provided. The tabs serve to indicate the total length of magnetic tape 5 contained in the cassette 4. Each tab may
25 then correspond to a specific length of magnetic tape, so that in the present case three types of cassettes with different lengths of magnetic tape can be distinguished from each other. However, coded combinations of tabs which are present or have been removed may also be used, so that in the case of a binary code a maximum
30 of eight types of cassettes can be distinguished from each other with the present cassette having three tabs.

The cassette 4 shown in Figure 1 can only be inserted in the cassette receptacle 3 in one specific position, namely so that
35 its wall 6 is positioned on the bottom 12 of the cassette receptacle. In order to enable recordings to be made on the

magnetic tape 5 in the cassette 4 contained in the cassette receptacle 3, the apparatus 2 is equipped, in known manner, with a drive arrangement for the transport of the tape, with a scanning device, which for example comprises magnetic recording heads, erase heads, control signal heads etc., for scanning the tape, with amplifier arrangements for amplifying signals to be recorded on the tape, and with further arrangements. For the sake of clarity these arrangements are not shown in Figure 1. In order to enable all these arrangements to be controlled correctly, to be put into and out of operation, and to switch further functions of the apparatus or the apparatus itself on and off, the recording apparatus 2 is equipped with a control device 13, which in a manner not shown performs these control operations, in that it cooperates with the corresponding apparatus parts. For this purpose the control device may comprise electronic or electromagnetic circuit elements, such as switching transistors and electromagnets.

The recording apparatus 2 furthermore comprises a micro-processor 14, to which an input device 16 is connected for the input of instructions via a bus 15 of input lines, which input device is provided, in known manner, with a number of switching buttons marked with symbols. The control device 13 is connected to the microprocessor 14 via a bus 17 of output lines. Thus it is ensured that instructions applied to the microprocessor 14 by means of the input device 16 via the bus 15 are processed in said processor, are transferred to the control device 13 in processed form as control signals via the bus 17, which control device 13 controls the recording apparatus in accordance with the applied instructions, for example for making a recording.

In order to enable a time-preprogrammed recording to be made with the recording apparatus 2, the instant at which the recording is to be started and stopped being determined prior to the actual recording, the apparatus is provided with a timer.

In the present case, the timer is formed by means of the microprocessor 14 which performs the timer functions and in which moreover the start instant and the stop instant of at least one preprogrammed recording are entered, by means of the input device 16 and stored. For the optical display of the time instants laid down by the timer a display device 19 is connected to the microprocessor 14 via a further bus 18 of output lines, which display device comprises three display elements 20, 21 and 22 for displaying the day, the hour and the minutes at which the recording just preprogrammed is to be started or stopped. It is obvious that this display device may also be adapted to display other functions or data; it may also continuously display the time. By comparison of the stored instants with the time setting when the starting instant is reached the microprocessor then ensures that automatically such control signals are supplied to the control device 13 via the bus 17 that the control device causes an automatic recording in the recording apparatus to be started. When the stop instant is reached the microprocessor in a similar way ensures that the previously started recording is again automatically terminated. Thus, the microprocessor performs all the usual functions of a timer, whilst enabling several automatic recordings in succession to be programmed.

In the case of such a time-preprogrammed recording it is obvious that it is only guaranteed that the desired recording is completely recorded on the magnetic tape in a cassette if the length of tape available for recording is sufficient for this purpose. So far a user of such a recording system had to make sure that the recording period attainable by means of a cassette inserted in the apparatus was sufficient to allow a preprogrammed automatic recording to be recorded completely. Especially, if several automatic recordings over a longer period of time are preprogrammed this is inconvenient and may give rise to incorrect operation.

In order to eliminate this problem the recording apparatus 2 of Figure 1 comprises a detection device 23 for detecting the recording time attainable with a cassette 4 placed on the apparatus and a comparator device 25 which controls a warning device 24 for warning the user of the apparatus. The comparator device 25 thus receives the output quantity of the detection device 23, which is a measure of the recording time attainable with the cassette, at an input 26, for which purpose an output 27 of the detection device 23 is connected to the input 26 of the comparator device 25. Moreover, at a second input 28 the comparator device 25 receives a reference quantity which is derived from the timer constituted by the microprocessor 14 and which is a measure of the total time, determined by means of said microprocessor during which preprogrammed automatic recording is possible, for which purpose a corresponding output 29 of the microprocessor 14 is connected to the input 28 of the comparator device 25 via an output line 30. To the output 31 of the comparator device 25 the input 32 of the warning device 24 is connected, which in the present example comprises a lamp 33, which lights up if the total time for preprogrammed automatic recording with the apparatus is greater than the recording time attainable with the cassette.

In the recording system in accordance with Figure 1 it is assumed that in the case of a time-preprogrammed automatic recording suitably a cassette is inserted whose total length of tape is still available for recording. In practice this requirement is usually met. Therefore, the detection device 23 of the recording apparatus 2 is designed accordingly, which device in the present case comprises a sensing device 34 for the marks provided on the cassette 4, which indicate the length of magnetic tape contained in the cassette and which are constituted by the said tabs. The sensing device 34 comprises three slides 35, 36 and 37, which are guided so as to be movable perpendicularly to the bottom 12 of the cassette receptacle 3 and sense the tabs in the cassette, which slides are each urged in the direction

of the bottom 12 under the influence of springs 39, 40 and 41 respectively which bear against a bracket 38 on the apparatus. The three slides 35, 36 and 37 are each provided with a collar 42, 43, or 44 respectively, against which the springs 39, 40 and 41, which cooperate with the corresponding slide, bear. When a cassette is inserted in the cassette receptacle 3, each slide 35, 36 and 37 bears against the bottom 12 with its collar 42, 43 or 44 under the influence of the springs 39, 40 and 41 which act on said slides, the free ends 45, 46 and 47 of the slides 35, 36 and 37 projecting into the cassette receptacle 3 through the bottom 12. When a cassette has been inserted into the apparatus the slides 35, 36 and 37 are set to a specific position in accordance with the combination of tabs which are present or absent, as can be seen in Figure 1.

For decoding the positions of the slides 35, 36 and 37 the detection device 23 is furthermore provided with a decoding device 48, which comprises three switches 49, 50 and 51 which cooperate with the slides 35, 36 and 37. One contact of each switch is connected to a common voltage source V and the other contact of each switch is connected to a resistor 52, 53 and 54 respectively. The ends of the resistors 52, 53 and 54 which are remote from the switches are interconnected and connected to one end of a further resistor 55, whose free end is connected to earth. The resistors 52, 53, 54 and the resistor 55 then constitute a voltage divider, whose dividing ratio depends on the positions of the switches 49, 50, 51 and thus on the positions of the slides 35, 36, 37 which cooperate with the switches. The dividing ratio of the voltage divider then determines the output quantity of the decoding device 48, which appears on the tapping 56 of the voltage divider and which at the same time constitutes the output quantity of the detection device 23 which is applied to the comparator device 25. Thus, the output quantity of the detection device 23, which

is determined by the positions of the slides defined by the tabs on the cassette, represents a measure, indicated by the tabs on the cassette, of the total length of the tape in the cassette, so that said output quantity at the same time
5 represents a measure of the maximum recording time attainable with the cassette.

As is shown in Figure 1, the two slides 35 and 37 are set to such a position by the two tabs 10 and 11 that the switches 49 and 51 which cooperate with the slides 35 and 37 are in the
10 closed positions. However, the slide 36 does not engage with a tab, so that under the influence of the spring 40 which acts on it, it is urged with its free end 46 into the recess 8 formed in the wall 6 of the cassette 4. The switch 50 which
15 cooperates with this slide 36 is then in its open position. Because of this setting of the switches 49, 50 and 51 a specific dividing ratio of the voltage divider 52, 53, 54 and 55 is obtained, which results in a specific output quantity of the detection device 23 on its output 27. This output
20 quantity is applied to the comparator device 25 via the input 26.

If the user of the present recording system now for example programmes several automatic recordings each with a start instant and a stop instant by means of the timer constituted by the
25 microprocessor 14, the following process is performed in the apparatus. In the microprocessor the length of each preprogrammed recording is determined and stored, after which the sum of the lengths of all preprogrammed recordings are determined and an output quantity is formed corresponding to said sum. This
30 output quantity of the microprocessor is transferred as reference quantity from its output 29 to the input 28 of the comparator device 25 via the output line 30. The comparator device 25 now compares the quantities applied to its inputs 26 and 28, which are available as electrical signals in analog form, and in
35 the case that the maximum recording time attainable with the cassette and determined by the detection device 23 is shorter

than the total length required for the automatic recordings preprogrammed on the apparatus by means of the timer it supplies a signal to the warning device 24, so that said device is actuated. The lamp 33 of the warning device 24 then lights up and thus provides a visual indication to the user that the programming is incorrect. In the present case the comparator device 25 should compare two analog quantities, which can simply be realized by forming their difference.

As stated previously, the slides 35, 36, 37 are each loaded by a spring 39, 40, 41, which urge each slide with its collar 42, 43 and 44 against the bottom 12 of the cassette receptacle 3 when no cassette is inserted in said receptacle. The slides are then kept in such positions that the switches 49, 50 and 51 of the decoding device 48 which cooperate therewith are all in the open position. In these switch positions no voltage appears on the output 27 of the detection device 23 as output quantity, which indicates that no cassette and thus no magnetic tape is available in the apparatus for the purpose of recording. Thus the output quantity in this case indicates that the available recording time is zero. When in this case the recording system is preprogrammed, the comparator device 25 detects that the available recording time is smaller than required for the preprogrammed automatic recording. Consequently the warning device 24 is controlled in the previously described manner so that said device provides an optical warning signal with the lamp 33. In this case the detection device 23 is also suitable to detect whether or not a cassette has been inserted in the apparatus.

In the case of a recording system comprising a recording apparatus which accepts different types of cassettes containing different lengths of magnetic tape, which system enables preprogramming of automatic recordings with the aid of a timer, it is thus ensured, that erroneous programming of the total time required for the preprogrammed automatic recordings relative to the recording time attainable with a cassette is virtually

avoided. In the case of such an incorrect programming this is immediately signalled to the user by an optical indication, so that the user may correct the programming or insert a different cassette with a greater recording capacity. The construction of the detection device with a mechanical sensing device for the tabs on the cassette which serve as mechanical marks ensures a robust and reliable arrangement, which in this case is also suitable to detect the presence or absence of a cassette in the apparatus.

The recording system 101 shown in Figure 2, serves for use in conjunction with reversible cassettes. The recording apparatus 104 comprises a cassette receptacle 103, in which a cassette 104 can be inserted either with a wall 106 or the other wall 157 facing the bottom.

Depending on the position of the cassette in the cassette receptacle a recording can be made on each half of a magnetic tape 105. The tape 105 is movable, in known manner, between two reels 158 and 159 which are rotatable in the cassette 104, one of the reels serving as take-up reel and the other as supply reel depending on the position of the cassette in the cassette receptacle. In the situation shown in Figure 2 the reel 158 for example serves as supply reel and the reel 159 as take-up reel. For driving the two reels 158 and 159 there are provided two winding mandrils 160 and 161 which are each mounted on a rotatable shaft 162 and 163. For driving each shaft 162 and 163 there are provided a motor 164 and 165 respectively cooperating with said shafts, which via a switch 166 and 167 respectively are connectable to a motor supply circuit 168 and 169 respectively for the power supply of the motors. The motor supply circuits 168 and 169 may then take the form of known control circuits for obtaining a specific tension in the tape or a specific speed of said tape. The switches 166 and 167, which of course may take the form of electronic switches, are controlled by a control device 113, as is indicated by the dashed

lines in Figure 2.

The cassette 104 has recesses 107, 109 and 170, 171 in its two major walls 106 and 157 respectively, in each of which removable tabs 110, 111 and 172, 173 respectively are arranged as mechanically detectable marks. Said tabs again indicate the total length of magnetic tape 105 accommodated in the cassette. The provision of said tabs on both walls 106 and 157 of the cassette enables the detection of the length of the magnetic tape with the aid of a detection device 123 which comprises a sensing device 134 in both positions of the cassette 104. Obviously, these marks may also be provided on a side wall of the cassette or may take the form of for example optically detectable marks.

The detection device 123 of the apparatus shown in Figure 2 comprises a sensing device 134 and a decoding device 148. These devices serve for determining the length of tape contained in the cassette 104. The detection device is also adapted to detect the presence or absence of a cassette in the apparatus. The sensing device 134 comprises two slides 135 and 137, corresponding to the two tabs 110, 111 and 172, 173 respectively, which via two switches 149 and 151 of the decoding device 148 produce an output quantity. Each of the outputs 174 and 175 is connected to an input 176 or 177 respectively of the microprocessor 114, which in this case also constitutes the comparator device which processes the output quantities of the decoding device 148.

In addition to the detection device 123 the apparatus shown in Figure 2 comprises a second detection device 178, which is adapted to detect the length of magnetic tape actually available for recording in a cassette inserted in the apparatus. The output quantity of the first detection device 123, which provides an indication about the total length of the magnetic tape contained in the cassette 104, serves as reference quantity for the second detection device 178.

The second detection device 178 comprises two tachogenerators 179 and 180 which are connected to the shafts 162 and 163 and

which generate on their outputs 181 and 182 an output quantity which is proportional to the speed of the reels 158 and 159 which are coupled to the corresponding tachogenerator 179 or 180 via the shaft 162 or 163 and the winding mandrel 160 or 161 respectively. Each output 181 or 182 of the tachogenerators 179 and 180 respectively is connected to an input 183 or 184 of the microprocessor 114, so that the output quantities of the tachogenerators are applied to the microprocessor, which in the present case is also used for the formation of the second detection device. The microprocessor performs the computation required for determining the length of magnetic tape actually available for recording in the cassette 104. When a recording is preprogrammed with the input device 116 the microprocessor 114 initiates a brief limited transport of the magnetic tape at a predetermined speed via the control device 113. As a result of this the reels 158 and 159 are driven and the tachogenerators 179 and 180 supply information about the relevant speeds of the reel 158 and the reel 159 to the microprocessor. With the aid of these quantities and the additionally entered further parameters which are required, such as the diameter of the hubs of the take-up reel and the supply reel, the thickness of the magnetic tape and the total length of the tape, the microcomputer computes the length of tape still contained on the supply reel, which represents the length of tape actually available for recording. This process may for example be effected in a manner as described in detail in German Offenlegungsschrift 27 30 134.

The value supplied by the microprocessor 114, which represents the length of tape carrier actually available for recording is converted into a quantity which corresponds to an output quantity of the second detection device in the microprocessor. This quantity is again compared with the reference quantity which is a measure of the total time required for the automatic recordings preprogrammed by a user by means of the timer and derived from the data stored in the timer with the aid of the microprocessor.

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This is effected in the microprocessor itself. The microprocessor thus also performs the function of the comparator device for comparing the two said quantities and supplies a signal corresponding to the result of the comparison on an output 185. The output 185 of the microprocessor 114 is connected to the input 132 of the warning device 124, which in the present case takes the form of an acoustic signal generator. Thus a signal appears on the output 185 of the microprocessor 114 which signal actuates the signal generator 186, if the time required for the preprogrammed automatic recording is greater than the recording time attainable with the cassette, which time in the present case is equal to the time corresponding to the length of magnetic tape actually available for recording.

For determining the length of magnetic tape actually available for recording, certain cassette parameters should be entered into the microprocessor, as stated previously. These parameters may for example be entered into the microprocessor by the manufacturer, or by the user by means of the input device 116. In the present example one of these parameters, namely the total length of magnetic tape in a cassette, is automatically entered into the microprocessor by means of the first detection device 123. As stated previously, this is effected by applying the two output quantities of the first detection device 123 to the microprocessor via its two inputs 176 and 177, said output quantities serving as reference quantities for the second detection device 178 for determining the length of magnetic tape actually available for recording. This step is advantageous because the total length of magnetic tape represents a cassette parameter which frequently varies depending on the type of cassette used. The other parameters, namely the thickness of the tape and the diameter of the reel hubs are generally the same for all cassettes of one recording system. Thus the two last-mentioned parameters may be permanently stored in the microprocessor. The variable parameter relating to the total

length of the magnetic tape in a cassette is automatically entered into the microprocessor for each individual cassette. If desired, other parameters may be indicated on a cassette in the form of detectable marks, which are then detected by suitable detection devices, which in their turn transfer the information detected by means of the marks to the microprocessor.

The second detection device is constructed so that it may also be used for determining whether or not a cassette has been placed in the apparatus. If no cassette is placed on the apparatus, the winding mandrel corresponding to the supply reel remains stationary and thus the tachogenerator connected thereto, so that said tachogenerator does not supply an output signal. This situation can be assessed in the microprocessor, after which said microprocessor drives the warning device so as to provide a suitable warning signal.

The embodiment of Figure 2 ensures that incorrect operation is prevented, even if a cassette is used which is already partly provided with a recording. The time which is actually available for recording is derived from the available length of tape and is compared with the time required for preprogrammed automatic recording selected by a user of the recording system. If no cassette is placed in the apparatus, the user is warned. The use of the microprocessor for the formation of the timer, the second detection device as well as the comparator device has the advantage that a very compact and economic construction is obtained.

It is obvious that a series of modifications to the embodiments described herein are possible. This is especially so in respect of the construction of the two detection devices, the comparator device and the warning device. As an example, it is also conceivable to design a recording system so that in the case of incorrect programming the comparator device supplies a signal to the control device of the apparatus, which energizes a further device which

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causes the cassette to be ejected from the apparatus, so that the warning to the user is then constituted by the ejection of the cassette from the apparatus. A detection device for detecting the length of magnetic tape which is actually available for recording may for example also be formed by only one tachogenerator which is coupled to a reel and by one tachogenerator which detects the speed of transport of the record carrier, in which case the time actually available for automatic recording can be derived from the output quantities of these two tachogenerators.

The reversible video cassette 204 of Figure 3 comprises a cassette housing, of which the Figure shows one plane major wall 206, a side wall comprising two portions 211a and 211b, two reels with reel hubs 212 and 213, a slide 214 and a cover 215 which is pivotable into two directions. By moving the slide 214 forwards said cover can be closed in order to protect a magnetic tape 205. For a further description of the cassette reference is made to the Applicant's British Patent Application No. 7915684. In this respect it is to be noted that the cassette is of the reversible type and that a recording on the magnetic tape 205 only covers half the tape width, whilst a recording can be made on the other half of the tape width after reversal of the cassette.

Near a corner 216 of the cassette three marking apertures 207-209 are formed in the major wall 206. The marking aperture 208 is provided with a removable wall portion 210. This group of marks indicate the playing time of the cassette in accordance with a 3-bit binary code, namely in accordance with the following code in which a "0" means that no removable wall portion is present and an "x" means that the removable wall portion is still present.

	<u>207</u>	<u>208</u>	<u>209</u>	<u>playing time</u>
	0	0	0	2 x 30 minutes
	0	0	x	2 x 90 "
5	0	x	0	2 x 150 "
	x	0	0	2 x 210 "
	x	x	0	2 x 60 "
	x	0	x	2 x 120 "
	0	x	x	2 x 180 "
10	x	x	x	2 x 240 "

As the cassette is reversible three identically coded marks are of course provided in the major wall which in the drawing is disposed on the lower side of the cassette and at a location which after reversal of the cassette coincides with the location of the marks 207-209 shown in the drawing.

**CLAIMS:**

1. A magnetic tape cassette comprising a housing formed by two substantially rectangular major walls interconnected by side walls, magnetic tape supply and take-up means rotatably mounted within the housing, and a group of at least two tape length marks formed by one of the walls, wherein the group of marks are indicative of the length of the magnetic tape contained on the supply and take-up means and is in a form which is detectable by a recording apparatus when the cassette is placed thereon, and wherein the group of marks is fixedly positioned and is unalterable by normal handling of the cassette.
2. A cassette as claimed in Claim 1, wherein the group of marks is formed by one of the major walls.
3. A cassette as claimed in Claim 2, wherein the group of marks is arranged on a part of the major wall which lies outside an area formed by projecting a full tape supply means and a full tape take-up means onto the major wall.
4. A cassette as claimed in Claim 3, wherein the group of marks is provided adjacent a side wall.
5. A cassette as claimed in Claim 4, wherein the tape length marks are located near a corner of a major wall of the cassette housing.
6. A cassette as claimed in any one of Claims 1 to 5, wherein the tape-length marks are optically detectable marks.
7. A cassette as claimed in any one of Claims 1 to 5, wherein the tape-length marks are mechanically detectable marks.
8. A cassette as claimed in Claim 6 or 7, wherein the tape-length marks comprise a multi-bit binary code, each bit being constituted by a respective one of the marks, which may have one of two specific conditions.
9. A cassette as claimed in Claim 8, wherein the tape length marks, comprise marking apertures which can be closed by removable wall portions and wherein one of the two specific conditions of each mark is constituted by the presence of the removable wall portion of a marking



aperture and the other of the two specific conditions by the absence of the removable wall portion.

10. A cassette as claimed in Claim 1, substantially as hereinbefore described with reference to Figure 1, Figure 2 or Figure 3 of the accompanying drawings.

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